

REVIEW ARTICLE
BIOSPHERE LANDSCAPES: PRINCIPLES AND LOCAL PRACTICES
CHALLENGING SUSTAINABLE DEVELOPMENT IN AFRICA

1 Tekalign Tafese Gebretsadik (Ph.D. student), Department of Natural Resource Management,
College of Agriculture & Natural Resource, Wolkite University, Ethiopia

2 Aden Abdurahman Shekur (Ph.D. student), Department of Natural Resource Management,
College of Agriculture & Natural Resource, Dilla Universities, Ethiopia

**Correspondence: tekalign.ma@gmail.com ; Tekalign Tafese; P.O.Box: 07, Wolkite University,
Wolkite, Ethiopia; Tele: +251943206455*

Abstract

A biosphere reserve is a unique kind of protected area that differs from national parks and other kinds of protected natural areas having three very different, but equal, aims: conservation, scientific research and monitoring; and sustainable development. MAB was launched in 1971 and the BR network in 1976. Currently, WNBR had grown to include 686 BR in 122 countries, including 20 trans-boundary sites. AfriMAB regional network, contains 79 BR recognized as part of the WNBR, across 28 countries. Pre-Seville (1976 to 1995) and post-Seville (1996 to 2018) phases of BR, there exists both success and less success stories globally and in African. The first phase lays its philosophy on strict environmental protection, i.e. strict BR to serve science while the second delimited along sustainable resource use principle, therefore, can be defined as Biosphere landscape management. The notion of converting the concept's implications into reality at international, national and local scales raises a number of challenges arise from three main functional factors leads to failure and or success of biosphere landscape i.e., BR designation, participation, and delivery. The aim of this article is to review the existing empirical literature about the consistency of principles of BR with local practice and challenging factors associated with successful management of BLs in Africa. The review collects relevant and recent articles published globally and African context and used reports of UNESCO MAB program and AfriMAB to see the current status of the program globally and African context.

Keywords: UNESCO, Biosphere Reserve, Landscape, Sustainable Development, Africa

1.0 Introduction

World's biological treasures threatened to an extent no previous generation has experienced (Philip J. and Michael S., 1995). As of Plato “what now remains compared with whatever then existed is like the skeleton of a sick man, all the fat and soft earth having wasted away, and only the bare framework of the land being left” (Philip J. and Michael S., 1995). Looking back on 100 years, enormous change has observed in relationship with the earth and human; like high population increase, development of world economy, need for natural resources increased exponentially, and converted land from natural ecosystems to managed landscapes at a rate unprecedented in history. These altered every natural ecosystem on the planet, and in the process, countless species became extinct and many others are now threatened. If it continues to indifferently transform the biosphere, the layers of crust, water, and atmosphere that support life on the earth, and if it continues to disrupt the ecological interactions and flows in our oceans, deserts, forests, mountains, fields, and lakes, it threaten very existence by disrupting the fragile relationships that maintain our life support system (Philip J. and Michael S., 1995).

Biosphere reserves are areas comprising terrestrial, marine and coastal ecosystems designed to deal with one of the most important questions the world facing; to reconcile conservation of biodiversity and biological resources with human activity through the sustainable use of natural resources. One of their objectives is to give rise to innovative sustainable

development practices (UNESCO, 1996, 2003, and Ana F. *et al.*, 2018). The Biosphere Reserve Program emerged to play a prominent role in efforts to integrate biological diversity conservation and sustainable development. The biosphere reserve concept originated as a tool for international cooperation, addressing issues and problems at the interface between nature conservation, interdisciplinary research and monitoring and educational prerogatives in the ecological and environmental sciences (Ishwaran *et al.*, 2008). The principles behind the development and management of biosphere reserves have evolved rapidly over the years and continue to develop as lessons are learned from past experiences, and innovative policies and strategies are explored (Philip J. and Michael S., 1995).

The global growth in the number and area of BRs, as well as the concept's further evolution toward the implementation of the SDGs are already fundamentally positive developments (Susanne S. and Tim, 2017). New reserves are designated every year by the International coordinating Council for the programme, established by UNESCO in the early 1970s; a body with a rotating elected membership of 34 UNESCO Member States. The Man and the Biosphere Programme is an intergovernmental scientific programme that aims to improve relations between people and their natural environment (Maureen G. and Merle M., 2013 and C. Starger 2016, and UNESCO, 2018 b). The biosphere reserve principle, as promoted by UNESCO's Man and the

Biosphere programme, combines biodiversity conservation with a strong cultural focus. It is therefore considered a promising approach to mitigate the loss of biodiversity and to foster sustainable land use while putting the needs of local people and ethnic minorities at its core. This is particularly appropriate in culturally diverse countries (Renée M., 2015).

The BR network was launched in 1976 (UNESCO, 2008). BR is an international designation granted by UNESCO's MAB Programme (Ishwaran, *et al.*, 2008), and Presently, (a as of 2018) had grown to include 686 BR in 122 countries, including 20 trans-boundary sites distributed across regional networks of BR (UNESCO, 2018). International Coordinating Council of the Man and the Biosphere Programme also had withdrawn 40 BR sites from WNBR during the (MAB ICC) meeting in Paris, France (UNESCO, 2018).

Adopting the framework of the UNESCO MAB programme, the regional network of African Man and Biosphere (AfriMAB) was created in 1996 and institutionalized in 2010 during its first General Assembly, with the aim of building and strengthening the capacity MAB National Committees and BR Mangers to promote BR as privileged tools of experimentation in conservation of environment and sustainable development (AfriMAB, 2017). The AfriMAB network was established with no legal status but has statutes and internal rules (AfriMAB, 2017). Under UNESCO's

Man and the Biosphere Programme (MAB), there are 79 BR recognized as part of the World Network of BR in regional network of Africa as of 2018. These BRs are distributed across 28 countries (UNESCO, 2018).

The endeavor of sustainable development requires BR to move further towards embracing more integrated and effective forms of sustainable livelihoods for their inhabitants. This means placing people at the heart of BR policy and management, and enabling to become pioneers and ambassadors for realizing effective sustainable development. BR and related institutions have to work towards true integration of their ecological, social and economic potentials, and set up a framework of genuine sustainability governance (Susanne S. and Tim, 2017). Yet, BRs still need to build (more) trust through real relationships with communities and other relevant stakeholders (Stoll S., and O'Riordan T. 2018).

The notion of converting the concept's implications into reality at international, national and local scales raises a number of challenges (Ishwaran *et al.*, 2008). The implementations of UNESCO's Man and the Biosphere (MAB) Programme have never been officially documented and much undervalued framework in South Africa (Pool R., 2013). In the two phases of BR, pre (from 1976 to 1995) and post Seville strategy (1996 to present) there exists both success and less success stories globally and in African context (C.Van *et al.*, 2017).

Problems are also argued in the use of the word “reserve,” which appears to convey the message of an area where people are excluded which in negative connotation for inhabitants in South African BR while a more positive-sounding alternative exists in Austria, where BRs are called Biosphere Regions (Stanvliet 2014, and Stoll and O’Riordan 2018). In addition, there is a generalized lack of information about how biosphere reserves are being managed and governed, and at what point their goals are being achieved, which limits a better understanding of the factors influencing biosphere reserve management effectiveness (Ana *et al.*, 2018). Therefore, this paper tries to review the historical development of BR, the general principles and frame works related to its practical implementation and challenges to assure sustainable BLs in African context, taking in to account some published articles.

General Objective

- To review existing empirical literature about the consistency of principles of BR with local practice and challenging factors for successful management BLs in Africa

Specific objectives

- To review how principles of BLs are consistent with local practices in Africa?
- To review factors challenging successful management of BLs in Africa

Materials and methods

For this article we collected relevant articles published globally and African context. The reviews collected in this special issue seek precisely to

elucidate what is known about challenges of implementing biosphere landscape under UNESCO MAB program and the degree of confidence associated with available knowledge. We also used reports of UNESCO MAB program and AfriMAB to see the current status of the program globally and African context. The review distilled knowledge from more than 100 research articles, and collectively the interventions assess cover more than 686 biosphere reserves of the world. For the review analysis articles published in the last 10 years are considered to show the current picture of the program. But reports and general information and definitions are used from their early inception of idea. We properly acknowledge for all relevant materials used as a reference through citation. Reports of BR showing progress in different time frame are presented in table and figure format.

2.0 Biosphere Landscape

In the 1960s UNESCO, as the UN agency with responsibility for science, developed a new programme dealing with human biosphere interactions, the Man and the Biosphere (MAB) programme. It was a ground breaking programme, seeking to use UNESCOs convening power in education, natural and social sciences, culture and communication to forge a new way of understanding the natural world and the role of people in it. MAB blended new science direction with an innovative site based approach, the Biosphere Reserve, (Peter, 2016, and UNESCO, 2008). MAB was launched in 1971 after the 1968 conference on the rational use and

conservation of the resources of the biosphere' (Batisse, 1986), as a progression from the International Biological Program (IBP; Di Castro, 1976), while this conference is referred to as the 'Biosphere Conference' (UNESCO, 1993 cited in Kaera L. *et al.*, 2013).

MAB was formally endorsed by U.N. Member States at the U.N. Conference on the Environment (the first "Earth Summit") in 1972. The original aim of MAB was to establish protected areas representing the main ecosystems of the planet in which genetic resources could be protected and research and monitoring could be carried out. These protected areas were to be called "biosphere reserves" in reference to the MAB program's name (Batisse 2019, UNESCO, 2008 and 2017). The BR as a concept and a tool of UNESCO has an origin in the protected areas domain but has now evolved into an international designation that allows context-specific conservation and development relationships to be developed in land and seascapes where more than 80% of the designated area lies outside of legally protected core zones (Ishwaran *et al.*, 2008).

Biosphere reserve is an international designation granted by UNESCO's MAB Programme, seen as a successor to the International Biological Programme (IBP). IBP was non-governmental endeavor of international research program that come to an end in 1974 had focus on scientific issues having limited abilities and insufficient emphasis on areas at the interface where neighboring ecosystems met (Ishwaran, 2012). The concept expanded into the

development dimension and noted at the First International Congress on Biosphere Reserves in Minsk, Belarus in 1983, and which matured at the Second International Congress on Biosphere Reserves in Seville, Spain in 1995 (Ishwaran *et al.*, 2008).

A BR is a unique kind of protected area that differs from a national park, wilderness area, national forest, or wildlife refuge in having three very different, but equal, aims: conservation of genetic resources, species, and ecosystems; scientific research and monitoring; and promoting sustainable development in communities of the surrounding region (UNESCO, 2008). All three of these aims are equally important in a biosphere reserve while national parks and other kinds of protected natural areas usually are primarily concerned with conservation, and only secondarily with research and sustainable development. By design, there is no single model for running BR, but there are two common underlying principles: the management system of a BR needs to be open, not closed to community concerns; and it needs to be adaptable to changes in local circumstances. BRs are meant to be places where communities can work in concert with the area's land-managing agencies, local governments, schools, and other institutions to design responses to external political, economic, and social pressures that affect the ecological and cultural values of the area (UNESCO, 2008).

The word "biosphere" refers to the three regions of the Earth capable of being occupied by living organisms (UNESCO, 2008). This includes as described below in Fig.1.

1. The surface of the Earth (land, oceans, lakes, rivers, and other waters);
2. Close-lying subsurface areas occupied by plants and animals (including microorganisms),
3. The low-altitude atmosphere where birds, insects, other flying animals, and plants can live.

If you imagine a cross section of the Earth in space, a side view of the planet as if it were cut in half from top to bottom, the biosphere would be a very thin slice of the total picture; no more than the "skin" of the Earth along with the area just above and below it. The word "biosphere" therefore conveys a special quality of rarity and value, and of life's inherent fragility. This, then, is the basic concept behind the name "Man and the Biosphere"; the life supporting areas of Earth are valuable and fragile, and need to be treated with care by human beings (UNESCO, 2008).

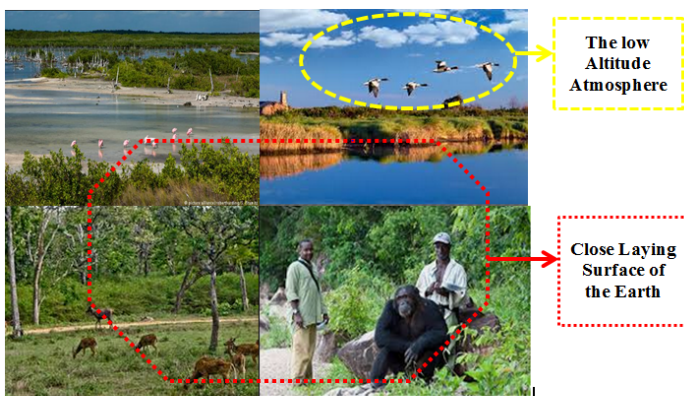


Fig. 1. Regions of the Earth capable of being occupied by living organisms (adopted from www.unesco.org).

The concept of BR originated as a tool for international cooperation, addressing issues and problems at the interface between nature

conservation, interdisciplinary research and monitoring and educational prerogatives in the ecological and environmental sciences (Ishwaran *et al.*, 2008). Hence, inevitably the origin and the evolution of the concept has enjoyed an interactive relationship between MAB's interdisciplinary research, training and educational agenda and the nature conservation and related socio-economic development interests of the global environmental and conservation communities (Ishwaran *et al.*, 2008). The network is a key component in MAB's objective of achieving sustainable balance between the sometimes conflicting goals of conserving biological diversity and promoting economic development, and maintaining associated cultural values. BRs are sites where these objectives are tested, refined, demonstrated and implemented (UNESCO, 2008).

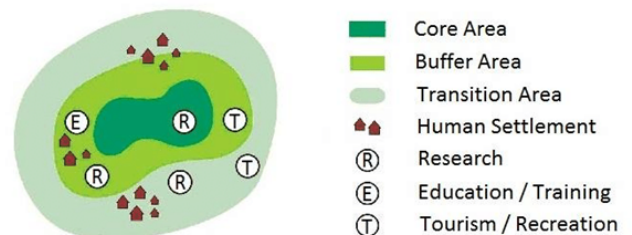


Fig. 2. Zonation in a terrestrial Biosphere and Functions (adopted from GIZ 2016 and www.unesco.org).

In the phases of BR program, these functions need to be implemented within a defined landscape and delimited according to interconnected zonation system along a progression from preservation to sustainable resource use (Mehring and Susanne 2010, Pool 2013 and GIZ, 2016). Given that strict environmental protection and development are not usually mutually exclusive; BRs have a generalized

spatial zonation of acceptable land uses relative to proximity to conservation areas. Different land uses fall into zones of permissible access and enforced controls (Kaera L. *et al.*, 2013).

A terrestrial BR consists of core, buffer and transition zones as described in fig.2 above. The natural and an inner core area is an undisturbed and legally protected ecosystem (strictly protected areas), buffer zones surrounds the core area, and is managed to accommodate a greater variety of resource use strategies, and research and educational activities (delimited for management purposes on sustainable land use) and an outer transition zone is the outermost part of the BR (an area of active cooperation between reserve management and the local people, wherein activities including settlements, cropping, forestry, recreation and other economic uses continue in harmony with people and conservation goals). The functions support the notion of sustainable development as it is widely used today (Mehring and Susanne S., 2010, and Pool R., 2013).

Current Status of Biosphere Reserves of the World: Post and Pre-Seville Period

The essence of the BR concept is about the combination of three complementary functions: conservation of biological and cultural diversity (of landscapes, ecosystems, species and genetic variation), sustainable development in terms of cooperation with local populations (fostering economic development which is ecologically and culturally sustainable), and logistical support

(research, monitoring, education and training through participation) (UNESCO, 1996, and Mehring and Susanne S., 2010). The Man and the Biosphere Program (MAB) was launched in 1971 and BR network in 1976 (UNESCO, 2008, and Ishwaran *et al.*, 2008). As of 2018, BR has grown to include 686 BR in 122 countries, including 20 trans-boundary sites distributed across regional networks of BR as described in fig. 3 below (UNESCO, 2018).

Failure to fulfill the criteria set in Statutory Framework, that allow individual BRs to meet the basic conservation, development and logistic roles expected of a site of excellence may eventually lead to a site's UNESCO 'BR' status being revoked (Martin *et al.*, 2010, and Kaera *et al.*, 2013). International Coordinating Council of the Man and the Biosphere Programme withdrawn 40 BR sites from world network of BR program, 82.5percent of sites from regional network of Europe and North America while 17.5percent from regional network of Asia and the Pacific. From the World Network of BR program BR, USA takes major share of withdrawal history (45percent of BR), 17.5percent from Australia and 10percent from each of Austria, Bulgaria and UK ((Martin *et al.*, 2010, UNESCO, 2018 and www.unesco.org). All have been voluntary removals by member states themselves, recognizing divergence between the status of the BR and the ideals of the BR concept (Kaera L. *et al.*, 2013).

The first phase of BR from 1976 to 1995, lays its philosophy on Western form of conservation focusing conventional ecological learning (Reed and

Massie, 2013). During the first phase of BR designation, Europe and North America; i.e. Western, Eastern and Central Europe, USA and Canada, comprised more than 50 percent of the total number of sites in the World Network (Ishwaran *et al.*, 2008). However, the post-Seville period (second phase) marks the first time that the total number of biosphere reserves in Africa, Arab States, Latin America and the Caribbean and Asia and the Pacific together exceeded the number in Europe and North America as described in fig 3 below (Ishwaran *et al.*, 2008).

The second phase, i.e. from 1996 to present, where the need and interest of local people become more important in determining the locations of and implementing research programs associated with BRs. This approach has its root on 1987 World Commission on Environment and Development (Brundtland Commission) and ongoing international discussions that focus the existence of people as part of conservation solution (UNESCO, 1996).

Since the second phase of BR (1996) implementation of the program focus on incorporating mutually nonexclusive concepts of ecological and social learning. Since then, the idea of who should learn and about what was being learned shaped the purpose and philosophy and further complicated the criteria for site selection and altered the ability to assess effectiveness of biosphere reserve as exemplary of conservation and sustainable development (Reed and Massie, 2013).

Principal UNESCO Regions and Achievement in the two phase

BR is nominated by national governments and remains under the sovereign jurisdiction of the states where they are located. Their status is internationally recognized (www.unesco.org). Building on activities at the site and national levels, the encouragement of collaborative activities, at bilateral, sub-regional and regional levels is a crucial link in contributing to the development of the WNBRS, and in promoting the exchange of information and experience between biosphere reserves in different countries. To improve collaboration and partnerships WNBRS has well-coordinated with each other through thematic network such as the World Network of Island and Coastal BR and five regional networks to set-up of trans-boundary BRs; twin arrangements between two sites in different countries; and establish sub-regional, regional and thematic networks. These are regional networks of Africa, Arab States, Asia and the Pacific, Europe and North America, and Latin

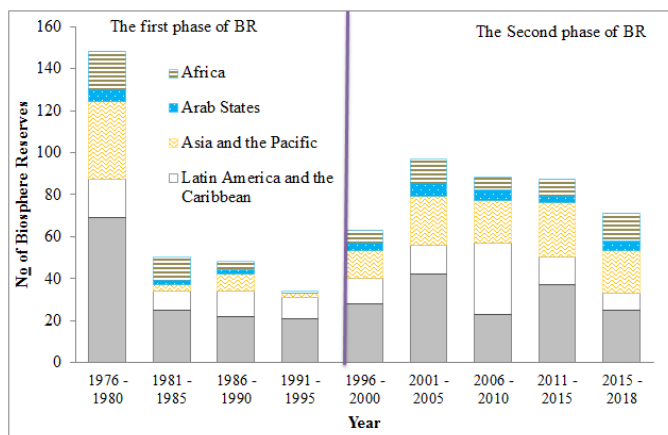


Fig. 3. Biosphere Reserves (BRs) by regions of World Network of BR (1976 to 2018)

(Extracted from lists compiled by UNESCO's MAB Program, 2018, and www.unesco.org).

America and the Caribbean, and s as described below in table 1. This networking has great role for better networking and communication among BR managers, researchers and other stakeholders (C. Starger 2016 and www.unesco.org).

In the two phases of implementations success and failure to achieve the criteria, objective and principles set by UNESCO MAB program is observed across the regions of World Network of BR. The review indicate that top countries having the highest number of nominated successful BRs are Canada and Germany (8 sites), Vietnam (5 sites), Mexico, Spain and South Africa (4 sites each). Six commonly nominated less successful BRs were spread across five countries (Australia, Chile, Kenya, the US and Thailand) (C.Van *et al.*, 2017). Thirty sites (10 post-Seville and 20 pre-Seville BRs) across WNBR were nominated as less successful, as an example Australia (7 sites) and Germany (4 sites) are the countries having the largest number of less successful BRs (C.Van *et al.*, 2017).

Post-Seville generation had the highest proportion (59percent) in the list of the successful sites, while a significant percentage (41percent) of successful sites belonged to the pre-Seville generation. There is perhaps no better set of internationally networked areas where conservation and sustainable use of biodiversity and its relationships to broader regional sustainable development perspectives could be studied and tested and the gained experience and knowledge shared amongst all nations of the world

(Ishwaran *et al.*, 2008). Large numbers of sites from the first and second generation are not fully compatible with the Seville vision.

It is at this level of matching scientific and technical analysis of the periodic review and implementing the recommendations of the review for the whole BR that practice lags significantly behind thinking and conceptualization can be seen in the case of the Amboseli Biosphere Reserve in Kenya (Ishwaran *et al.*, 2008). Pre-Seville BRs were selected according to their relevance in regard to biological conservation and potential research interests. Thus, most of these sites had already been declared national parks or equivalent areas where research activities and management facilities could be used or enhanced (Mehring and Susanne S., 2010). In this era BR were characterized by two primary functions: conservation of biodiversity and support of related scientific research (Ishwaran, *et al.*, 2008). As such ecological learning dominated during this period and considered as BR served science (G.Reed and M. Massie, 2013). More than 40percent of first generation of sites did not describe the zonation of the nominated area (Ishwaran *et al.*, 2008).

Table 1. Two phases of UNESCO BR by the five principal UNESCO regions |

WNBR Regions	First Phase (1976- 1995)		Second Phase (1996- 2018)	
	No of sites	percent	No of sites	percent
Africa	35	5.10	44	6.41
Arab region	10	1.46	21	3.06
Asia and Pacific	54	7.87	94	13.70
Europe and North America	174	25.36	126	18.37
Latin America and the Caribbean	50	7.29	78	11.37
Total	323	47.08	363	52.92

(Data extracted from lists compiled by UNESCO 2018 and www.unesco.org)

The contemporary concept of incorporating mutually nonexclusive concepts of ecological and social learning officially introduced a new function to BR: sustainable development involving the conservation of cultural diversity and livelihood. Even though the classical ecologist viewed the approach as destructive or degrading of biodiversity, the function of BR in the phase was recognized and affirmed the importance of understanding and learning about human environmental interaction (UNESCO, 1996).

The post-Seville period marked the time when biosphere reserves were not considered merely as protected areas and additional zones, but seen as ecosystems and landscapes where sustainable development, characterized by a context-specific relationship between biodiversity conservation and socio-economic growth, came to be viewed as the essence of the governance and management of the designated area (Ishwaran *et al.*, 2008). Most of post-Seville sites, 98percent of the designated sites had described all three zones in the nominations submitted by the states and included in the World Network. Among the post-Seville sites, about 11percent of the total area constitutes the legally protected core zone; 32percent of the total area comprises the buffer zone and 57percent make up the transition zone (Ishwaran *et al.*, 2008).

Biosphere Landscapes in Africa

Africa is home to a rich and diverse animal, plant, and marine biodiversity that provide critical ecosystem services, driving the continent's economy

and serving as buffers to climate change. However, the continent is experiencing a dramatic loss of biodiversity (The World Bank Group, 2019). It is estimated that by 2100, climate change alone could cause the loss of over half of African bird and mammal species, as well as trigger a 20 – 30percent decline in lake productivity (the plant and animal life produced by a lake), and a significant loss of plant species. Even more immediate are the ongoing threats to African biodiversity from natural habitat loss and degradation (especially from agricultural expansion), direct overexploitation of wildlife and fishery species (including from illegal hunting and trade), and the spread of certain non-native invasive species (Wachira *et al.*, 2001 and Nakileza *et al.*, 2017). This loss of biodiversity affects livelihoods, water supply, food insecurity, and lessens resilience to extreme events, particularly for people living in rural areas who are often the poorest (The World Bank Group, 2019 and Nakileza *et al.*, 2017).

The global growth in the number and area of BRs, as well as the concept's further evolution toward the implementation of the SDGs are already fundamentally positive developments. Yet, BRs still need to build (more) trust through real relationships with communities and other relevant stakeholders (Stoll and O'Riordan 2018). Under UNESCO's Man and the Biosphere Programme (MAB), there are 79 biosphere reserves recognized as part of the World Network of Biosphere Reserves in Africa as of 2018 as described below in table 1. These are distributed across 28 countries (South Africa 10 sites, Kenya 6

sites, Ethiopia, Madagascar, Senegal, and Tanzania, 5 sites each, and Morocco, and Guinea 4 sites each constitute more than 50percent) recognized as part of the World Network of Biosphere Reserves in Africa.

Biosphere reserves in Sub-Saharan Africa are organized in the AfriMAB regional network. While Biosphere reserves in Northern African countries belong to ArabMAB, UNESCO's regional MAB network i.e., Algeria, Egypt, Morocco, Sudan, Tunisia and Mauritania totally having 22 BR sites (Algeria registered 8 sites and each of Morocco and Tunisia registered 4 sites, Sudan 3 sites and Egypt 2 sites) belong to ArabMAB, UNESCO's regional MAB network for Arab countries, (UNESCO, 2018 and www.unesco.org).

Democratic Rep. of Congo is the first African country to be recognized as part of the World Network of Biosphere Reserves, by registering two sites (Yangambi and Luki BR) in 1976. Tunisia, Mortious, Nigeria, Mauritius, Cote D'ivoire, Congo, Central African Republic joined the world network of BR in 1977 and Kenya in 1978 (UNESCO, 2018) as described above in fig. 4.

Ethiopia, Zimbabwe, Sao-Tome and Principe, Malawi, Guinea Bissau and Togo joined world network of BR only in post-Seville period (after 1996), registered a total of thirteen sites and DR.Congo, Congo, CAR, Coted'-Ivoire, Gabon, Rwanda, Nigeria, Mauritius, Mali and Cameroon registered only during pre-Seville BRs with a total of

seventeen sites while other African countries registered in both periods.

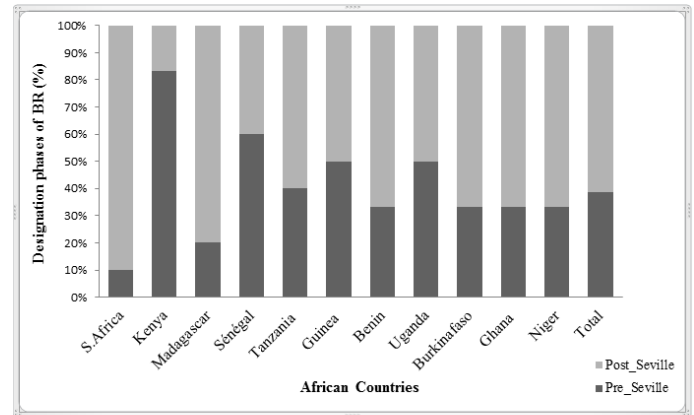


Fig. 4. Countries from regional network of Africa registered in the two phases of Biosphere Reserves (BRs), Pre-Seville (1976 – 1995) and Post-Seville (1996 - 2018). (Data extracted from lists compiled by UNESCO's MAB 2018, and www.unesco.org)

Out of 10 BR in S. Africa 9 of them were joined the network in the post-Seville while 5 of the BR in Kenya registered in pre –Seville and 1 in post-Seville period (UNESCO, 2018) as described above in fig. 4.

Table 2. BR Designated internationally and in Africa in two phases

Share	Time Period			
	1976 to 19 95	percent	1996 to 2018	percent
International	320 ^a	46.65	366 ^b	53.35
Africa	45 ^b	44.55	56 ^b	55.45

Data adapted from ^aMaureen G.R. and Merle M. M., (2013) ^a, and ^bUNESCO, 2018

Principles and Implementation Challenges in Africa Principles and Framework of Biosphere reserve.

Each biosphere reserve has its own system of governance to ensure that it meets its functions and objectives. By design, there is no single model for running biosphere reserves, but there are two common underlying principles in post Seville strategy; the management system of a biosphere reserve needs to be open, not closed to community concerns; and it needs to be adaptable to changes in local circumstances. Biosphere reserves are meant to

be places where communities can work in concert with the area's land-managing agencies, local governments, schools, and other institutions to design responses to external political, economic, and social pressures that affect the ecological and cultural values of the area (UNESCO, 2008). The Lima Declaration and Action Plan, serve as the roadmap that can focus the MAB Programme on achieving sustainable development (Starger 2016).

The post-Seville vision as the hallmark of the biosphere reserve appeals essential link between conservation and development promoted by many policy and decision-makers. This vision seems to have also been more attractive to countries in many parts of the developing world, particularly since 1992, as the ecosystem approach to management of biodiversity and biological resources received endorsement from the Conference of Parties of the Convention on Biological Diversity (Ishwaran *et al.*, 2008).

UNESCO, 2018c described are eight recommended standard framework as essential steps towards successful BR management which are not mutually exclusive, but rather complementary. These are participatory platform, policy integration, partnership and networking, periodic review, strengthen administration, legal recognition, promoting existing framework, and strategic dissemination of the framework. Often it is found useful to set up a committee or board that coordinates all biosphere reserve's activities. Usually a

coordinator is named as the contact person for all matters dealing with the biosphere reserve (UNESCO, 2008).

Implementation Challenges.

Developing a sustainable BLs is an enormous challenge in the face of the ever increasing demands on the earth's natural resource (Huntley *et al.*, 1992). Diversity of factors potentially influences the capacity of BLs to achieve their goals. BLs is not islands (Ana *et al.*, 2018) they are influenced by the intertwined effects of social and ecological contextual factors at different spatial and temporal scales. They are dependent on a set of inputs to be managed and governed, which are also associated with a diversity of scales and actors. The varied strategies used to manage and govern social–ecological systems in BLs are also important, because they trigger social and ecological changes, and not only in a positive way (Ana F. *et al.*, 2018).

If BRs want to become an accepted local partner, all relevant stakeholders and the local people should have the opportunity for their voices to be heard. Engaging communities in the governance and management of BRs is a complex one that involves many hurdles. Factors beyond the control of the BLs communities and their management, such as structural poverty, corruption, and weak governance, may overrule even the best-designed programs, with degradation and destruction of biodiversity as the final output of these failures (Stoll S., and O’Riordan T., 2018). Generally, C. Van *et al.*, 2017, identified

three main functional factors leads to promoting and hindering of BLs i.e., BR designation, participation, and delivery.

Periodic reviews of Biosphere Reserves in Africa.

The periodic review is an important event in the life of a biosphere reserve (Martin et al., 2010). Periodic reviews are required to understand whether the structure of zones within the BR; i.e., its design is sufficient to meet BR objectives. Additionally, in keeping with the Statutory Framework of 1995, reviewers have also drawn attention to whether management and governance systems are adequate for assuring that biodiversity conservation and sustainable development objectives are addressed (Reed and Eguny 2013). Periodic review occurs ones every ten years of the functioning, zoning, scale and the implications for the populations in the reserve. It also makes it possible to evaluate the evolution of the various functions of the reserve, be it conservation, research, education or sustainable development. Failure to do periodic review processes may result withdrawal from WNB (Martin et al., 2010).

The review indicate that more than 370 periodic review reports were received by the Secretariat and examined by the MAB International co-coordinating Council in World Network of Biosphere Reserves (WNB) (UNESCO, 2018). As of UNESCO, 2018 report, out of 35 Pre-Seville sites designated in AfriMAB regional network 48.5, 42.9, and 8.6percent reviewed two times, one time, and never

been reviewed as described respectively. Among AfriMAB regional network, BR never been reviewed belongs to Central Republic of Africa (two sites), and Rwanda (one site) as described below in fig.5.

Out of 44 Post-Seville sites designated in AfriMAB regional network, 6.8, 22.7, and 70.5percent of BR sites reviewed 2 times, one time and never been reviewed respectively. Most of Post-Seville, due to their early registration (less than ten years) they were not goes through review process (Fig.5). The review of UNESCO, 2018 report indicate that one BR in each of Niger, Benin and Burkna-Faso, goes through joint and national review process.

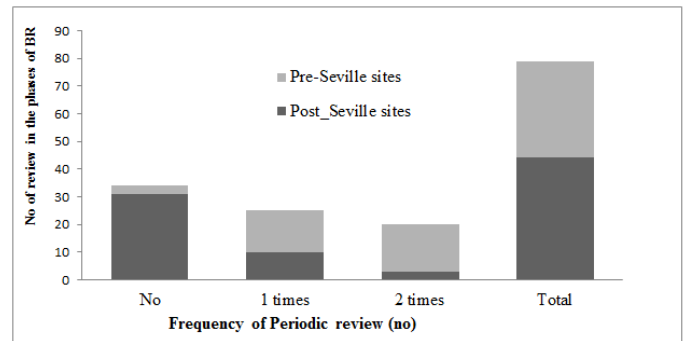


Fig. 5. The status of periodic review in two phases of BR in regional network of Africa (Data extracted from lists compiled by UNESCO’s MAB 2018, and www.unesco.org)

Local Practice of Biosphere reserve.

Local practice refers to the entire range of actions and activities that facilitate the expression and implementation of the biosphere reserve concepts developed at international level to be executed at specific BR level (Ishwaran et al., 2008). The zonation of core areas or other restrictions in the use of natural resources may conflict with local property rights, commercial interests, or local people’s perceptions of the main problems in the region (Stoll and Riordan 2018).

The post-Seville period marked the time when biosphere reserves were not considered merely as protected areas and additional zones, but seen as ecosystems and landscapes where sustainable development, characterized by a context-specific relationship between biodiversity conservation and socio-economic growth, came to be viewed as the essence of the governance and management of the designated area. The realization of this vision, particularly at the local level, continues to be challenged by complexities in zonation and land tenure, inadequate science, research, education and monitoring and inappropriate governance and coordination mechanisms for moderating stakeholder interests throughout the biosphere reserve (Ishwaran *et al.*, 2008).

Although on paper BRs seem to offer innovative thinking toward socially inclusive environmental management and are designed to be laboratories of research and education, they are experiencing different degrees of effectiveness in realizing their prescriptive functions with regard to addressing SDGs (Stoll S. and O’Riordan T. 2018). BRs face a number of challenges, both familiar and new (Stoll and O’Riordan 2018). Biosphere reserves have been initiated by the UNESCO to expand the idea of nature conservation to a network of model regions for sustainability they have not been in the focus of sustainability transitions research (Armin, 2018).

Tesfu *et al.*, (2018) reported that 75percent user activities are illegal in Yayu BR of Ethiopia. Level and Bouamrane (2008) also indicated that due to clearly defined use rights in West African BR, illegal exploitation of natural resources in core areas results biodiversity erosion. Tesfu *et al.*, (2018) indicate that extraction of products from Yayu BR in Ethiopia; 65percent fuel wood removal and charcoal production, 60percent bush meat hunting, 45percent livestock grazing, 40percent logging for local use, 35percent fodder collection, 30percent of uncontrolled land conversion to their farming activities and 25percent of settlement on BR territory were undertaken illegally. Ayele 2011, and Matthias 2015 report also indicates that the same trend of BR utilization in parts of Kaffa Coffee Forest BR, Ethiopia which results forest fragmentation.

Population Pressure and Economic Dependency.

In both emerging and developed countries, world’s population represents one of the greatest challenges to ensuring basic human welfare and the functioning of viable ecosystems (Lotze C. *et al.*, 2008 and Stoll and O’Riordan 2018). The accelerating loss of biological diversity in many world regions is one of the key results of unsustainable human-nature interactions (Lotze *et al.*, 2008). C. Van *et al.*, 2017 indicated that lack of finance and skilled human resource was considered the important contributor to biosphere failure in both developed and developing countries. Whereas the poor people who inhabit them have only limited access to basic services, are deprived of meaningful participation in decision-

making, and face extreme vulnerability to natural disasters, urban areas are also loci of concentrations of knowledge, innovation, and productive resources that could be used for UBRs. They can be seen as priority areas and large-scale laboratories for observation of the effects of global change on ecosystems (e.g., significant warming and increased nitrogen deposition).

Reports by Andrew *et al.*, 2017 indicate that high unemployment, poverty, lack of opportunity, lack of sectorial communication is major factor challenging Waterberg Biosphere Reserve in South Africa. Levrel and Bouamrane (2008) also indicate that local communities have few viable livelihood options and scarce fertile land around West African BR leads to threat biodiversity. Report by Alfsen and Benjamin (2002) in South Africa indicate that the greatest enemy of the environment is human poverty. Equally, one of the greatest causes of human poverty is environmental degradation. The interdependencies are not limited to poverty. To control nature is to control people; hence armed conflict, migration, and disease are at times all intimately tied to ecological resources, their scarcity, and relationships with people. Economic development needs, particularly in developing countries like ecotourism, green energy, branding and product certification and alternative income activities in BR appear a significant limitation in practice (Van *et al.*, 2017).

The pressure on agricultural land in the wake of the sharp increase in meat and dairy-product

consumption and the concomitant demand for huge swathes of terrain devoted to massive feed cultivation (especially of soya and maize) constitute a major problem that is detrimental to the implementation of BRs worldwide. The consequences of the accompanying dramatic increase in the intensification of agriculture have not spared BRs, and the land-grab plague now affects BRs and other protected areas on every continent (Stoll and O’Riordan 2018).

Institutional and logistic problems.

The management framework developed with strong local and regional integration based on the combination of top-down and bottom-up participation and consultation process leads to success stories in BR. This framework integrated different interests of conservation, agriculture, forestry, economy, research and environmental education (C.V. Cuong *et al.*, 2017).

Strong government and stakeholders' commitment ensures the long-term finances and resources that lead successful implementation (C.V. Cuong, *et al.*, 2017). Most BR in Africa depends on external funding; there for fails to meet its goal with low and unsustainable funding (AfrimMAB, 2017). Inadequate institutional framework and low Political will is also other problem to facilitate effective implementation of BR in South Africa (Pool 2013 and Andrew *et al.*, 2017). Reports of Pool 2013 indicate that the dedicated funding support for BLs from South Africa’s national government is still very

limited and almost impossible. Inadequate capacity to implement MAB programme can also cause on implementation of BR. There is a lack of clarity in terms of who must do what at which level, causing planning inertia and poor decision making (Andrew *et al.*, 2017).

The review also indicates that the legal standing of biosphere reserves remains a challenge in S. Africa. The Western Cape is the only province that has promulgated a Biosphere Reserve Act (in 2011) (Stanvliet 2014). It is a regulatory act to support the establishment, management and funding of biosphere reserves in the province (Pool R., 2013). Identifying appropriate authorities and institutions that can influence governance and management regimes also challenges implementation of the program. More than 80percent of post-Seville sites designated area is not under any protected areas legislation. The protected area manager has no jurisdiction beyond the core, in buffer and transition zones (Ishwaran, *et al.*, 2008). Similar reports is also observed by C. V. Cuong, *et al.*, 2017; indicating that the operation and management effectiveness of BR in Vietnam is hindered by the predominant practice of sectorial and top-down control, and relatively weak legal status of BR within the national framework.

Participation and Cooperation.

Local participation and cooperation with stakeholders can create a synergy for sustainable management (L. Schultz *et al.*, 2010 and L. Durand

and L. Bernardo 2011). Successful BR management requires more experimentation with participatory methods and a more systematic reflection of success and failure factors (Stoll and O’Riordan 2018). Strong stakeholder engagement supported formulation of good participatory governance in BR helps to ensure successful implementation of BR program (C.V. Cuong, *et al.*, 2017), whereas, lack of cooperation (lack of participation) and communication are the most important constraints blocking the way to successful implementation of activities for sustainable development (Mehring and Susanne 2010, and Weldemariam *et al.*, 2016).

The various official plans emphasize that participatory and good management approaches, allowing multiple stakeholders to be an integral part of BRs, manifest themselves in effective partnerships through cooperation across all governmental levels, the private sector, mass media, civil society organizations, indigenous and local communities, as well as research, monitoring, and education centers (Stoll and O’Riordan, 2018). Weak involvement of stakeholders’ resources augmented with poor awareness and visibility activities as a tool for development at policy and decision makers and conflicting interest from various sector poses problem on successful management of BR (AfrimMAB, 2017).

Report by Pool 2013 indicate that the earlier establishment of the BR was very much a top-down approach and oral communication with a strong

element of spatial planning and development and later BR designation with community-driven initiative and to pro-actively conserve and promote indigenous people with rich history in S.Africa.

Awareness and Communication.

The benefits of implementing the MAB framework through BR must be made very clear (Pool 2013). Despite stern efforts by a group of BR practitioners, the concept is still not well known and sufficiently supported in S. Africa. In South Africa, however, BR is often wrongfully perceived as a conservation instrument with which to block unwanted development (Stanvliet 2014). The review indicates that problems are argued in the use of the word “reserve,” which appears to convey the message of an area where people are excluded which in negative connotation for inhabitants in South African BR while a more positive-sounding alternative exists in Austria, where BRs are called Biosphere Regions (Stoll and O’Riordan 2018). According to Tesfu *et al.*, (2018) most farmers Yayu BR in Ethiopian had limited skills for biodiversity management and conservation. Ayele, 2011 also reported that local communities have very insignificant knowledge about the concept of BR in parts of Kaffa Coffee Forest Biosphere Reserve, Ethiopia.

Opportunities for Sustainable Function of Biosphere Landscape

BRs are a coordinated global network of protected areas designed to ensure the conservation of global biological diversity. These protected landscapes,

under the auspices of UNESCO and its Man and the Biosphere (MAB) Program, are based on the premise that it is possible to achieve a sustainable balance between the conservation of biological diversity, economic and social development, and the maintenance of associated cultural values. BR is also centers of cooperative research, education, and environmental monitoring (Batisse 1982, MAB 1987, US-MAB 1994 cited in (Nyhus and Adams, 1995, and Stoll and O’Riordan 2018)). WNBR of the MAB Programme consists of a dynamic and interactive network of sites. It works to foster the harmonious integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty reduction, human well-being improvements, respect for cultural values, and by improving society’s ability to cope with climate change. It promotes North-South and South-South collaboration and represents a unique tool for international cooperation through the exchange of experiences and know-how, capacity-building and the promotion of best practices.

The BRs have huge potential as landscapes where socio-ecological land management can be practiced towards a more sustainable future for all (Pool, 2013). Biosphere reserves may offer a unique opportunity to understand pathways for more sustainable social–ecological systems. Their ambitious goals match the huge challenges we currently face, including halting biodiversity loss and ending poverty (Ana *et al.*, 2018).

According to Mehring and Susanne (2010), BRs with the typical zonation of core, buffer, and transition zone generally seem to be an appropriate instrument in terms of natural (forest) resource conservation. Biosphere Reserves that the MAB Programme could play a more prominent role in government strategies related to poverty alleviation, environmental sustainability, social upliftment, transformation and economic development. The local level in areas adjacent to BR, it is desirable to have some economic growth from which local people directly profit (Susanne and Tim O'R., 2017). Within the South African context the biosphere reserve concept should be realized as a valuable land management tool with which to integrate people and the environment in a manner that supports the country's natural and cultural conservation and sustainable development objectives while improving human well-being (Pool, 2013).

The MAB Programme has been seen as a vehicle for implementing provincial policies as well as a strategic partner in support of provincial agendas such as sustainable development, climate change adaptation, environmental education and training in S. Africa. One of the added values of the BR concept lies in its international designation and its international affiliation by UNESCO stamp of approval (Pool, 2013). The BR concept is very much in line with modern thinking of landscape management because it seeks to balance ecological requirements with the economic needs of people living in these particular areas. For this reason it is

potentially one of the greatest instruments to promote collaboration across administrative and political boundaries, especially in sub-Saharan Africa, while demonstrating a practical implementation of sustainable development (Pool, 2013).

BR fosters collaborative thinking about the future management of a defined space. They promote decentralization of decision-making whilst promoting collaboration and co-management practices between all stakeholders (Pool, 2013). It is argued that BR creates a platform of to share knowledge and ecologically sound practice with in the world network of biosphere reserve that act as model regions or "real world laboratories" and therefore play an important role in the gathering of knowledge about the complex processes of sustainability transitions (Armin, 2018).

These sites are laboratories of harmonious interaction between people and nature, allowing for advances in the sciences and in traditional knowledge. They facilitate the sharing of knowledge, promote the interaction between science and society and help bring concrete improvements to the lives of local populations (Stoll and O'Riordan 2018, and UNESCO, 2018 b). The program employs science to harmonize relationships between people and their environments to achieve the goal of improving human livelihoods while safeguarding natural ecosystems. Biosphere reserves encourage research into biodiversity loss, climate change, environmental monitoring, and sustainable development. This work

develops solutions relevant to local cultures and environments (Stoll and O’Riordan 2018).

4.0 Conclusions

It is a well-known fact that the future of our world as we know it is in jeopardy. If carefully executed, the biosphere reserve concept does have a future with socio-ecological land-management strategies and biosphere reserves could indeed live up to their reputation as ‘special places for people and nature. The future of the MAB Programme in Africa could be more secure if it recognizes that it addresses the focus areas of national government, namely climate change mitigation and adaptation, and social development including poverty alleviation and job creation with the realm of multi stakeholder participation, focus on endogenous knowledge and culture, interdisciplinary research, monitoring and evaluation.

The focuses and principle of managing biosphere reserve in two phases of implementation vary with concept and philosophical arrangement. Pre-Seville BRs lays its philosophy on Western form of conservation focusing conventional ecological learning. Given that strict environmental protection and development are not usually mutually exclusive; therefor it can be said strict BR considered to serve science while in the second phases (post Seville) of BR program, these functions need to be implemented within a defined landscape and delimited according to interconnected zonation system along a progression from preservation to sustainable

resource use; in such case it could be defined as Biosphere landscape. Therefore, the terminology (Biosphere Reserve Vs. Biosphere Landscape) has to be an arguing concept with their nature of comprehensive thoughts arose in the two phases of biosphere program implementation.

The finding indicate that three main functional factors leads to failure and or success of biosphere landscape i.e., BR designation, participation, and delivery. These challenges specifically arise from local level practice of weak stakeholder participation and collaboration, governance and institutional arrangement, population pressure and economic structure, finance and resources, management, and awareness and communication are the most influential factors for failure of the biosphere reserves in Africa. Keeping with the Statutory Framework of 1995 periodic review occurs ones every 10 year, to evaluate the various functions of the reserve, be it conservation, research, education or sustainable development and as well as attention to whether management and governance systems are adequate for assuring that biodiversity conservation and sustainable development objectives. Globally, until 2018 more than 370 periodic review reports were received by WNBR. Out of pre-Seville sites designated in the regional network of AfriMAB 48.5, 42.9, and 8.6percent of sites two times, one times and never been reviewed respectively. While post-Seville sites of it 70.5, 22.7, and 6.8percent of sites never been reviewed, one time and two times

respectively. CR. Africa and Rwanda are countries having pre-Seville sites never been reviewed.

For successful implementation of the BLs concept needs to be clearly understood and applied through landscape zoning. Designated reserves then need a management system with inclusive good governance, strong participation and collaboration, adequate finance and human resource allocation and stable and responsible management and implementation.

5.0 References

- AfriMAB, (2017), Holding at International Institute for Tropical Agriculture, 5TH Session of the General Assembly of the African Network on Man and the Biosphere (Afrimab), (Iita), Ibadan, Nigeria
- Ana F. Ferreira, Heike Zimmermann, Rui Santos and Henrik von Wehrden, (2018), A Social–Ecological Systems Framework as a Tool for Understanding the Effectiveness of Biosphere Reserve Management, *Sustainability*, 3608; doi:10.3390/su10103608
- Andrew Lyon, Philippa Hunter-Jones, and Gary Warnaby (2017) Are we any Closer to Sustainable Development? Listening to active stakeholder discourses of tourism development in the Waterberg Biosphere Reserve, South Africa, *Tourism Management* 61, Pp. 234 to 247
- Armin Kratzer, (2018), Biosphere reserves as a model region of sustainability transitions? Insights in to the peripheral mountain area Grosses Walsertal (Australia), *Applied Geography* 90, pp. 321 – 330
- Ayele Kebede Gebreyes (2011), Delimiting the Interface between Garden Coffee Expansion and Forest Coffee Conservation and its Implication for Protected Area Management: The Case of Kafa Coffee Biosphere Reserve A Thesis Submitted to the Master of Science Programme, University of Klagenfurt In Partial Fulfillment of the Requirements for the Degree of Master of Science in Management of Protected Areas (MPA, University Of Klagenfurt
- Brian Huntley, Exequiel Ezcurra, Eduardo R. Fuentes, Koichi Fujii, and Peter J. Grubb (1992) A Sustainable Biosphere: The Global Imperative the International Sustainable Biosphere Initiative, *Ecological Society of America*, Vol. 73, No.1, Pp.7-14
- Christine Alfsen-Norodom and Benjamin D. Lane (2002) Global Knowledge Networking for site Specific Strategies: The International Conference on Biodiversity and Society, *Environmental Science & Policy* 5, Pp. 3–8
- Chu Van Cuong, Peter Dart, Marc Hockings, (2017), Biosphere reserves: Attributes for success, *Journal of Environmental Management* 188, 9 - 17
- Chu Van Cuong, Peter Dart, Nigel Dudley, and Marc Hockings (2017) Factors influencing successful implementation of Biosphere Reserves in Vietnam: Challenges, opportunities and lessons learnt, *Environmental Science and Policy* 67, pp., 16–26
- Craig Starger (2016) Biosphere Reserves as Living Laboratories for Sustainable Development, *Future earth Blog*, Research, Innovation and Sustainability
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (2016): Biosphere Reserves Inspiring Action for Agenda 2030, Bonn and Eschborn, Germany
- Feyera Senbeta, Tadesse Woldemariam Gole, Manfred Denich, and Ensermu Kellbessa 2013, Diversity of Useful Plants in the Coffee Forests of Ethiopia, *Ethnobotany Research & Applications* Vol11/i1547-3465-049-069
- Harold Levrel and Meriem Bouamrane (2008) Instrumental Learning and Sustainability Indicators: Outputs from Constriction Experiments in West African Biosphere Reserves, *Ecology and Society* 13 (1), 28
- Hermann Lotze-Campen, Fritz Reusswig, and Susanne Stoll-Kleemann (2008) Socio-Ecological Monitoring of Biodiversity Change – Building upon the World Network

- of Biosphere Reserves GAIA 17/S1, Pp. 107–115
- Ishwaran, N., Persic, A. and Tri, N.H. (2008) 'Concept and practice: the case of UNESCO biosphere reserves', *Int. J. Environment and Sustainable Development*, Vol. 7, No. 2, pp.118–131.
- Kaera L. Coetzer, Edward T. F. Witkowski and Barend F. N. Erasmus, (2013), Reviewing Biosphere Reserves globally: effective conservation action or bureaucratic label? *Biological Reviews*, 000–000, Cambridge Philosophical Society
- Katherine Cunningham 2017, The Benefits of Integrating Biodiversity Conservation and Climate Change Adaptation in Global Development, A Global Knowledge Portal for Climate and Development Practitioners, Blog post
- Leticia Durand and Luis Bernardo Vázquez (2011) Biodiversity Conservation Discourses. A Case Study on Scientists and Government Authorities in Sierra de Huautla Biosphere Reserve, Mexico, Elsevier, *Land Use Policy* 28, 76–82
- Lisen Schultz, Andreas Duit and Carl Folke (2010) Participation Adaptive Co-management, and Management Performance in the World Network of Biosphere Reserves, Elsevier Ltd. *World Development* Vol. 39, No. 4, Pp. 662 -671
- Marion Mehring_ and Susanne Stoll-Kleemann (2010), Principle and practice of the buffer zone in biosphere reserves: from global to local –general perspective from managers versus local perspective from villagers in Central Sulawesi, Indonesia, Springer-Verlag, Berlin Heidelberg, Pp. 413 – 430
- Martin F. Price, Jung Jin Park and Meriem Bouamrane (2010) Reporting Progress on Internationally Designated Sites: The Periodic Review of Biosphere Reserves, *Environmental Science & Policy*, Vol.13,5, pp. 49–557
- Maureen G. Reed and Felicitas Eguny (2013), Management effectiveness in UNESCO Biosphere Reserves: Learning from Canadian periodic reviews, *environmental science and policy* 25, Pp. 107–117
- Maureen G. Reed and Merle M. Massie, (2013), Embracing Ecological Learning and Social Learning: UNESCO Biosphere Reserve as Exemplars of Changing Conservation Practice, *Conservation and Society* 11(4): 391 – 405
- Mersha Yilma, Mapping and Cataloguing Community Resources in Ethiopia, MELCA-Ethiopia
- Michel Batisse (1985), Action Plan for Biosphere Reserve, *Environmental Conservation*, 12 (1), pp. 27 – 27
- Nakileza Bob Roga, Wilem Ferguson, Festus Bagoora (2017) Transboundary Conservation Areas in African Mountains: Opportunities and Challenges for Addressing Global Change, *Earth Sciences*, Vol. 6, No. 6, pp. 117-126, doi: 10.11648/j.earth.20170606.13
- Natarajan Ishwaran, (2012), Science in intergovernmental environmental relations: 40 years of UNESCO's Man and the Biosphere (MAB) Programme and its future, *Environmental Development* 1, Pp 91–101.
- Peter Bridgewater (2016), The Man and Biosphere programme of UNESCO: rambunctious child of the sixties, but was the promise fulfilled? *Current Opinion in Environmental Sustainability*, 19:1–6, <http://dx.doi.org/10.1016/j.cosust.2015.08.009>
- Philip J. Nyhus and Michael S. Adams (1995), BIOSPHERE RESERVES of the World Principles and Practice, Department of Botany and Institute for Environmental Studies, University of Wisconsin
- Pool-Stanvliet R. (2013), A history of the UNESCO Man and the Biosphere Programme in South Africa, *South African Journal of Science* 109(9/10), Art. #a0035, <http://dx.doi.org/10.1590/sajs.2013/a0035>
- Renée Moreaux (2015) Potential of further UNESCO-Biosphere Reserves in Ethiopia, *Terrains / Fieldworks*
- Ruida Stanvliet (2014) The UNESCO MAB Program in South Africa: New Criteria for Future Designation Based on Empirical Studies of Existing Biosphere Reserves, Inaugural dissertation CapeNature, Stellenbosch, South Africa

- Schöller, Matthias (2015) Biodiversity of Beetles (Coleoptera) in Areas under Participatory Forest Management in Kafa Biosphere Reserve, Ethiopia, Conference on International Research on Food Security, Natural Resource Management and Rural Development organized by the Humboldt-Universität zu Berlin and the Leibniz Centre for Agricultural Landscape Research (ZALF) Tropentag, Berlin, Germany
- Stoll-Kleemann S., and O’Riordan T. (2018) Biosphere Reserves in the Anthropocene. In: Dominick A. DellaSala, and Michael I. Goldstein (eds.) *The Encyclopedia of the Anthropocene*, vol. 3, p. 347-353. Oxford: Elsevier.
- Susanne Stoll-Kleemann and Tim O’Riordan, (2017) *The Challenges of the Anthropocene for Biosphere Reserves*, PARKS Vol. 23, pp. 89 – 100
- Tesfu Fekensa, Weldemariam Tesfahunegny and Asersie Mekonnen, (2018) Impact of human activities on biosphere reserve: A case study from Yayu Biosphere Reserve, Southwest Ethiopia, *International Journal of Biodiversity and Conservation*, Vol. 10(7), pp. 319-326
- The World Bank Group, (2019) *This is What it’s All About: Protecting Biodiversity in Africa*
- UNESCO (1996), *Biosphere Reserves: The Seville Strategy and The Statutory Framework of the World Network*, UNESCO, Paris
- UNESCO (2008) Draft Report from the U.S. participants at the Third World Congress of Biosphere Reserves, What are biosphere reserves all about? Madrid, Spain
- UNESCO (2017), *A New Road Map for the Man and the Biosphere (MAB) Program and its World Network of Biosphere Reserves*
- MAB Strategy (2015 – 2025), Lima Action Plan (2016 – 2025), Lima Declaration, ISBN 978-92-3-10020-6-9, Paris, France
- UNESCO (2018), *World Network of Biosphere Reserves in Africa*, Africa: 79 biosphere reserves in 28 countries
- Ecological Sciences for Sustainable Development, Paris, France
- UNESCO (2018)b, *Twenty-four new sites join UNESCO’s World Network of Biosphere Reserves*, Mount Huangshan Biosphere Reserve, China
- UNESCO (2018)c, *A Standard Framework for Biosphere Reserve Management Informed by Sustainability Science*, Jakarta, Indonesia
- UNESCO, (1996) *Biosphere reserves: The Seville Strategy and the statutory framework of the World Network*, UNESCO, Paris, France
- UNESCO, (2003), Editor: Cathy Lee, and Samantha Wauchope; *The Importance of Sacred Natural Sites for Biodiversity Conservation*, International Workshop on the Importance of Sacred Natural Sites for Biodiversity Conservation Kunming and Xishuangbanna Biosphere Reserve, People’s Republic of China; United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France
- Wachira K., Muluka B., & Wepundi M. (2001) *Mt Elgon Conflict: A Rapid Assessment of the Understanding of Socio-Economic, Governance and Security Factors*, Amani Papers. UNDP/OCHA.
- Weldemariam Tesfahunegny, Tesfu Fekensa, Getachew Muluaem (2016) *Avifauna Diversity in Kafa Biosphere Reserve: Knowledge and Perception of Villagers in Southwest Ethiopia*, *Ecology and Evolutionary Biology*. Vol. 1, No. 2, pp. 7-13. doi: 10.11648/j.eeb.20160102.11
- Worku M (2017) *Lake Tana as Biosphere Reserve: Review*, *J Tourism Hospit* 6: 310. doi: 10.4172/2167-0269.1000310
- Zhijun Ma, Bo Li, Wenjun Li, Nianying Han, Jiakuan Chen and rew R. Watkinson, (20019), *Conflicts between biodiversity conservation and development in a biosphere reserve*, *British Ecological Society, Journal of Applied Ecology*, 46, 527–535, Blackwell Publishing Ltd https://en.wikipedia.org/wiki/World_Network_of_Biosphere_Reserves_in_Africa