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Deep Bay, Vancouver Island
The Heron in the Cedar tree
Spreads his wings and squawks Pterodactylily.
He lifts off his perch, the branch rebounds,
Indifferent to archaic sounds.
But I'm alert to watch his shadow drift
Across an ancient valley rift,
And feel the continent divide
Though I have just now stepped outside.
He settles on the tidal shore
No longer leathered Pterosaur.
Then he assumes his breakfast pose,
And I return to breakfast prose.
But my day is brighter now by half
Because I heard the Heron laugh.

Larry William 06/17

INTEGRATED ASSESSMENT OF CHANGES IN WETLAND TYPES IN THE SONGOR BIOSPHERE RESERVE, GHANA

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Abstract

The Songor wetlands form an ecologically valuable resource in Ghana, providing numerous support for biological diversity. Despite its relevance, studies have shown that overexploitation due to developmental activities and overdependence on their values for livelihood pose a threat to the existence of the wetlands. This study investigated long-term changes that have occurred as a result of human activities in the area over a 25 year period (1990-2015). Landsat TM and ETM+ and OLI/TIRS images were used to categorize and quantify the changes in the various wetland types. Local perceptions of the riparian population on the historical changes and drivers for the changes were also sought to complement the assessment. The study revealed that, lagoon/lake and inter-tidal forested wetland experienced increase in spatial extent while seasonal/intermittent and permanent marshes experienced a decrease over the 25 year period. Among the various land use activities undertaken in the Ramsar site agriculture was seen to have greatest impact on biodiversity conservation through truncation of streams in upland areas for fish and crop production. The study strongly recommends that various stakeholders should be involved in the management of the Songor Ramsar site and the regulator should institute stringent monitoring of the wetland due to the constant anthropogenic pressure.

Keywords: Songor wetland, Remote sensing, Perceptions, Human disturbances, Biodiversity conservation

1.0 Introduction

Wetlands are one of the most important ecosystems in the world. They occupy about 6 percent of the earth's surface and vary according to origin, geographical location, hydro-period, chemistry, and plant species (Nyarko, 2007). They play an immense role in the survival of man by providing services such as water quality maintenance, agricultural production, and habitat for fish and wildlife species (Tijani et al., 2011). Communities that live around wetlands in many parts of the world depend directly and indirectly on them for their livelihoods (Aheto, et al., 2011). Despite these advantages, wetlands have been considered "wastelands" (Williams, 1993) and, therefore, subjected to degradation through dredging, flooding, filling and excavation for various land use activities. In most places, increasing population and subsequent demand for more wetland resources to sustain livelihoods have resulted in conversion of wetland types to different land uses, thus accelerating their degradation and threatening biodiversity conservation and sustainable development of wetland areas.

The Songor wetland serves as a feeding, nesting and roosting site for water birds, while the coastal stretch serves as nesting sites for marine turtles and fish species. The mangroves serve as habitat for diverse wildlife species. To ensure sustainable use of the site resources and to enhance the benefits derived from the wetlands by the local

communities, it was designated as Songor Biosphere Reserve as part of the World Network of Biosphere Reserves in 2011 by the United Nations Educational, Scientific and Cultural Organization (UNESCO), based on ecological communities including water bird populations whose presence relate to the international importance of the site (UNESCO, 2011). Despite its relevance, the Songor wetlands are under increasing threat from over-exploitation and degradation. According to Yeboah, Nii-Moe and Nani (2013), there is a perceived loss of the ecosystem services. A study by the Centre for African Wetlands in 2014 on land use and land cover indicated that between 1990 and 2007, there has been an estimated loss of 57.6% of healthy vegetation cover from 3,087 hectares to 1,308 hectares at the site. Field observations and satellites images analysis of the Songor biosphere reserve depicts that the wetland landscape show spatially fragmented patches with decreasing configuration and composition (Adade et al., 2017). The current situation, if allowed to continue, is likely to result in biodiversity loss from the wetland, consequently diminishing both the local and international significance of the wetland. Therefore, this study investigated long-term wetland changes that have occurred as a result of human and developmental activities in the area for the periods between 1990 and 2015. This is to improve understanding of wetland functions and help decision makers implement

policies and adopt management approaches for the protection and conservation of wetlands.

2.0 Study Area

The study area is the Songor Ramsar Site ($5^{\circ} 45'0''N$ $0^{\circ} 30'0''E$) located in the Dangme East District in Ghana, as shown in Fig. 1. It is about 79 km from the national capital, Accra, and is the second largest Ramsar site along the coast of Ghana. The Songor wetland covers an estimated area of 51,133.3 ha and is the only natural point where the Volta River enters the sea. The boundaries of the site include the West Bank of the Lower Volta River estuary and the Songor lagoon. It was designated a Ramsar wetland site of international importance number 14 in August 1992. In 2011, UNESCO approved the Songor Biosphere Reserve as part of the World Network of Biosphere Reserves (UNESCO, 2011). Among several other important functions, the Songor Ramsar Site acts as a habitat and breeding ground for several notable species of water birds such as black winged stilt. Major land use activities in the Songor area include farming, livestock grazing, fishing, salt production, recreation and settlement.

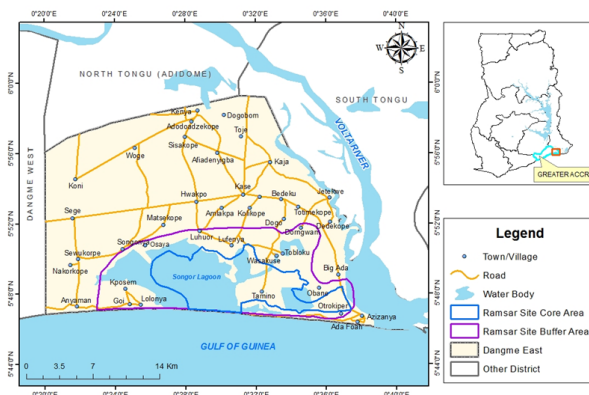


Figure. 1. Map showing the core and buffer areas of the Songor Biosphere Reserve in Dangme East District of Ghana.

3.0 Materials and Methods

3.1 Field data collection and analysis

Both primary and secondary data were used for the study. Data from the field was based on field observation, informal interviews and field measurements. The field observations were undertaken to identify physical features such as vegetation types and other land use activities. Interviews were conducted in communities and the number of respondents were Obane (7), Osaya (10), Otokper (18) and Pute (25). The survey targeted residents in the communities who have lived in the site for at least 25 years. The number of selected respondents varied between communities because of differences in populations. Descriptive statistics was employed in analyzing the close-ended questions in the schedule with the help of Statistical Product for Service Solution (SPSS) version 21. The open questions were categorized under common

themes. Photographs were taken as part of the observation to back data collected with the other tools. The interview data are presented primarily using tables, graph, pictures and narrations.

3.2 Secondary data collection and analysis

In addition to the field data, secondary data such as satellite images, aerial photograph and topographic maps of the study area were also used. Three Landsat imageries of the years 1990 (TM), 2003 (ETM+) and 2015 (OLI/TIRS) were freely downloaded from the United States Geological Survey (USGS) website. Acquisition dates of the multi-temporal satellite data fell within an equivalent season. Ortho-photos and topographic maps of the study area were also obtained from the Department of Geography and Regional Planning (DGRP) of the University of Cape Coast.

The satellite images were subjected to processing operations such as stacking single bands, radiometric and geometric corrections in ERDAS 2013 software and subsetted using the boundary polygon of the core and buffer areas of the reserve. The subset images were then geometrically registered to each other before all other image processing and analyses were performed. In the wetland classification process, bands 1,2,3,4 and 5 of Landsat TM, EMT+ and bands 2,3,4,5,6 and 7 of Landsat OLI/TIRS were used. The study employed both unsupervised and supervised classification algorithms. Unsupervised

classification was done to aid in the exploration of the wetland types. Normalized Vegetation Index (NDVI) were generated for 1990 Landsat TM, 2003 Landsat ETM+ and 2015 Landsat OLI/TIR to help in the categorization of the wetlands. Thereafter, four wetland classes were identified on the three images based on the Ramsar classification of wetland type (Table 1). The wetland classes include: lagoon/lake, inter-tidal forested wetland, seasonal marshes, permanent marshes and non-wetland.

Table 1: Description of wetland categories based on Ramsar classification system for wetland type

Wetland class	Description
Inter-tidal forested wetlands	It includes mangrove swamps and tidal freshwater swamp forests.
Permanent marshes	It comprises marshes and swamps with emergent vegetation waterlogged for at least most of the growing season.
Seasonal/intermittent Marshes	Its include sloughs, potholes, seasonally flooded meadows, sedge marshes.
Lagoon/lake	This constitute brackish/saline/fresh water lagoons and lakes

4.0 Results

4.1 Wetland types and distribution in the Core and Buffer areas

The core area is designated to protect rare and sensitive plants and animal species with land use

activities mostly restricted in the area. As shown in Table 3 and Figure 2, Lagoon/lake was the dominating wetland type in this area. It occupied 4130.28 ha, 5281.21ha and 5647.23h ha in 1990, 2003 and 2015 respectively. Intertidal forested wetland also increased steadily within the core area. From 1990 to 2003 it increased from 343.71 ha to 569.07 ha and then increased to 574.83 ha in 2015. The seasonal/intermittent and permanent marshes occurring at the eastern and south-eastern portions of the core area, however, continue to decrease significantly. From 1990 to 2003, seasonal/intermittent and permanent marshes reduced significantly by 221.85 ha and 141.48 ha respectively. More so, from 2003 to 2015 they further reduced by 440.46 ha and 259.29 ha respectively.

Similarly, considering the Buffer Area (Table 3 and Figure 2), Lagoon/lake was the most prevalent wetland type in the area which permeated the middle sectors of the study area with small isolated patches occurring in the eastern fringes. It covered 2886.48 ha, 4281.21 ha and 4625.19 ha in 1990, 2003 and 2015 respectively. The area under Inter-tidal forested wetland increased from 749.07 ha in 1990 to 1328.94 ha in 2003 and 1491.66 ha in 2015. Seasonal/intermittent marshes reduced significantly in area from 1735.83 ha in 1990 to 1498.05 ha in 2003 and 910.53 ha in 2015. Similarly, permanent marshes which formed the third most predominant wetland class in 1990, reduced from 1739.07 ha in 1990 1402.29 ha in

2003 and 646.29 ha in 2015. These wetland types remained consistent in the south-eastern part of the buffer area giving way to other land use/cover types.

Table 2: Buffer and Core Area statistics for 1990, 2003 and 2015 (Hectares)

Wetland Type	1990		2003		2015	
	Core area	Buffer area	Core area	Buffer area	Core area	Buffer area
Lagoon/lake	4130.3	2886.5	5259.6	4281.2	5647.2	4625.1
Inter-tidal forested wetland	343.7	749.1	569.1	1329.0	574.8	1491.7
Seasonal/intermittent marshes	1218.6	1735.8	996.8	1498.1	556.3	910.5
Permanent marshes	740.1	1739.1	598.6	1402.3	339.3	646.3

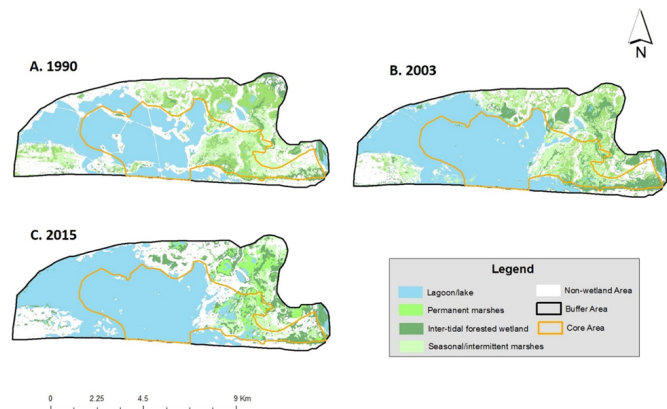


Figure 2: Wetland types distribution in 1990, 2003 and 2015

4.2 Total Changes in Wetland types and Trend

The trend analysis of the Songor wetlands revealed some changes in the spatial extent of the four wetland types over the 25 year period of the study (Figure 3). Lagoon/lake experienced the larger increase while permanent marshes experienced the large reduction. From 1990 to 2003, lagoon/lake and inter-tidal forested wetland experienced an increment in area while seasonal/intermittent marshes and permanent marshes experienced a reduction in area. From 2003 to 2015, the same trend continued with lagoon/lake and inter-tidal forested wetland experienced an increment in wetland area while seasonal/intermittent marshes and permanent marshes experienced a reduction in area.

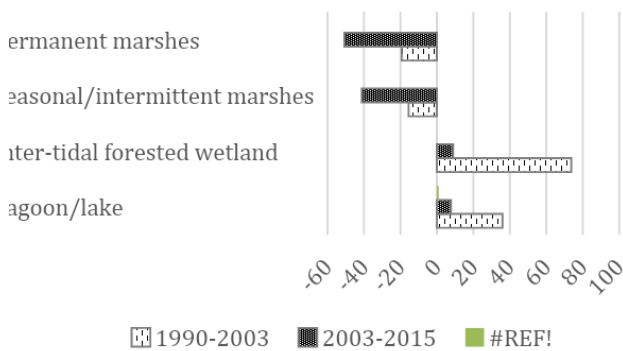


Figure 3: Percentage change in wetland types from 1990-2003 and 2003-2015

4.3 Land Use Activities in Songor Biosphere Reserve

Human activities have shown to have a significant influence on all aspects of wetland ecosystems. Thus it is essential to understand how humans interfere with the landscape systems. All the

respondents indicated that the reserve was important for their livelihood and supported a vast number of residents within the catchment areas. Figure 4 shows the major land use activities and their seasonal calendar in the Songor wetland site respectively. The respondents were engaged in seven main socio-economic activities: These were fishing (26.0%), crop production (21.9%), salt production (19.2%), harvesting natural herbaceous vegetation (16.4%), building and construction (6.8%), tourism (5.5%) and livestock grazing (4.1%). The results indicate a high demand for wetlands goods and services by the residents within the site. The least of the respondents (4.1%) used the site as pasture for small-scale free range livestock production.

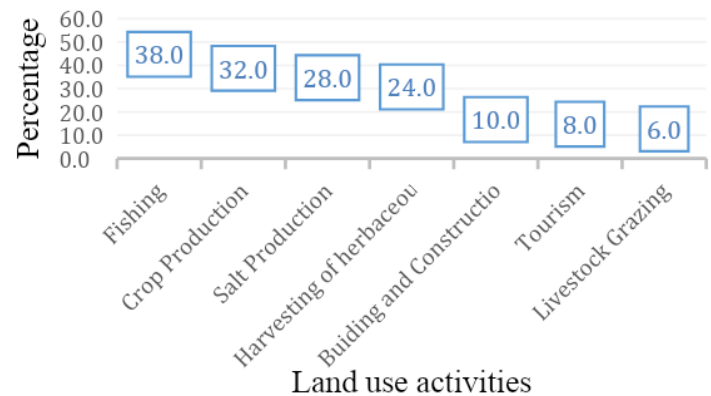


Figure 4: Land use activities in Songor Biosphere Reserve

4.4 Perceived Causes of Wetland Degradation and Loss

There are both natural and human causes of degradation in wetland ecosystems. However, the Ramsar Convention Secretariat (2007) suggested that the Ramsar site wetland degradation is mostly as a result of human activities rather than natural events. The above assertion was in tandem with respondent's views as they identified a total of seven human causes of wetland degradation and loss shown in Table 3. The results presented in Table 3 indicates that wetland degradation in the site is largely caused by agricultural activities (36.1%), followed by road construction (26.9%), saltpan construction (15.4%), changing weather pattern (11.5%), solid/liquid waste disposal (6.7%), and landfilling (3.4%).

Table 3: Perceived causes of wetland degradation and loss

Perception	Frequency	Percentage
Agriculture	75	36.1
Road construction	56	26.9
Saltpan construction	32	15.4
Landfilling	31	14.9
Solid/liquid waste disposal	14	6.7
Total	208*	100

*Frequency is more than 60 because of multiple responses

5.0 Discussion

5.1 Driving factors for the observed changes in Wetland types

The analysis from the satellite images of the Songor wetlands over the 25-year period, revealed

some changes in the spatial extent of the four wetland types in both the buffer and core area. From 1990 to 2003 lagoon/lake and inter-tidal forested wetland experienced an increase in area while seasonal/intermittent marshes and permanent marshes experienced a reduction. From 2003 to 2015 the same trend continued, with lagoon/lake and intertidal forested wetland experiencing an increase in wetland area while seasonal/intermittent marshes and permanent marshes experienced a reduction in area. The significant increase in the physical extent of Songor lagoon from 1990 to 2015 as result of the increase in the level of unsustainable salt mining by small-scale artisanal salt miners around the lagoon. Salt extraction was also identified as a cause of degradation in the site (Table 3). The construction of evaporating ponds and crystallising pans in the flatlands lead to biodiversity losses. This arises from destruction of mangroves and benthic communities as a result of scraping material from the bottom of the lagoon during pan construction (Ntiamoa-Baidu, 1992). The embankment constructed in the lagoon during salt production act as barriers, preventing free movement of fish within the habitat. This practice according to Hanski and Gagiotti (2004) may isolate the fish species population into sub-populations. It may also lead to the displacement of some wetland resources and introduce some invasive species into the system. Salt production occurs during the dry season from November to

April, which overlaps with the non-breeding season of migrating shorebirds.

Similarly, the extent of inter-tidal forested wetlands also increased throughout the period of 25 years. This increase might be attributed to the awareness of the importance of these forested wetlands and management practices instituted by government agencies, particularly the Wildlife Division of the Forestry Commission of Ghana, traditional authorities and environmental NGOs. From the interviews some respondents indicated that various environmental NGO's such as the Ruddorf organization have supported initiatives such as planting mangrove and acacia tree as well as provision of alternative livelihoods for surrounding communities.

This reduction in both seasonal and permanent marshes could be attributed to the truncation of the streams upland and increase in anthropogenic activities such as the construction of irrigation facilities, urban expansion and increased livestock rearing. Observations made indicated that large tracts of these wetland types have been converted to settlements, farmlands and rangeland. Leachate from solid waste landfills often has high biological oxygen demand (BOD), ammonium, iron, and manganese in concentrations and can be potential threat to aquatic ecosystems and public health (Eggen, Moeder & Arukwe, 2010). A study by Yeboah et al. (2013) revealed that the Azizanya community used to be a wetland area, but it was

totally reclaimed with red sand (laterite) for settlement development. Pute, Totope, Anyamam, Goi, Loloyna and other coastal communities are reclaiming wetland areas with solid waste for construction of houses after being displaced by tidal waves.

Majority of the respondents indicated that agriculture is the major cause of wetland degradation within the site. This finding clearly affirms USEPA (1994) cited in Aragaw (2013) assertion that agriculture is the major factor in freshwater and estuarine wetland loss and degradation. This does not only relate to agricultural land expansion, but also other agricultural activities such as harvesting food and construction of irrigation ditches break the wetlands into smaller fragments. Furthermore, livestock grazing also lead to degradation of wetlands which would otherwise have been reserved. In recent years, animal husbandry in the Songor wetland area has developed greatly to meet the needs of population growth and economic development, causing conflicts between wetland conservation and sustainable use of natural resources. Mostly, these marshes are overgrazed and over-trampled by domesticated animals that resulting in the disappearance of primary plant species, hardening of soils and increased surface runoff. These activities according to Tian, Lu and Chang (2004) results in increased soil erosion, changes in plant species composition and spatial

patterns, eventually altering the entire landscape pattern of the nature reserve.

The residents pointed out that road construction can disrupt habitat continuity and drive out more sensitive species. Observation from the site suggests that roads have been constructed throughout the wetland connecting various towns and villages and industrial development. These roads impede movement of certain species or result in increased mortality for animals crossing them. According to Wilson (1998), wetland biodiversity is being threatened while many others are at the verge of extinction due to human activities. Thus, wetland degradation at the site is largely due to these economic activities as these are the main occupation of the communities around the site.

6.0 Conclusion and Recommendations

The study indicated that the open access to the Songor Biosphere Reserve has made it difficult for the authorities in charge to protect the site from over-exploitation and degradation. This has resulted in the transformation of wetland ecosystem to other land use activities. Most respondents depend solely on the wetland resources for their livelihood. They also undertake activities such as crop production, fishing, salt production, and housing construction in the wetland. The intensity of these activities if not controlled could affect broader ecosystem functioning and biodiversity assemblages. The

study strongly recommend that various stakeholders should be involved in the management of the reserve to continue monitoring the wetland due to the constant anthropogenic pressure. Secondly, we also propose that further studies should be conducted, combining geographic, socioeconomic and ecological information to identify and delineate specific areas of risk. Lastly, sensitization and education to create awareness among civil society and policy-makers of the ecological and socioeconomic services of wetlands and the need for their conservation. Sustainable financing mechanism need to be explored and developed for effective national wetlands conservation programs.

Author Contributions

RA‡ took part in the field data collection, analysis and writing the manuscript. DWA ‡ Supervised the work, developed the layout of the paper, contributed in writing the manuscript. DYA‡ took part in the field data collection and contributed to the writing the manuscript. All authors read and approved the final manuscript.

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A COMMITMENT CHARTER FOR THE RECOGNITION OF THE SOCIO-ECONOMIC ACTORS OF THE BIOSPHERE RESERVES

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ABSTRACT: *A commitment charter has been drawn up to recognise the socio-economic actors of the Biosphere Reserves and acknowledge their commitment to the environment and sustainable development. This progress strategy complements the labelling of products and services and has set up networks of eco-actors, who are partners and ambassadors of the Biosphere Reserves.*

In order to be recognised models contributing to the implementation of Sustainable Development Goals, the Biosphere Reserves must promote green and sustainable initiatives and the social economy. To do so, they are advised to encourage comprehensive development initiatives, the creation of labels for products and services supporting their goals integrating biodiversity conservation and human development (UNESCO 2017).

At the end of the 1990s, this topic developed as part of the global network of Biosphere Reserves, under the green economy label. In Europe, the Biosphere Reserves of Rhön (Germany), Entlebuch (Switzerland) have registered trademarks so that the enterprises of their territories can enhance the promotion of their products (especially food) and services (mainly touristic).

In France, socio-economic actors living and working in the Biosphere Reserves asked MAB

France for the authorisation to use the image of the Biosphere Reserve and of UNESCO on their products, in order to recognise their commitment to the environment. The request also included affixing the Biosphere Reserve logo on their products.

Several enterprises also mentioned the Biosphere Reserve in their communication and on their packaging, with no specific authorisation.

This situation generated several problems: a problem regarding the use of the Biosphere Reserve name and a legal problem for the ensuing allegations, absence of harmonisation between the actors as regards the communication of transmitted values, lack of readability for consumers and the risk of illegitimate image appropriation by enterprises that do not apply the principles of the Biosphere Reserves (Mercier et al. 2006).

What mechanisms could be used to promote enterprises contributing to Sustainable Development Goals in the Biosphere Reserves?

The question of establishing a Biosphere Reserve trademark was thus raised. A trademark is a sign that can be used for graphic representation to distinguish the products or services of a natural or

legal person, according to article L.711.1 of the Code of Intellectual Property in France.

Another possibility explored was the recognition of certification in relation to a standard, i.e., a standard produced by the professionals, public authorities and consumers concerned (ISO).

The inventory of existing labels and trademarks showed that there was a multitude of them in France (Mercier et al., 2006), particularly for agricultural and touristic products. As a result of this plethora of trademarks (appellations of origin, labels and quality standards...), most consumers no longer understood what they meant.

Studies carried out showed that setting up and controlling trademarks and ISO certification was costly and required the development of specifications and regular audits.

It should be noted that Biosphere Reserves are not very visible in France as they do not generally have their own legal structure and they are often managed by an area protected under national law (national park or natural regional park). This overlap is not generally a problem for the implementation of functions, as the objectives of these types of protected areas are similar to those of the Biosphere Reserves. However, readability for the public is often unclear as communication generally focuses on the park including the Biosphere Reserve rather than on the “UNESCO Biosphere Reserve”. In addition, their means of communication are relatively limited, particularly in comparison to those of major commercial brands. Finally, the promotion of products or

services is not their core profession. Their purpose is to lead conservation actions, to support local development and the development of the territory, to educate the public... in view of territorial development combining nature, culture and the economic and social development of the inhabitants. In this context, the French Biosphere Reserves did not seem to be in a position to effectively promote a new trademark in order to make it visible and desirable for consumers.

The utility of a new trademark (and its logo) thus appeared to be questionable from several points of view for the Biosphere Reserves, although they were interested in ways of helping, recognising and promoting enterprises in the Biosphere Reserves, provided that they were involved in local sustainable development.

A decision was thus taken to promote enterprises in the Biosphere Reserves committed to sustainable development approaches. The mechanism chosen for this is a commitment charter.

The Biosphere Reserve commitment charter

The implementation of a commitment charter highlights a common identity around the Biosphere Reserve, as it is based on values shared by the designation of the territory in question as a UNESCO Biosphere Reserve, on one hand, and on its natural, cultural and social attributes, on the other. Establishing the terms of this document requires numerous exchanges allowing each actor to grasp the expectations of a Biosphere Reserve, and to share the issues of the territory in question

and promote dialogue focusing on the notion of local sustainable development.

Whereas the branding of products and services and certification are governed in a centralised way and correspond to a "top-down" philosophy of action (experts apply a method to the actors of the territories in question), the commitment charter is an approach leading to collective action. The Charter draws up the theoretical framework of the management of collective assets (Ostrom, 1990), refers to ways of acting in the domain of cooperation and dialogue in order to preserve a "treasure" together, "all around the table".

It combines the values of the territory that this treasure represents (its biodiversity, landscapes, the uses and traditions that humans have developed there) and international recognition by the prestigious UNESCO institution.

In this way, the charter enables territorial actors who make efforts to promote the environment and sustainable development to stand out from other actors who use the regional image as a sales pitch. Indeed, the image of the site is used by all kinds of economic actors, regardless of their approach to sustainable development and the ecological and social impact of their activity. The aim of the Biosphere Reserve Charter is thus to indicate this geographic attachment for those who "guarantee" that they respect biological diversity, that they experiment sustainable development, share experiences and operate as part of the network. The idea is thus to exclude those who make no efforts with these points.

The stakeholders must thus share the functioning of the Charter and understand the effects of the actions of each participant on the others. The collective construction of the Charter is a phase requiring a lot of time and investment from the different actors. Each participant is then in a position to understand the impacts of their actions on the system as a whole. In this process, mutual confidence is very important. It is fundamental during the co-construction of the terms of the Charter. This is the consolidation phase of a founding group, the phase that determines the "membrane" that identifies the group in relation to the rest (Servigne and Chapelle, 2017). The solidity of the membrane will then be crucial for accepting new members. It will develop if the group is strengthened by increased visibility as part of the Charter or the Biosphere Reserve.

Confidence is also essential for the smooth running of the commitment charter. Each actor will be required to make commitments, keep their word, report their activities and observations. This may seem logical for the founding members, but is it not automatically transposable for members who will ask to adhere at a later stage and who will not yet have invested in the structure. By making commitments and promoting the Charter of the Biosphere Reserves, actors will grow together, and benefit from increased visibility. There will be no rivalry between them. If they respect their commitments, their reputation will grow, and thereby strengthen the collective structure. Finally, these committed actors can use the rules

and trust capital created by the Charter and supported by the Biosphere Reserve, and its reputation, for personal means.

But if the trust capital is overexploited, or not maintained or updated, it will collapse. The erosion of trust is a risk in systems of certification such as this one, as it is not based on a structure guaranteed by the State (K. Levin & al, 2009). In other words, the commitment charter is liable to collapse if stakeholders do not develop it or if they do not respect their commitments.

It is thus essential to set up a system of surveillance and sanctions. The commitment charter proposed to the Biosphere Reserve enterprises is a system of continuous improvement: they formally make concrete commitments in relation to their activities, to be accomplished within a specified time (2 or 3 years in general), possibly with the help of sponsors. They are asked to make their commitments known to their clients and the public, in order to contribute to strengthen the credibility of the Charter and to breathe new life into it. In this way, each one can check whether the commitments made are respected or not. The total transparency of the commitments made, and the operating rules of the Charter enable social monitoring and contribute to the trust capital. Other types of surveillance, in addition to this social control, can be envisaged: by an independent outside structure, by a commission of control consisting of actors from different sectors. This is clearly the least costly formula for structures with limited means.

Sanctions contribute to lending credibility to the commitment charter when they are clearly applied to offenders according to shared rules. As it can sometimes be problematic to apply them at a local level, a mechanism of national exclusion can be used in case of local conflicts: in this way the Charter is signed by the enterprise, the director of the Biosphere Reserve in question and by the leader of the MAB at a national level.

This commitment charter embraces the whole diversity of enterprises and can also be applied to other actors present in the Biosphere Reserves (associations for example): in the domains of agriculture, tourism, but also services and industries, provided that they agree to the aims of economic and social development in the region, while safeguarding its biodiversity, its landscapes, its natural cultural values and ecosystem services. The commitment charter requires an institution for admitting new members, surveying the quality and credibility of the commitments made and their implementation. The charter committee generally comprises the Biosphere Reserve leaders, founding members representing their values, and personalities representing the main territorial issues, who are able to critically discuss the terms of the commitments and the way they are accomplished. This committee defines the tempo of meetings (generally one to two per year) and continues participative work.

The networks of eco-actors

The commitment charter thus formalises relationships between the actors of the Biosphere Reserve and its supporting structure, as a means of strengthening and sustaining the project. They are designated “eco-actors of the Biosphere Reserve of...”. The sharing of values and discussions on the sustainable development of their region results in the construction of networks: they exchange on their practices, help each other and can also develop common projects. The supporting structure must contribute to the network, by organising meetings and encouraging participants to take the initiative to set up formal and informal consultations. In addition to the statutory meetings of the charter committee, training sessions are set up to contribute to improving and sustaining actions and festive sessions are organised in order to consolidate the network.

ASSOCIATED CONTENT

The presentation of the commitment charter and examples of its implementation are accessible on <http://dwink.pro/86/>

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

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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).

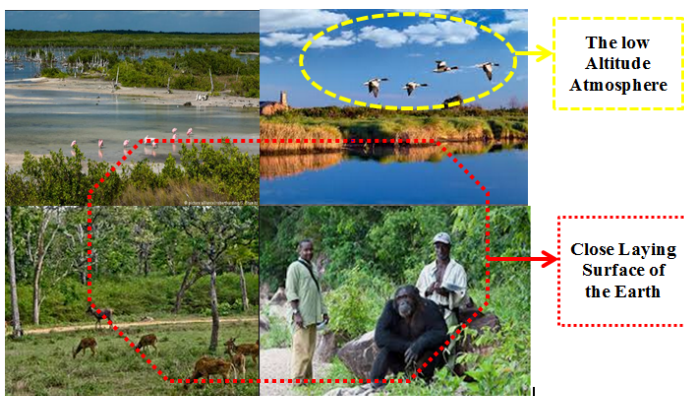


Fig. 1. Regions of the Earth capable of being occupied by living organisms (adopted from www.unesco.org).

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).

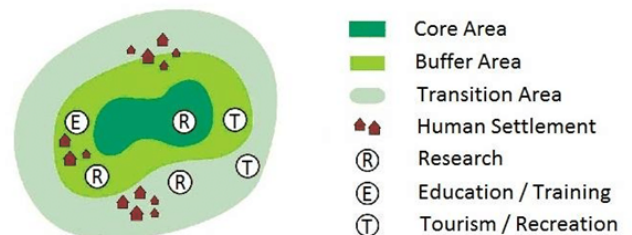


Fig. 2. Zonation in a terrestrial Biosphere and Functions (adopted from GIZ 2016 and www.unesco.org).

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

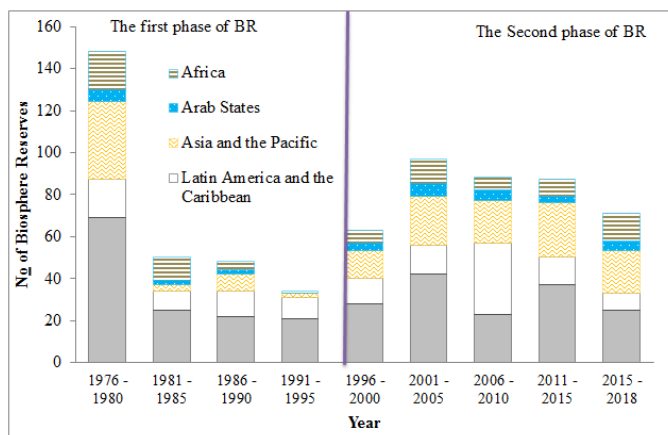


Fig. 3. Biosphere Reserves (BRs) by regions of World Network of BR (1976 to 2018)

(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, Mauritius, 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.

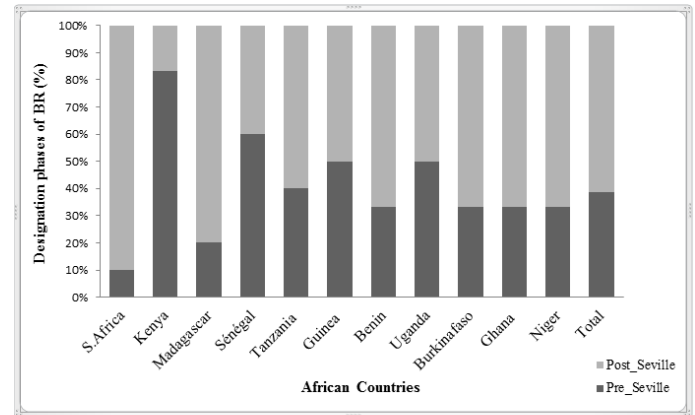


Fig. 4. Countries from regional network of Africa registered in the two phases of Biosphere Reserves (BRs), Pre-Seville (1976 – 1995) and Post-Seville (1996 - 2018). (Data extracted from lists compiled by UNESCO's MAB 2018, and www.unesco.org)

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 Egunyru 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.

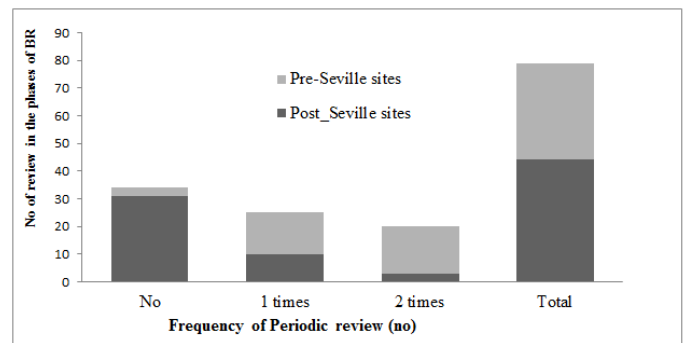


Fig. 5. The status of periodic review in two phases of BR in regional network of Africa (Data extracted from lists compiled by UNESCO's MAB 2018, and www.unesco.org)

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.

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Learning by example: A historical account of the experiences and transformation in the management of the Mount Arrowsmith Biosphere Region (Reserve), Vancouver Island, Canada.

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ABSTRACT

This report outlines the developmental history of the MABR from its conception in the early 1990s through its evolution into an effective, functional biosphere region in 2016. It describes why and how the biosphere reserve concept was initially felt to be appropriate for the region; the challenges in trying to achieve UNESCO recognition without initial senior (provincial and federal) governmental support, and how this lack of support was overcome; the initiatives undertaken in the first decade after establishment; and how the biosphere reserve almost collapsed when it was largely commandeered by community members that had an anti-development advocacy agenda. It concludes by describing how the initiative evolved into what is now one of the most productive and dynamic Canadian biosphere reserves. The documented experiences of the world's biosphere reserves are valuable educational products, and it is hoped that descriptions of the challenges encountered and overcome in the Mount Arrowsmith Biosphere Region (Reserve) can benefit the development of other biosphere reserves both in Canada and worldwide.

Keywords: *Biosphere Reserve, Governance, History, Watersheds.*

INTRODUCTION

The United Nations Educational, Scientific and Cultural Organization's (UNESCO) Man and the Biosphere Programme (MAB) created the concept of biosphere reserves to recognise areas where local citizens are attempting to achieve a balanced relationship between people and nature to ensure environmental, economic and social (including cultural and spiritual) sustainability. This is achieved by striking a balance between the goals of conserving biological diversity, promoting economic development, and maintaining associated cultural values. A biosphere reserve demonstrates practical approaches in addressing

its unique challenges in balancing conservation and local human use in its area.

The Biosphere Reserve World Network is more than a listing; biosphere reserves exchange knowledge and experiences on sustainable development innovations across national and continental borders. Of the more than 669 biosphere reserves designated by UNESCO MAB in 2016 (Fig. 1), each has a unique story and history.¹ Benefits gained from being part of

¹ The number of biosphere reserves worldwide as of May 2018 (www.unesco.org/new/en/natural-sciences/environment/ecological.../biosphere-reserves/)

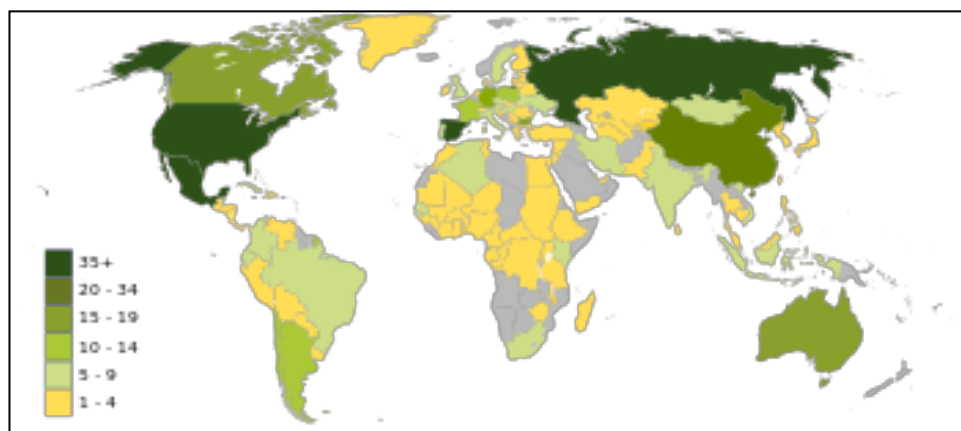
the network include access to a shared base of knowledge and scientific research, working toward high-level and common goals, and the opportunity to connect internationally to other biosphere reserves on issues of conservation, development, and sustainably managed ecosystems. The biosphere reserve concept is applied differently within each local context, and even among biosphere reserves in one country such as Canada, there are a multitude of ways that local communities embrace the opportunity that a designation offers (e.g., Canadian Biosphere Reserves (2012)).

Biosphere reserves are areas that explore innovative approaches in a vast diversity of policy and management fields to work towards achieving a balanced relationship between mankind and nature as defined in Biosphere Reserve policy and strategy documents (Seville

Strategy (1996), Madrid Action Plan (2008-2013)). In order for an area to be included in the World Network of Biosphere Reserves, work towards these ends within the area must be initiated at the local level, appropriate information about the region must be summarised, and the local population needs to have expressed its written support. Nominations for a biosphere reserve are prepared and submitted to UNESCO by national governments, in most cases through MAB national committees.

This document summarises the development history of one of the earlier community-initiated biosphere reserves in Canada, that of Mount Arrowsmith, in the hope that descriptions of the challenges overcome there can benefit the development of other biosphere reserves both in Canada and world-wide.

Figure 1: Map showing the World Network of Biosphere Reserves. As of 2016 total membership has reached 669 biosphere reserves, including 12 transboundary sites, in 120 countries occurring in all regions of the world.



THE CANADIAN CONTEXT

Biosphere reserves were established in Canada (Fig. 2) in two general episodes: an early federal government-initiated creation of six biosphere reserves (1978 to 1990) and a later more community-driven establishment from 2000 to

present day. There are now 18 biosphere reserves (BRs) in Canada, with the most recent, Beaver Hills BR in Alberta and Tsá Tué BR in the Northwest Territories, designated in 2016.

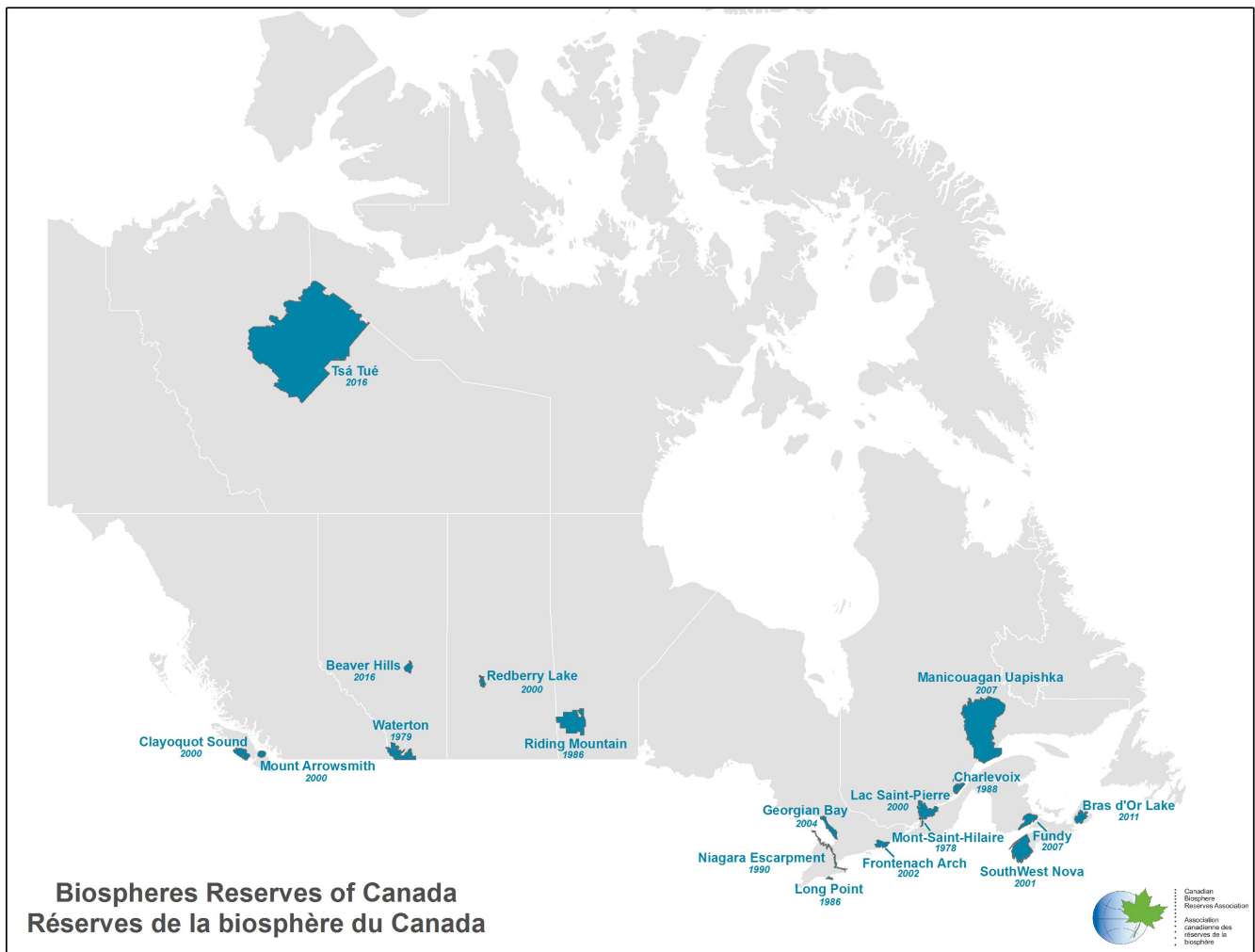


Fig. 2. Canadian biosphere reserves in 2016. Mount Arrowsmith is second from the left.

BIOSPHERE RESERVES IN CANADA – PRIOR TO 2000

Canada's first biosphere reserve, Mont Saint-Hilaire, was established in Quebec in 1978, followed by Waterton in Alberta in 1979. Between 1986 and 1990, four more were established – one in Quebec (Charlevoix), two in Ontario (Niagara Escarpment and Long Point), and one in Manitoba (Riding Mountain), creating a Canadian network of six biosphere reserves. In keeping with early days and development of the MAB Programme, these biosphere reserves were all established by the federal government with little required involvement by local people.

DEVELOPMENT OF THE MABR PROPOSAL

In the late 1980s and early 1990s, public interest in the well-being of the environment in British Columbia (BC) increased dramatically: the logging of old growth forests in coastal BC was of particular concern, along with concerns about sprawling residential development and the scale and nature of resource extraction activities occurring in many west coast communities. This increase in human environmental impacts in BC coincided with the new awareness in BC of the potential of biosphere reserves, which until then had not been regionally talked about. In the

early 1990s in the area of the future MABR, a group of local citizens were organizing regional and local environmental committees to try and conserve local environmentally sensitive areas that were being threatened by residential development, including the Englishman River estuary in Parksville on the east side of Vancouver Island. The Society for the Preservation of the Englishman River Estuary (SPERE) was formed, and along with other local groups, pressure (including national news coverage) was exerted on governments to protect this area, resulting in the establishment of the provincial Parksville/Qualicum Wildlife Management Area (PQWMA) in 1992. However, Dr. Glen Jamieson, then president of SPERE, soon realized that while the Englishman River estuary area was now protected, a functional estuary only existed if the river's water flow rate and quality were also being adequately monitored and managed, which was not then the case. For example, in the winter, when rains were heavy and the river had its maximum flow rates, turbidity was high, so cleaner water from regional wells was the preferred municipal water source and impacts on the river were minimal. However, in drought periods in the summer, river flow rate often decreased to less than one m³/sec, yet this was the time of year when river water use by local

governments was high due to the river's summer low turbidity. Coupled with a greater summer municipal water demand from a growing residential uses, gardening, increasing tourism and increasing pollution from agricultural runoff upstream, the health of the river for aquatic species was increasingly a concern of SPERE. Protection of the estuary alone was seen as not sufficient, and sustainable water management needed to include the entire watershed.

In 1993, environmental groups around the Strait of Georgia were brought together by the Georgia Strait Alliance, formed in 1990. The concept of "biosphere reserves" was raised at one of the early information meetings, and Dr. Jamieson realised that this concept might be appropriate for the east side of Vancouver Island. This area in the Georgia Basin had both unique ecosystems and unique resource management challenges, as it was almost entirely privately owned and the most urbanised area in BC. While biosphere reserve designation in itself did not legislatively protect land, it would encourage awareness and responsibility by local peoples to take actions that would conserve values identified as important.

Emphasis was placed on the biosphere reserve's non-advocacy role and their potential to be living examples of how research and education

relating to specific local challenges could lead to improved sustainable management. It was this new awareness of the concept that resulted in an effort to establish a biosphere reserve in the British Columbian Georgia Basin, and specifically in the Englishman River watershed, which led to the proposal of the MABR. However, despite the local importance of the Englishman River Estuary, its extent (about one square kilometre in area) was relatively small compared to the areas of other Canadian BRs, and did not include any legislated core protected areas which often formed the basis of a BR given UNESCO guidelines of the day (Seville Strategy 1996). To ensure that riverine flow rates and water quality issues could be managed as sustainably as possible over a more extensive area of adjacent watersheds, the desired boundaries of the MABR were established as the entire watersheds of the rivers and creeks flowing into the Strait of Georgia from Lantzville to the southeast and Bowser to the northwest (a straight line distance of about 30 km, although the actual shoreline distance is about twice that). These were the Englishman, Cameron and Little Qualicum River watersheds, the Nanoose and Bonell Creek watersheds, and the smaller stream watersheds between them (Fig 3). Five relatively small Provincial Parks within these watersheds then met UNESCO's definition of core areas within the BR.

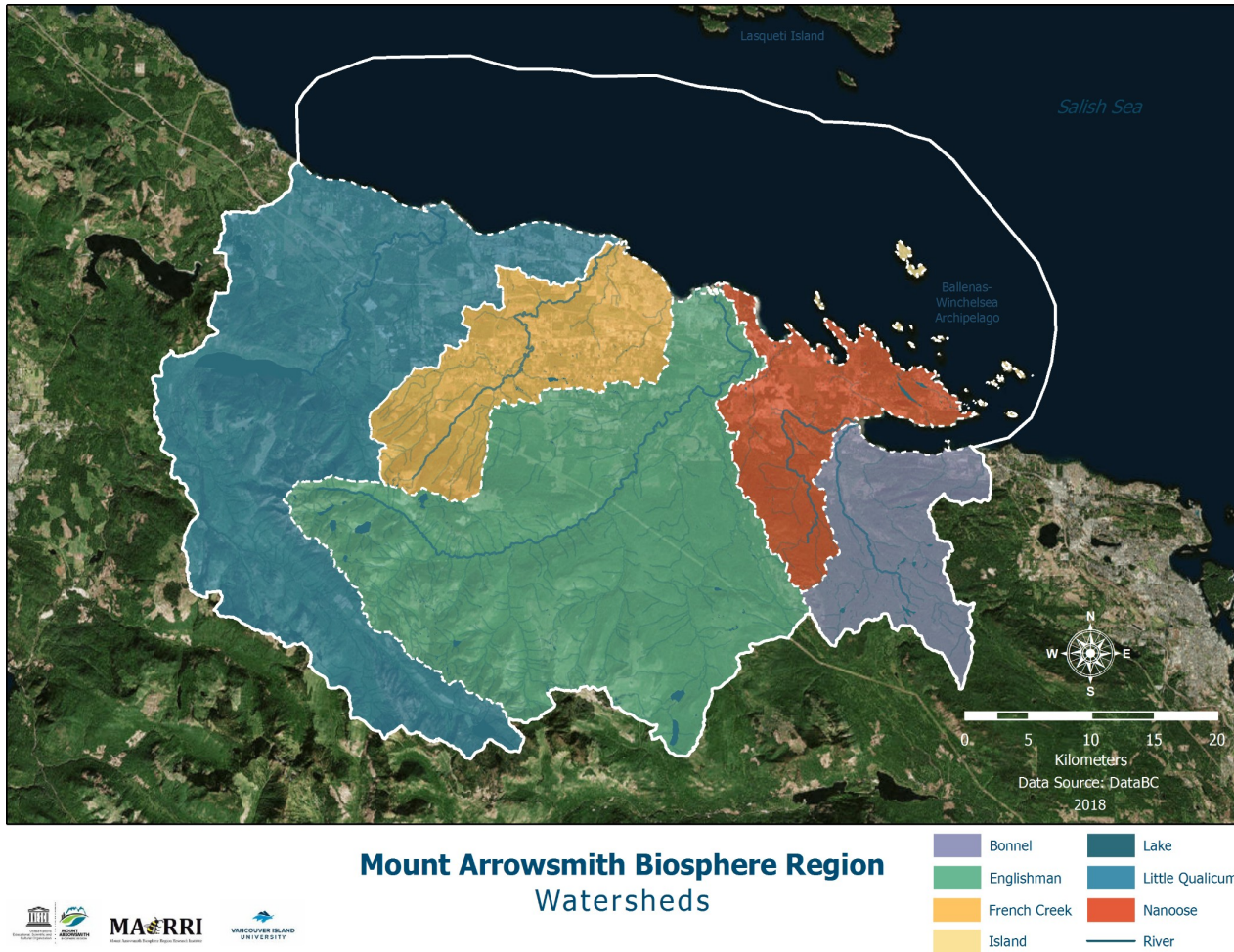


Fig. 3. Map of the Mount Arrowsmith Biosphere Region (Reserve).

Based on his involvement with local stewardship groups, and the termination of SPERE after the establishment of the PQWMA in 1993, Dr. Jamieson prepared a prospectus for a Mount Arrowsmith Biosphere Reserve (MABR) that he presented to municipal governments. At the same time, he engaged the Canadian Commission for UNESCO (CCU) and representatives from the six established biosphere reserves in Canada (four were affiliated with a National Park) in an effort to

find out how to establish a new biosphere reserve. Representatives from the other Canadian biosphere reserves and Parks Canada provided encouraging support. During the mid-1990s, the UNESCO designation process advanced to incorporate recommendations of the Seville Strategy (1996), which required evidence of bottom-up community interest in the concept, including municipal and provincial support in the Canadian context.

While at the time there were no official steps or directives on how to proceed, it was suggested by a representative from the CCU that to achieve a Biosphere Reserve designation, an area would have to be functioning as a biosphere reserve before applying for the designation. It was noted that evidence for this would include the provision of regionally relevant research in support of achieving sustainability.

Dr. Jamieson, as a federal research scientist, took on the scientific/educational aspects of UNESCO's directives for biosphere reserves and initiated a program of regionally relevant research in support of achieving sustainability. By 1996, the first specific MABR research initiatives were underway, including a study with the Canadian Wildlife Service of Arctic-bound migrating Brant (a marine goose) which rely on seasonally productive waters for foraging each spring in the proposed biosphere area; an analysis of riverine/forest connectivity in the local area (the biodiversity and abundance of insects was monitored over streams and into the adjacent forest); and other initiatives supporting long-term research and monitoring such as the establishment of a Smithsonian Forest Monitoring Plot in the Mount Arrowsmith watershed.

With the cooperation of community members, the Mount Arrowsmith Biosphere Foundation (MABF) was registered in 1996 as a non-profit society, which was intended to be the management committee for a biosphere reserve in the area, if and when it was to be formally recognized. Based on the British Columbia Society Act (1996), the society was managed by a group of elected Directors who held decision-making and fiduciary responsibilities of the society as outlined in a formal MABF operating framework. Regional municipal representatives participated as liaisons, not as directors, to avoid any perceived conflict of interest. A seat on the Board was allocated to each of the two local Salish Sea First Nations (the Snaw-Naw-As in Nanoose Bay and the Qualicum further north), the two international timber companies that owned most of the proposed biosphere reserve's land, along with open chairs for community representatives. Thus, while there are seven First Nations with territories that the BR overlaps (see below), seats were only offered to the above two, since the others only had minor territory overlaps. The MABF provided a basic structure for activities, gave the initiative credibility, and to ensure as much community participation as possible, membership in the society was not restricted beyond paying for an annual \$5 membership. However, as will be shown, in addition to resourcing the MABF

(human and financial), this latter decision caused serious problems in the evolution of this biosphere reserve.

As the MABR concept was emerging on eastern Vancouver Island, representatives from the six existing Canadian biosphere reserves formed the Canadian Biosphere Reserves Association (CBRA), with the future MABR participating as an associate partner. The CBRA aimed to improve collaboration among Canada's existing biosphere reserves and to advocate for federal support on behalf of all Canadian biosphere reserves. Circa 1996, there was no directed federal financial support for any Canadian biosphere reserve, but those reserves that included a national park received logistical support and minimal funding (\$5000 year) from Parks Canada for associated activities. Incorporated in 1997, annual CBRA meetings were held, many in association with the "The Leading Edge" conference series jointly organized by the Niagara Escarpment and Long Point BRs near Hamilton, Ontario. Dr. Jamieson presented a number of papers (Jamieson 1997a,b) at these meetings, documenting his efforts in BC to establish the Mount Arrowsmith Biosphere Reserve, and in 1998, he was encouraged to gather and submit the information required for a formal application to the Canada Man and Biosphere Committee (Canada MAB)

to make this a reality. With assistance from two MABF members and Dr. Fred Roots, then Chair of Canada MAB, the application was in its final stages by late 1999. No financial or planning support was directed toward the project from potential funding agencies. However, the nomination process came to a sudden halt in 2000 when the BC government indicated it would not support the MABR application.

This lack of support centred on perceived conflict with another BC biosphere reserve initiative underway at the same time, which was receiving significant financial support from both the BC and federal governments. Together, these governments hired a consultant to prepare a submission for a proposed Clayoquot Sound Biosphere Reserve on the west coast of Vancouver Island. This initiative arose from Jean Chrétien's interest as Canada's Environment Minister in 1993 to address and resolve the dispute over old growth logging in that area that received international attention, in part due to the largest mass arrests for civil disobedience in Canadian history. In 1996, as Prime Minister, Chrétien decided that the creation of a biosphere reserve in and surrounding Clayoquot Sound would make a strong environmental statement in support of sustainability. Work was initiated to gain local support from communities, First Nations, and

local business groups (logging, fishing, and aquaculture). While the two initiatives were unrelated, Dr. Jamieson and Ross McMillan, the consultant that was leading the process to establish the Clayoquot Sound BR, were in close contact and the two initiatives, one on the east side and the other on the west side of Vancouver Island, happened to come to fruition at the same time. At that time, feedback to the MABF from the province indicated that the MABR application should be temporarily withdrawn, as representatives from both the province and Canada wanted the Clayoquot Sound application to be considered by Canada MAB alone to give it maximum profile. The understanding communicated to Dr. Jamieson was that the BC government would then support the Mount Arrowsmith submission in the next UNESCO consideration period of proposed new BRs.

In the Clayoquot Sound area on the west side of Vancouver Island, all forestry land was Crown Land, and as such, government had an influence on how it would be managed and ultimately logged. Governments were thus able to apply pressure to obtain consensus from all the main interests in the Clayoquot Sound area to support designation of the Clayoquot Sound BR. In contrast, because of the 1884 Esquimalt and Nanaimo (E&N) land grant on south-eastern

Vancouver Island between government and the logging industry, by the late 20th century, virtually all forestry lands in the Mount Arrowsmith area (i.e., most of the proposed biosphere reserve area) were owned by private international forestry companies and much of the remaining land base was also held by individuals under private ownership. Supporting an initiative that would place a UN designation on privately owned lands was a difficult request for international forestry companies to support, and these private entities could not be entreated to support the Mount Arrowsmith BR designation. Executives of the forest companies in the proposed MABR thus approached the province and said that since consensus for a BR was required by all the major interests in the Clayoquot Sound area, it should also be required in the Mount Arrowsmith area, which caused the province to back off on its earlier indication of support for the Mount Arrowsmith BR nomination. A provincial representative even suggested to Dr. Jamieson that all private forestry land should be removed from the proposed MABR boundary, which Dr. Jamieson refused to consider since it was not compatible with achieving desirable overall watershed management practices, which was the rationale for trying to obtain MABR designation in the first place.

In contrast, local communities and First Nations in the proposed MABR were receptive to the biosphere reserve concept and potential future opportunities it might invite, such as increased local environmental awareness and tourism to a “model area”, and provided written support for the nomination. In these early stages, none of the local First Nations that were engaged expressed concern about a biosphere reserve designation despite their unresolved territorial rights and claims associated with the proposed boundary.

Despite the lack of support from the province and the lack of clarity in the requirements to proceed with an application at the time, Dr. Jamieson nevertheless elected to proceed. Further research into the UNESCO nomination process revealed only two requirements actually existed at that time: 1) that proposed biosphere core zones (areas with legislative protection) would stay protected into the foreseeable future, and 2) that industry management policies were of a sustainable nature. There was no actual mention of a need for formal written support from the higher levels of either government or industry. Dr. Jamieson then confirmed in writing from local protected area managers that the existing parklands would remain protected into the foreseeable future. Policy documents from the local forestry companies were also

found on the internet and were included in the BR application to document that industry management policies indicated that the forest companies wanted to work with local communities in support of sustainable forest management. Dr. Jamieson submitted this collection of material as required in the nomination process for the MABR to the Chair of Canada MAB, where it was accepted and then sent to UNESCO in the spring of 2000. The nomination was also accepted that spring and due to a delay in Paris in the approval of earlier submitted nominations that included the Clayoquot Sound BR, formal recognition of both the Clayoquot Sound and Mount Arrowsmith Biosphere Reserves ultimately did occur unexpectedly together in November 2000.

The designation of the Mount Arrowsmith Biosphere Reserve was not expected by either the Province of BC or the forestry companies, and their concerns were expressed to both the Canadian Commission to UNESCO (CCU) and to UNESCO headquarters. However, UNESCO determined that all relevant criteria had been considered, and so recognition of the Mount Arrowsmith Biosphere Reserve remained. Provincial representatives then stated that while the “birth” of the BR was “irregular,” the “baby” had nevertheless been born, and so it would be recognised by governments. At a

public dedication ceremony of recognition by UNESCO six months after the designation, provincial representatives participated and even announced a significant expansion in area of one of the provincial protected BR core areas, the Parksville-Qualicum Wildlife Management Area. However, while the Clayoquot Sound BR received a \$12 million endowment fund (the Clayoquot Biosphere Trust) from Canada for its operations, Mount Arrowsmith did not receive any start-up or operational funding from either the province or Canada, and to this date, along with most other biosphere reserves in Canada, fundraising still remains a priority activity for the MABR.

MOUNT ARROWSMITH BIOSPHERE RESERVE - 2000 TO 2009

The Mount Arrowsmith Biosphere Reserve (MABR) is located on the east coast of Vancouver Island, British Columbia (Fig. 3). From the top of Mount Arrowsmith (1817 m) in the Beaufort Mountain range, the MABR extends down to the sea, where it includes islands in the Ballenas/Winchelsea Archipelago and a marine area extending halfway to Lasqueti Island to a depth of about 300 m below sea level. The total land area is approximately 800 km² and the marine area at the surface is about 400 km².

The BR is primarily within the Traditional Territories of the Snaw-Naw-As First Nation and Qualicum First Nation on the east side of Vancouver Island, but also overlaps portions of the unceded territories of the Snuneymuxw, K'omoks, Tseshaht, Hupacasath, and Ditidaht First Nations on the western side of Vancouver Island. Local governments include the City of Parksville, Town of Qualicum Beach, and the Regional District of Nanaimo (RDN). These governments and institutions are joined by dozens of registered non-profit organizations that address local MABF concerns, such as stream habitat enhancement and migrating seabird monitoring. Along with these groups, an active citizenry that is known for volunteerism and involvement in local issues characterizes the mid-Island area.

While it had been established early on that there was little in the way of formal guidelines for achieving the biosphere designation at the time, the MABF also found that the path for both achieving the high level mandate of BRs and to make it relevant at the “boots on the ground” level was also not clear, with the result that society membership remained small. In the early years following the MABR's designation, the society even struggled with maintaining a full slate of volunteer directors for the MABF's eight-member Board of Directors (BOD). Part

of the reason was that functional BRs often have funded support staff to achieve MAB goals. In the absence of funds and with few society members because of the challenge described above, the MABF had a reduced capacity to work towards realizing the potential benefits outlined in the MAB Programme. The reality was that 1) there was a very limited number of highly dedicated people involved, and 2) a lack of funding. A small group can do a lot, but dedicated time and effort is needed, which is difficult when funding is not available. In this situation, a small group might not accomplish as much in the same time as a larger one, although more could have potentially been accomplished with a different group of people. Under these circumstances, the MABR could have benefited had it had more capacity to support staff to work towards the goals the MAB Programme laid out (Seville Strategy 1996; Madrid Action Plan 2008-2013). In contrast, funding was not a problem with the nearby Clayoquot Sound BR, which could utilise funds earned by their large endowment. Thus, whereas the focus of the MABF quickly turned to fund-raising, the focus of its sister biosphere reserve was focused on how best to allocate its available resources.

However, difficulty in obtaining operating funding did not impede all progress in the early years - some limited, project-specific funding

was obtained for research, including:

- 1) the continued monitoring of the Smithsonian Biodiversity plot located in one of the MABR's core protected areas (with student and volunteer labour),

- 2) initial GPS documentation of invasive plants and animals locations in some of the core areas with federal-funded summer student support,

- 3) establishment of a GLORIA (Global Observation Research Initiative in Alpine Environments) site on the top of Mount Arrowsmith to document the effects of climate on alpine flora through involvement of a local university graduate student,

- 4) documentation of tagged migrating Brant geese for the Canadian Wildlife Service by a seasonal contract, and

- 5) development of a two-part television series titled "Liquid Assets", which was about the importance of water, i.e., its source and its usage, in the MABR, which was shown repeatedly on local television stations.

All this funding was secured by Dr. Jamieson through his professional contacts and his associate professor status with local universities, and he was the administrative supervisor in all these initiatives. While biological research was being conducted, initiatives in social sciences focused towards increasing community engagement were lacking. Volunteer effort within the BOD in this capacity was not present,

but Dr. Jamieson did manage to get some support to document the environmental education challenges the initiative was experiencing (Fraser and Jamieson 2003).

The MABF was also actively involved at the national level by participating on the BOD of the Canadian Biosphere Reserve Association (CBRA) and with participants from other biosphere reserves in documenting Canadian achievements (Jamieson *et al.* 2008). The nature and sophistication of biosphere programmes in sustainable development was described, and it was shown that while much variability in capacity existed across Canadian biosphere reserves, the biosphere reserve concept with respect to the achievement of sustainable development was widely embraced by all communities in Canada associated with biosphere reserves. There was a wide diversity of initiatives, and Canadian efforts to develop biosphere reserve models of sustainable development at the community level were showing successes, largely because of great imagination and volunteer dedication. The CBRA was ultimately successful in receiving a commitment to five years of federal funding (approximately \$57,000 per year per BR), starting in 2008, for all the Canadian BRs except for the Clayoquot Sound BR, which had its own

government sourced endowment fund. Unfortunately the five-year program was terminated one year early in 2012 as part of general cutbacks across the public service, with the resulting implications discussed below.

MABR FUNDING ACQUISITION INITIATIVES

Starting in 2003, there were two unique funding initiatives undertaken in the MABR, one under the biosphere name and the other through a separate society created to provide support for the biosphere, separate because it involved people not directly involved with the MABF. The first looked at establishing a Vancouver Island Biosphere Centre (VIBC) within the biosphere boundary, and to this end, funding was obtained from the City of Parksville and the Regional District on Nanaimo for three studies, an initial conceptual study, a feasibility study, and then a more detailed architectural study for a specific site. The VIBC was designed to be a physical building/structure that would showcase and interpret the exceptionally rich and diverse inventory of natural and cultural heritage resources that exists locally on Vancouver Island. The intent was to focus on increasing awareness of regional protected areas, their need to be effectively managed, and to highlight that protected areas can contribute economic value

to local communities. The challenges in its establishment were to identify a potential physical location for the centre that: 1) offered natural habitats around the centre for interpretative walks; and 2) was acceptable to the community. A pre-design investigation that started in 2008 identified a “straw dog” site within Rath Trevor Provincial Park, one of the BR’s core areas. However, public opposition to the commercialization of parkland ended conceptual-only discussions on this site, and the Centre remains at a pre-design stage to this day until another site can be determined.

The other funding initiative was founded through a separate registered society, the Oceanside Monetary Foundation (OMF). The purpose of the OMF was to raise funds for Oceanside (the local name for the Mount

Arrowsmith Biosphere Reserve area) community projects, promote a sense of regional pride, and foster local economic activity and autonomy. The Foundation created “Oceanside Dollars” that were a paper currency that could be purchased at local financial institutions and businesses and used throughout the area as regular paper currency at par with the Canadian Dollar. The Oceanside dollars resembled the Canadian paper currency in dimension and had a printed expiry date about two years from the date of issue. Certificates that were not redeemed by their expiry date created revenue for the OMF, as did the interest earned on the Canadian dollar reserve being held in the banks until each currency issue’s expiry date. There was a favourable response from local businesses and the program lasted for two years.

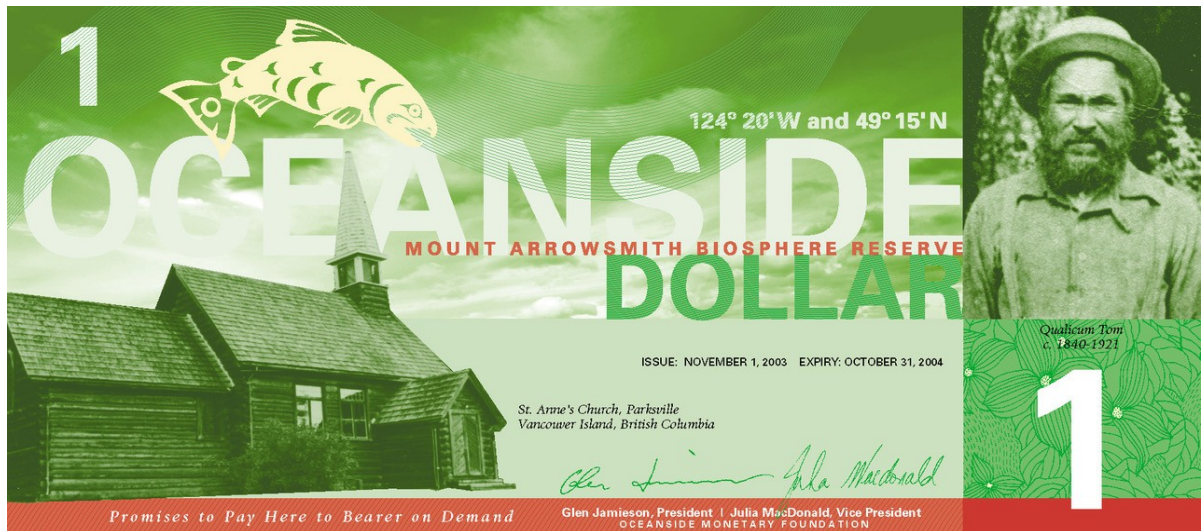
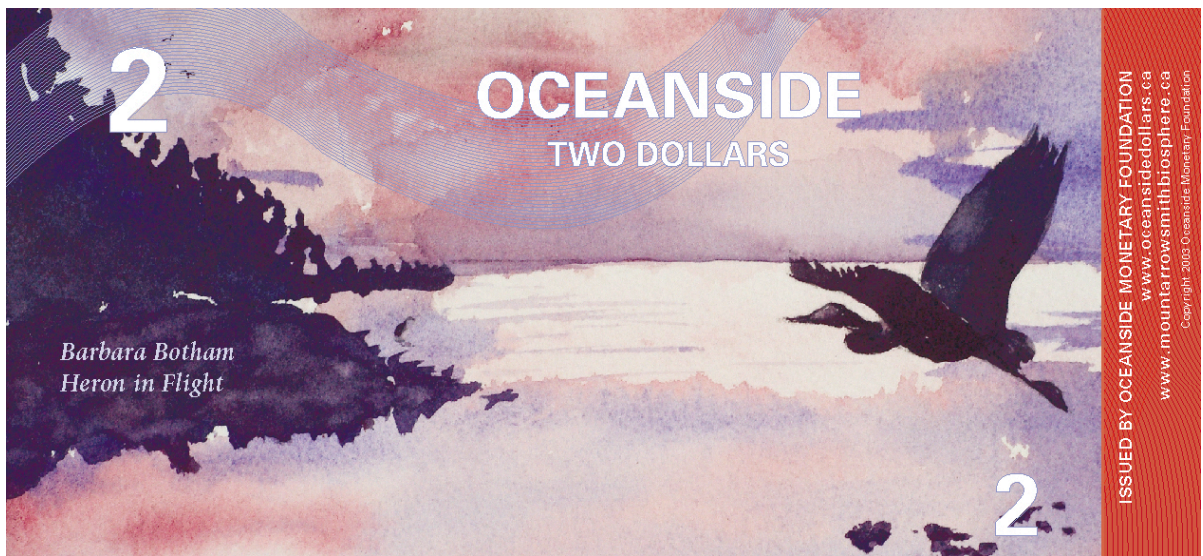
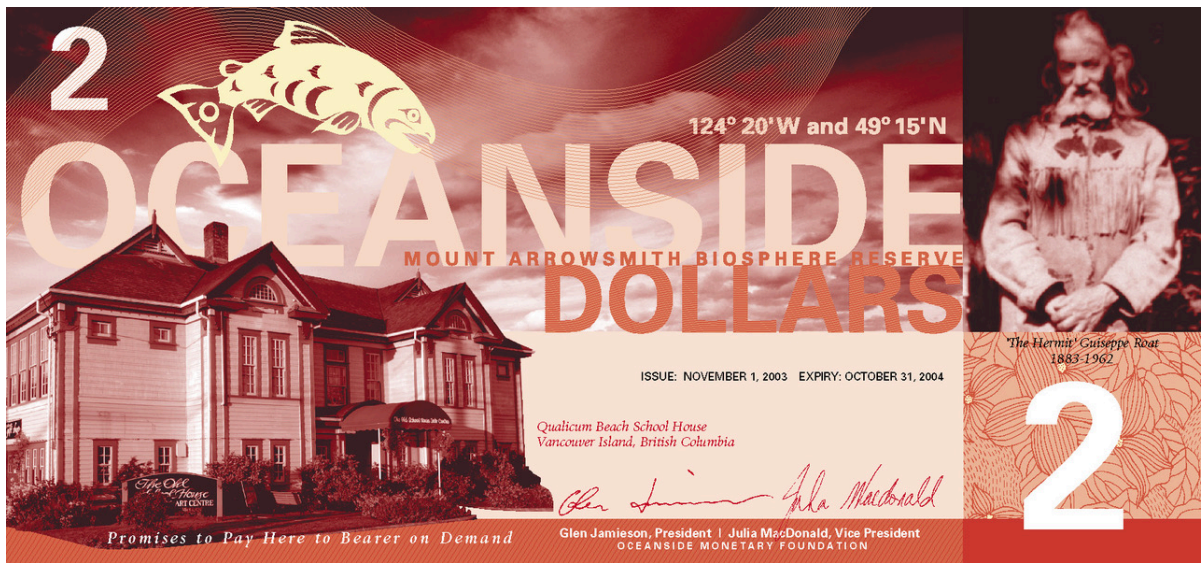
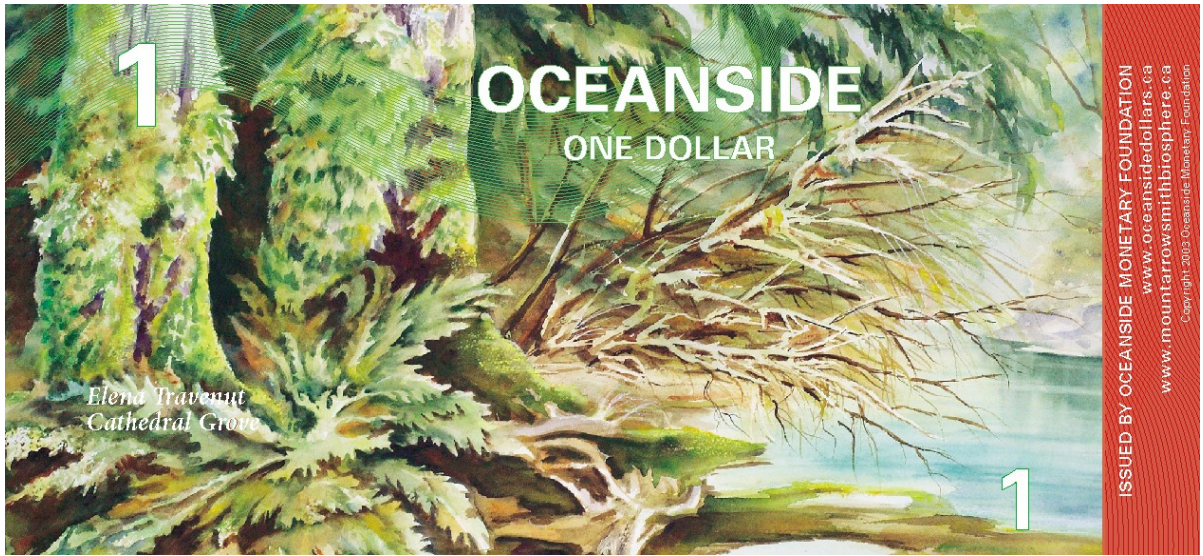



Fig. 4. Oceanside dollars for the Mount Arrowsmith Biosphere Reserve, the world’s first biosphere reserve currency (continued on next three pages, showing the front followed immediately by the back of each denomination)




5



124° 20' W and 49° 15' N



OCEANSIDE DOLLARS

MOUNT ARROWSMITH BIOSPHERE RESERVE




ISSUE: NOVEMBER 1, 2003 EXPIRY: OCTOBER 31, 2004

Coombs Country Market, Coombs
Vancouver Island, British Columbia

Glen Jamieson, President | Julia MacDonald, Vice President
OCEANSIDE MONETARY FOUNDATION



Commissioner Thomas Bales Coombs
1859-1943

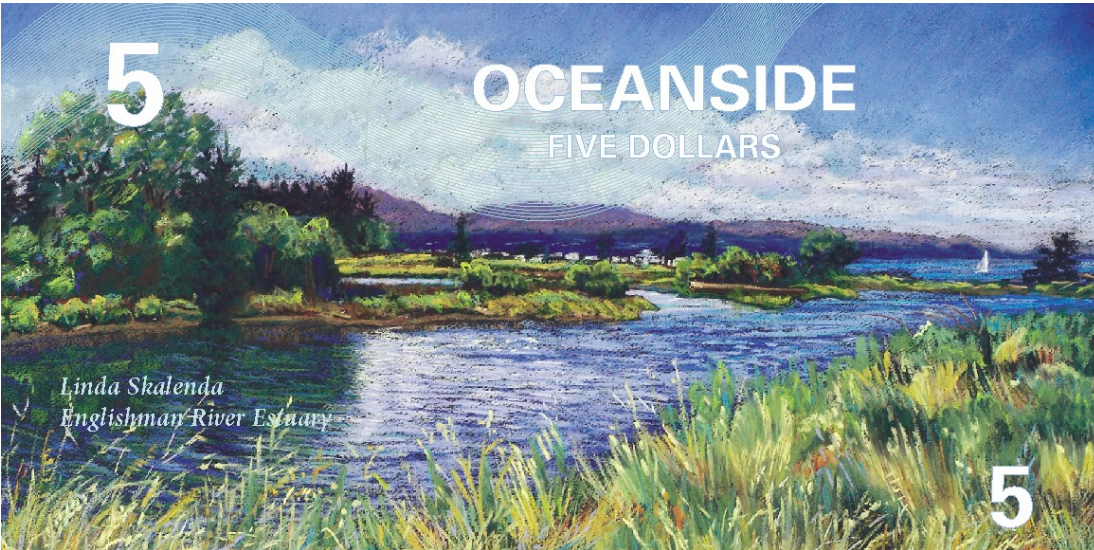
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Promises to Pay Here to Bearer on Demand

5

OCEANSIDE

FIVE DOLLARS




Linda Skalenda
Englishman River Estuary

5

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10



124° 20' W and 49° 15' N



OCEANSIDE DOLLARS

MOUNT ARROWSMITH BIOSPHERE RESERVE




ISSUE: NOVEMBER 1, 2003 EXPIRY: OCTOBER 31, 2004

Parksville Superior School, Parksville,
Vancouver Island, British Columbia

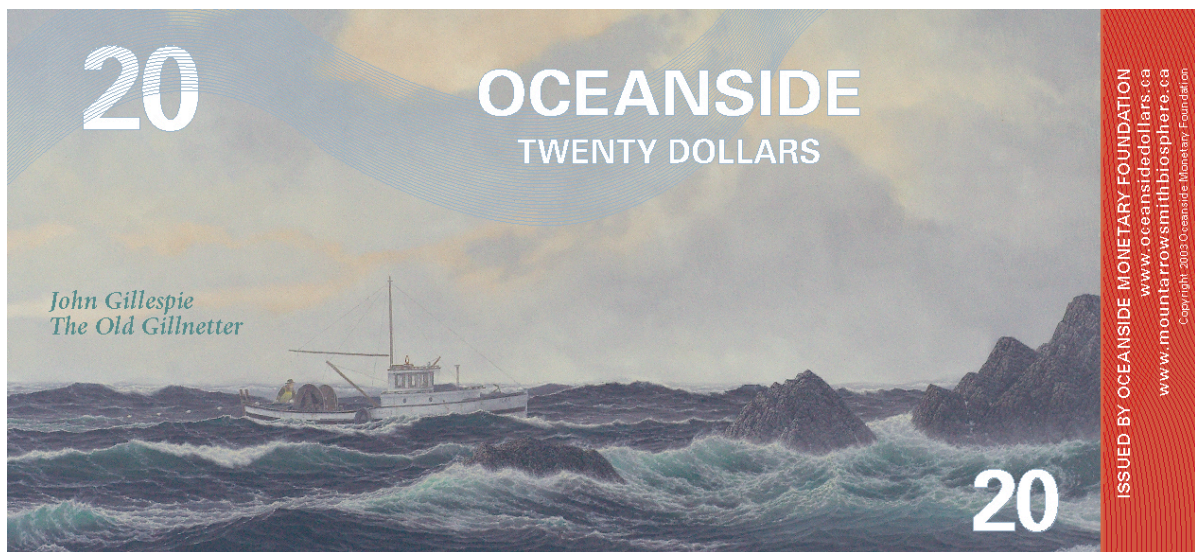
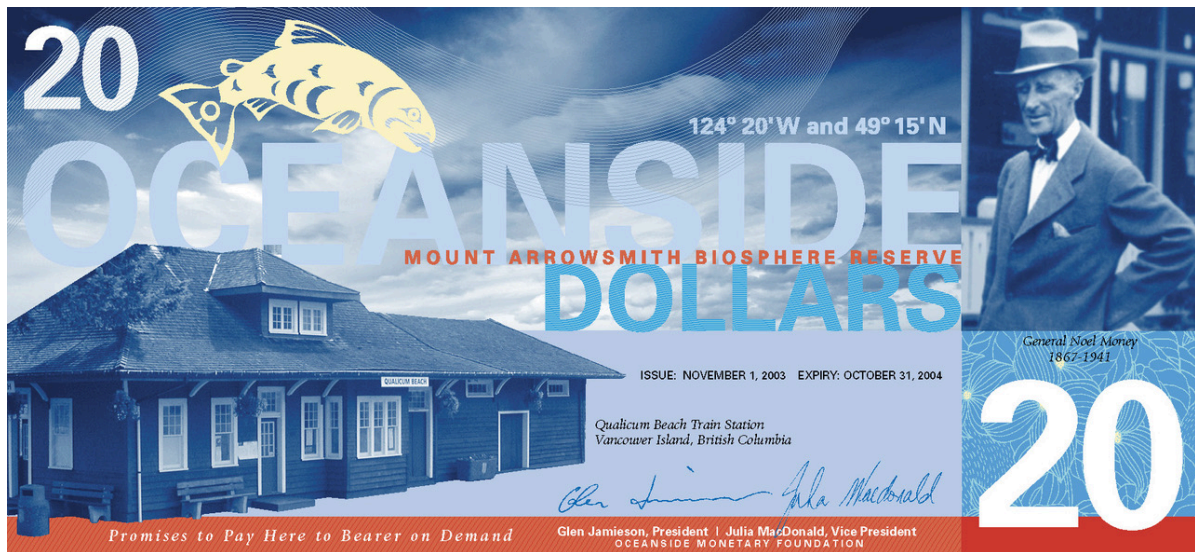
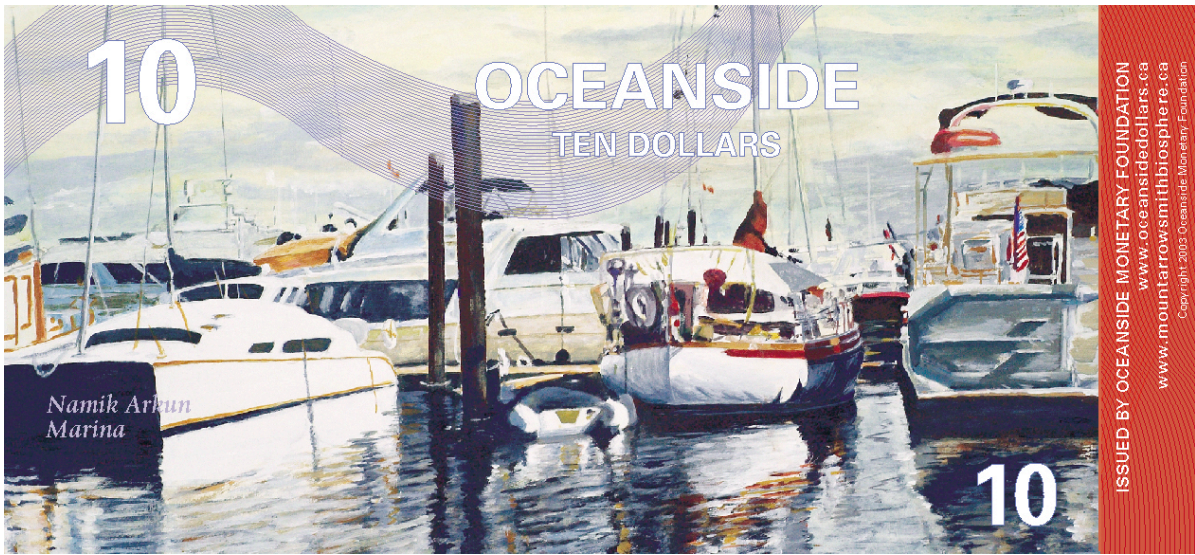
Glen Jamieson, President | Julia MacDonald, Vice President
OCEANSIDE MONETARY FOUNDATION



Elizabeth Rath
1866-1953

10

Promises to Pay Here to Bearer on Demand



While this concept was unique among biosphere reserves worldwide, it encountered some start-up problems that eventually led to its demise:

1. The bills had the latest state-of-the-art anti-counterfeiting technologies built into them: they were printed on Teslin®, a synthetic printing substrate, additional corresponding UV bill serial numbers could be seen under ultraviolet light, and there was an image of a “ghost salmon” over the director signatures. However, unanticipated, the first printing on the then new plastic bills was “softer” than on the existing regular Canadian paper currency, which resulted in scratches on the bills when they were run through financial institution paper bill counting machines, which effectively destroyed them. They could not thus be counted this way, which created problems for the financial institutions that were supporting the initiative. Although this issue was soon resolved, it was not quick enough to overcome some negative public relations that occurred in the first year following bill release.
2. The success of the program depended on getting a large amount of Oceanside Dollars into community circulation as quickly as possible. In hindsight, greater efforts on communication and promotions were needed. The sales methods used targeted

community markets and craft fairs, which was somewhat successful but time consuming, given the relatively little amount of Oceanside Dollars that ultimately entered into circulation. In hindsight, it would have been better to try and engage local groups such as Rotary, etc., and to ask their members to buy bills so as to get the bills into circulation faster.

3. The trend toward a “cashless” society with the increasing usage of credit and debit machines meant that local residents were less likely to use cash (or Oceanside Dollars) for their purchases.
4. The denominations of the bills (\$1, 2, 5, 10 and 20) were larger than most change given by businesses for many small cash purposes, which was generally in coins.
5. The \$1 and \$2 bills in Canada had also recently been entirely eliminated from circulation, being replaced by coins, called in Canada the “loonie” (it had an image of a loon on it) and “toonie,” respectively.

At the close of the program, approximately \$25,000 was placed into circulation, far short of the intended hundreds of thousands that had been hoped for. However, the program was still an imaginative and innovative fundraising initiative, and did increase MABR awareness within the community. On another positive note,

it also represented the world's first unique biosphere reserve currency.

MOUNT ARROWSMITH BIOSPHERE RESERVE - 2009 – 2014

The years between 2009 and 2014 proved to be an incredible challenge for the MABR but in the end, a positive outcome was achieved. During this time, the MABF suffered communication challenges including BOD disputes, difficulty retaining volunteers and staff, and a loss of funding when the Federal contribution agreement to Canadian Biosphere Reserves was cancelled in 2012. This period of difficulties in part took hold in 2009 following an Annual General Meeting (AGM) of the society, when none of the existing directors, including Dr. Jamieson, were re-elected to the Board of Directors, although Dr. Jamieson did remain as a society member. Being the only local “environmental” group at the time with dedicated federal funding, management of the society was taken over by a surge of new members that hoped to advance a more advocacy-driven agenda, with their sudden joining the society facilitated by the inexpensive (\$5) society membership fee.

Meeting minutes made by MABF board members show that the period from 2009-2010 was a very difficult year for the organization

because of core differences in MABR direction. Essentially, the MABF was in survival mode. Only three of the new directors persisted throughout much of 2010 and the first Coordinator hired had to be let go due to delays in the receipt of the approved federal funding. As shown by the minutes of the MAB, existing directors did not meet regularly as a result of an internal breakdown in communications and little progress was made in addressing the mandate of the organization during this time. Despite this breakdown, the BOD did undertake a hiring campaign and was able to bring on both a new Coordinator and a Communications Assistant in early 2011, as well as attract several new directors who together enabled a successful governance transition for the MABR in 2014 (described below).

In addition, there was the unfortunate timing of the first MABR Periodic Review, which began during the summer of 2010, as each biosphere reserve must undergo a formal evaluation every ten years. Recommendations from the review provide the basis for decisions made by UNESCO's International Advisory Committee (IAC) on the progress and fate of a designation. Periodic Reviews are organized by the host country's national MAB Committee, and reviewers are assigned on a volunteer basis. Despite the fact that there were severe issues

with funding, capacity and fierce internal disagreements, the MABF was able to host UNESCO researchers and facilitate the Periodic Review process. The reviewers spent several days interviewing MABF directors and members to compile information on how the society was operating for their review. Directors and staff of the MABF did not hear the results of the review until May 2011, and unsurprisingly, the review was not positive, but provided constructive recommendations. The MABF was then required to submit a Strategy and Action Plan that addressed these recommendations to the IAC by 2013, which if not accepted, would mean its loss of biosphere reserve designation.

Concerns identified by the review committee related to “not achieving the mandate of biosphere reserves, poor communications, limited community and First Nations involvement, and a lack of progress on local initiatives”. The problems that existed were well known by the MABF executive. However, a lack of procedure at Board meetings and the perceived advocacy role of Biosphere Reserves by some of the new MABF Directors and members remained key impediments to moving forward. It was noted by Directors and staff, including Karen Hunter that not all Directors were willing to embrace UNESCO’s

requirement for biosphere reserves to provide a community space for dialogue on sustainability and continued to promote an anti-development agenda. However, work on the education and science mandate of BRs was developed and led by MABR staff and volunteers through this time, and good progress was made through several initiatives. Some of the federal funding allocated to the MABR supported a publication on the status of the MABR (Clermont 2012), environmental education initiatives, a monitoring of marine invasive species project, and joint community removal initiatives for terrestrial invasive species within the MABR boundary.

Internal communications among the MABF BOD completely broke down in 2011 and a gap in the MABF’s bylaws regarding how to deal with such conflict left the BOD with few options. By the 2011 AGM, the nature of the break down was publicly voiced by Directors and members through speeches and grandstanding, but suggested changes to the bylaws promoted by the majority of the Board did not pass a vote (75% + 1). Proposed mediation to try and resolve differences within the BOD was put forth as a recommendation, but this failed to receive unanimous support.

For the remainder of 2011, much of the early energy and resolve that had sustained the biosphere reserve was reduced, but funded programming continued to be delivered by staff. Board meetings were cancelled for a brief period and when they resumed, one Director resigned and there were considerable lapses in attendance by another. However, the small group that remained continued to work towards the goal of developing and submitting a Strategy and Action Plan to the IAC as required including: completing reporting requirements required by the BC Society Act and Environment Canada, the federal funding agency, supporting existing programs and initiatives, and revising the governance of the MABF. The latter included the suggestion to close the Society and pass on the privilege of managing the MABR to others.

In 2012 and 2013, much of the small working Board's activities focused on both gathering information and preparing the MABR Strategy and Action Plan to respond to issues raised by the earlier Periodic Review and investigating alternate management systems for the MABR. In July 2012, the MABF Board proposed that the Regional District of Nanaimo manage the MABR as a Community Service. This proposition was declined principally due to the financial obligations of a new Service, but soon

after, the City of Parksville Council passed a resolution to give the MABF minimal administrative support while it pursued other governance options. The MABF AGM in 2012 occurred without incident, and no general meeting occurred in 2013, as is permitted by BC Society Act regulations.

Regular discussions continued in 2013, and a community-university management partnership for the MABR between Vancouver Island University (VIU) and the City of Parksville began to emerge for the management of the biosphere reserve. In mid-year, a Memorandum of Understanding outlining this partnership was drawn up and put forward to both the University and City for consideration. This news was communicated to CBRA, the CCU and Canada MAB through email channels, and presented in person to officials at the bi-annual meeting of EUROMAB, which that year took place in Brockville, Ontario. MABR representatives who attended this meeting believed that the positive communications at this meeting were instrumental in deciding the fate of MABR.

In 2014, news from UNESCO disseminated via Canada MAB stated that the MABR's Strategy and Action Plan had been accepted and the threat of losing BR designation was eliminated. Dissolving the MABF was then immediately

proposed and accepted by the MABF membership, with the understanding that the management of the MABR would then be passed to a new governing body comprised of Vancouver Island University, the City of Parksville, and other future members with jurisdictional interests in the MABR. A final MABF AGM was held to announce and celebrate the transition of the MABR designation to the new partnership.

THE MOUNT ARROWSMITH BIOSPHERE REGION – 2014 TO THE PRESENT

The new MABR governance model includes VIU, the City of Parksville, Snaw-Naw-As First Nation, Qualicum First Nation, two private forestry companies, the Town of Qualicum Beach, representatives from provincial agencies, and two community members. The Board operates as a Roundtable with quarterly meetings that address issues of shared interest.

An initial action undertaken by the Roundtable was the renaming of the entity as the Mount Arrowsmith Biosphere Region (instead of Reserve). This change was made for several reasons: 1) the term “reserve” has a legal meaning in Canada, relating to the assigning of lands for Canada’s Indigenous communities; 2) the term has other English meanings that imply

that a “reserve” is an area that is somehow protected or preserved from development, which is incorrect for most of the MABR’s area; and 3) the area is more accurately a region than a reserve by geographic definition.

In addition to the Roundtable, faculty and students at VIU initiated the development of a new research institute with a focus on creating new applied, community-based, participatory research initiatives that connect issues in the community to undergraduate and graduate student researchers. The Mount Arrowsmith Biosphere Region Research Institute (MABBRI) was founded in mid-2014 and to date has funded the involvement of over 120 students in a wide variety of research projects. Highlights include working with the City of Parksville on a Community Park Master Plan and Parks and Trails Plan, with the Snaw-Naw-As First Nation on a “Garden of Spiritual Healing”, eelgrass and bull kelp monitoring projects, and various other marine and terrestrial based restoration and mapping projects. To finance this, the Institute has been successful in attracting substantial funding from a wide variety of foundations and government sources.

The new management structure and the activities being conducted by the Institute have thus led to significant advancement in achieving

the mandate and goals of the MAB Programme. The management structure – a roundtable – is recommended for other biosphere reserves grappling with issues of contested space and jurisdiction. All roundtable members, which at present do not include the authors of this article, recognize that the seven First Nations with unceded territory on the east side of Vancouver Island where the MABR is defined hold the closest ties to the land and water and the strongest jurisdiction. The members also recognize that while there is very little land in the MABR that is classified as parkland by any level of government, creative ways need to be found to benefit the human/nature connection. Taking a solution-focused approach has also worked well for the roundtable, as has the adoption of a meeting “Culture of Engagement” document, which states:

“At the Mount Arrowsmith Biosphere Region Roundtable, we engage with one another and with the land and culture around which we gather in the following ways:

- 1) We acknowledge the Traditional Territories within which our meetings are held.
- 2) We demonstrate respect for Indigenous protocol as individuals and as a group, upholding the MABR’s Guiding Principles for Collaboration with First Nations.
- 3) Our communication is open, honest, transparent and unemotional, and we are comfortable and willing to discuss potentially sensitive topics.
- 4) Before entering the gathering place, we hang bad feelings on a nail outside the door.
- 5) We work together to reach common goals for the betterment of our region.

- 6) We leave personal wants outside.
- 7) We are open to new perspectives, we seek to understand where each person is coming from, and we share information and beliefs in an environment of trust.
- 8) We listen to each other and work together to ensure that everyone has an opportunity to speak.
- 9) We keep personal stories that are shared in confidence inside this room.
- 10) We arrive and depart feeling at ease, and we look forward to meeting again.”

The MABRRI has also been a significant feature in the new success of the MABR. The energy and endless capacity of students to engage in community-based applied research has enabled the MABR to raise its profile among both the worldwide biosphere reserve scientific community and, more importantly, the local community. Vancouver Island is known to be a prime destination for retirees from across Canada and the United States, and many of these individuals bring decades of experience relating to the human/nature connection. MABRRI has accessed some of this knowledge through the development of Technical Advisory Committees which bring local residents in to advise students on project development and protocols, and increasing these ties to community is the major focus of MABRRI in 2018/19.

LESSONS LEARNED OVER 20 YEARS

1. Margaret Meade stated that “Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.” This was true with respect to achieving recognition of the MABR. However, moving forward after recognition without any dedicated funding posed challenges that in hindsight perhaps should have been dealt with differently. The approach adopted was to try to obtain funding directly from its own initiatives, whereas perhaps the focus should have been on establishing different and more appropriate connections and collaborations within the community to allow engagement of a broader group in this endeavour.
2. Funding (or the lack of funding, more specifically) was always an issue for the MABR, even before it became designated as a biosphere reserve. It is difficult to attract volunteer resources when the first agenda item is always “fund raising,” and trying to develop a different approach might in hindsight have been desirable from the outset.
3. The overarching biosphere reserve concept can be difficult for many to grasp and identify with: working toward achieving

sustainability is a more nebulous goal than undertaking a specific activity, such as building a fish ladder or removing invasive species. In the MABR Area, there are many existing groups working on important, specific, task oriented initiatives, and instead of duplicating these, a biosphere management committee is better suited to:

- 1) act as a coordinating umbrella organization over a variety of community initiatives, and so support many initiatives and identify where gaps may exist in the overall achievement of cultural, economic and environmental sustainability; and 2) to participate in international in long-term monitoring activities efforts, such as GLORIA and with Smithsonian Biodiversity monitoring protocols. Communication on these facts is extremely important, and should be a major component of any biosphere reserve’s activities to ensure maximum buy-in to the concept. The MABF in its early stages neither had the capacity nor resources to achieve this as successfully as was desired.

4. It is important to think and act outside the “box of convention” as demonstrated by Dr. Jamieson’s success in achieving initial MABR recognition. While acknowledging that community projects require buy-in by

society in their initial phases to be acceptable to key players, community inclusion does not necessarily need to follow established formats. Establishing the MABR in the early 2000s was in hindsight again too constraining. It is a perhaps one of the reasons why UNESCO altered the designation application to be very specific about the nature of community level support desired. In British Columbia, societies and not-for-profit groups generally have an open membership that is achieved through registration or the payment of a membership fee. For the MABR, in an effort to be as inclusive as possible, membership was open to all with only a relatively inexpensive annual membership fee that allowed for BOD take-over with minimal effort. For the first 14 years when the MABF had no significant funding, this was not an issue, largely as membership was low (6 to 20 members per year). However, once some significant operational funding was realized in 2008, members from other more advocacy-focused groups in the community saw this as a way to advance their own specific interests. An open membership process allowed the entire Board of Directors of the MABF to be changed at the 2009 AGM, i.e., to have the agenda of the society replaced and determined by a new

slate of elected directors that were not focused on achieving either UNESCO's requirements or the BR mandate. Again in hindsight, society membership should thus have been restricted. This kind of open governance structure is therefore not recommended for societies that hope to achieve a functional process for BOD appointment and replacement.

Unpredictably, stable funding under these circumstances did not support the achievement of required identified BR objectives. The new MABR management structure now being used has avoided this problem by implementing a roundtable governance model (i.e., no open membership, and with both appointed directors and community advisors to the board) that meets to discuss issues of shared interest and to create opportunities for the Research Institute.

5. In Biosphere Reserves a poor level of funding can hinder the acquisition of committed volunteers and thus BR actions as they attempt to meet MAB objectives outlined in the Seville Strategy (1996) and the Madrid Action Plan (2008-2013). In the case of the MABR, there was burnout among the few committed directors, and frustration among experienced directors

because of the lack of resources to achieve what they desired to do. The result was great director turnover and a lack of capacity, with the resulting inability to really achieve the full potential of the biosphere reserve concept.

6. Biosphere Reserves require strong local leadership and ties to local governance in order to realize and implement the BR concept. If local governments do not value the BR as a community asset, it will be less likely to achieve outcomes over time that will be satisfactory to UNESCO. In the case of the MABR, the value of the BR concept was recognized by local communities, even with all the challenges that occurred after 2009, which was why a new, more functional management model was ultimately developed for the MABR. With strong municipal government support and the active involvement of the local academic research community, i.e., MABBRI and Vancouver Island University, the MABR has overcome its early operational difficulties and has now become an effective, dynamic, functional organization.

SUMMARY

This report outlines the developmental history of the MABR from its conception in the early

1990s through its evolution into an effective, functional biosphere region in 2016. There have been many successes and challenges over this time period, but the end result is positive and the momentum is now in place to lead to significant future achievements. While many challenges remain, notably around ongoing funding, there is widespread community support for this biosphere region and many active projects are now underway. It is hoped that by documenting our experiences, other biosphere regions (reserves), and those under consideration can learn from our setbacks and achievements.

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Dr. Glen Jamieson was a federal Fisheries and Oceans research scientist when he initiated the Mount Arrowsmith Biosphere Reserve initiative in 1993, initially in stock assessment and later in conservation biology, before retiring as an emeritus scientist in 2008. After 2009, while no longer directly involved in MABR management, he participated “behind the scene” in helping to achieve a new management structure to overcome the problems described above, and continues to support the MABR in whatever way he can.

Karen Hunter is a biologist who was hired in January 2011 as the MABR Coordinator. When funding terminated in 2012, she became a Director of the MABF where she represented MABR at regional, national, and international levels, and led the transition of the MABR to its new administrative home in 2014. Karen is employed as the Climate Response Program Lead at Fisheries and Oceans Canada, Science Branch since 2012.