Research article

Biosphere reserves: Attributes for success

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ABSTRACT

Biosphere reserves established under the UNESCO Man and the Biosphere Program aim to harmonise biodiversity conservation and sustainable development. Concerns over the extent to which the reserve network was living up to this ideal led to the development of a new strategy in 1995 (the Seville Strategy) to enhance the operation of the network of reserves. An evaluation of effectiveness of management of the biosphere reserve network was called for as part of this strategy. Expert opinion was assembled through a Delphi Process to identify successful and less successful reserves and investigate common factors influencing success or failure. Ninety biosphere reserves including sixty successful and thirty less successful reserves in 42 countries across all five Man and the Biosphere Program regions were identified. Most successful sites are the post-Seville generation while the majority of unsuccessful sites are pre-Seville that are managed as national parks and have not been amended to conform to the characteristics that are meant to define a biosphere reserve. Stakeholder participation and collaboration, governance, finance and resources, management, and awareness and communication are the most influential factors in the success or failure of the biosphere reserves. For success, the biosphere reserve 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. All rather obvious but it is difficult to achieve without commitment to the biosphere reserve concept by the governance authorities.

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1. Introduction

Biosphere Reserves are a mechanism within the UNESCO Man and the Biosphere Program (MAB) that seek to promote an approach to land management that harmonises interactions between people and nature. It is distinct from a protected area model as it considers the entire range of landscapes bound within the geographic limits of the management area (Batisse, 1985; UNESCO, 1996; Bridgewater, 2002), although protected areas are commonly the core of any biosphere reserve (BR). The conceptual model behind the BR idea was first developed in the 1970s and is based on integrated management across a landscape through a new approach to zonation of core, buffer and transition zones in order to harmonise conservation and development (Ishwaran et al., 2008;

Axelsson et al., 2011). However, the gap between theory and practice is still a significant challenge for BR management due to poor understanding of how a BR should work on the ground to achieve the goals of sustainability by harmonising interactions between people and the environment across the landscape (Matysek et al., 2006; UNESCO, 2010; Reed and Egunyu, 2013).

Discrepancies in understanding the concept of the BR model and its implementation in the early stages hampered their development at both national and international level because many BRs were purely designated or proclaimed within the areas of high value of biodiversity with the aim of facilitating research in protected areas (Brunckhost, 1997; Ishwaran et al., 2008; Price et al., 2010). As a consequence, the BR concept was re-articulated through the Seville Strategy formulated at the International Conference on BRs in Seville, Spain in 1995, to include sustainable development as a priority with local people involved in planning and management of the reserve. The Seville Strategy provided a legal statutory framework to ensure sites could fulfil the three BR functions: biodiversity conservation, development and logistic

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support (UNESCO, 1996).

Recent rapid growth in the extent and number of sites in the world biosphere network (WNBR) across biodiversity hotspot countries, particularly after adoption of the Seville Strategy in 1995, demonstrates promising progress in the recognition of the value of the biosphere program for providing achievable models for conservation and sustainable use of natural resources (Ishwaran et al., 2008; Brenner and Job, 2012; Coetzer et al., 2013). Since the first BRs were set up in 1976, the current WNBR has grown to include 651 sites in 120 countries with a total area of more than 600 million hectares (UNESCO, 2015). However, the BRs are still considered undervalued and underutilised, and their roles and functions not yet recognised and clearly understood by the public and governments (UNESCO, 2010). Within the current WNBR, the conventional approach of top-down biodiversity conservation involving multistakeholder arrangements and the aspiration for community-led management makes it more challenging to effectively manage BRs (Stoll-Kleemann and Welp, 2008; Schultz and Lundholm, 2010; Schultz et al., 2011).

Evaluation for individual reserves through a ten-yearly periodic review process was called for by the Man and Biosphere Program under the Seville Strategy. This Strategy document was incorporated under "*The Statutory Framework of the World Network of Biosphere Reserves*" and adopted by the General Assembly of UNESCO (UNESCO, 1996). The evaluation process aims to assess achievements of site management relating to the three core functions of BRs and explore learning opportunities at both national and international scales (Price et al., 2010; Coetzer et al., 2013). These assessments are used to show the appropriateness of the particular BR approach to achieve both conservation and sustainable development (Price, 2002; Reed and Massie, 2013). However, periodic reports mainly focus on the article 4 of the Strategy relating to BR selection criteria. As a result, the evaluation reports focus on assessment of zonation schemes while disregarding other aspects such as management practices and governance (Reed and Egunyu, 2013). The ten-year interval between reviews also hinders the process of active learning, adjusting and adapting management action (Price et al., 2010; Reed and Egunyu, 2013).

Using a Delphi process to elicit expert opinions, this paper identifies internationally recognised examples of successful and less successful BR implementation and key factors influencing success or failure of the BR model. The common factors defining the BR success or failure as well as their relationship to the frameworks and principles of the Seville Strategy are discussed and recommendations are made about attributes that are likely to be transferable across countries and governance systems.

2. Material and methods

The views of people with particular expertise in BRs were gathered using a Delphi Process. The Delphi process, named after the ancient Greek oracle at Delphi, was developed in 1960s by the RAND Corporation (Dalkey and Helmer, 1963). Using two or more rounds of consultation, the Delphi process allows for eliciting, refining and drawing-out the considered views of experts who are knowledgeable about the topic area (Gupta and Clarke, 1996; Okoli and Pawlowski, 2004).

Two rounds of a Delphi process were undertaken to identify successful and less successful BRs and identify factors impacting on success or failure. A list of 55 potential experts including scientists and managers was prepared for this process. From this group, 25 potential panellists from the scientific community were selected based on their work, experience and publications relating to BRs. Thirty senior managers who are now working at the UNESCO-MAB headquarters and the national MAB committees representing all

five MAB regions (AfricaMAB, IberoMAB, EuroMAB, AsiaMAB and ArabMAB) were also approached to join the expert panel.

Structured questions were sent to experts in round one asking them to: nominate five successful BRs and five less successful BRs in the global network; provide personal opinions or statements for up to five factors influencing the success and failure of each nominated site; and general statements about the contributing and hindering factors affecting the WNBR.

Information from respondents was synthesised to develop a list of nominated successful and less successful BRs. The attributes identified as contributing to the success or failure were grouped into 11 main factors. These were then returned to all people in the contacted list of both responders and non-responders in the first round. In this second and final round, the panellists gave their rating for the 11 the factors based on 5 levels: critical, very important, important, somewhat important and not important. Responders also were asked to add and rate any missing factors that they think are important to success or failure of BR management.

Feedback from the second round was synthesised as a rating on a scale from critical (5 for success factors/-5 for failure) to not important (1/-1). SPSS 20 then was used to calculate mean score of the influencing factors, develop the ranking list and identify the significant relationships among influencing factors using Spearman correlation.

3. Results

Twenty out of fifty-five (36%) contacted experts and managers participated in the first round questions. Thirteen respondents were scientists and 7 managers from the national MAB committees or BRs in both developed and developing countries. The response rate of the panellists in the second round was 27 out of 55 people (49%). This represented sixteen panel respondents in the first round and nine new participants (people who did not respond in the first round) who provided their rating and assessment in this round.

3.1. Nomination results

3.1.1. Successful and unsuccessful biosphere reserves

A total of 90 BRs belonging to 42 countries representing all five regions of the WNBR were nominated. Forty-seven nominated BRs belong to the post-Seville generation, set up from 1996 to the present and forty-three pre-Seville sites, which were established from 1976 to 1995. Approximately two thirds of the successful sites belong to post-Seville while two thirds of less successful BRs belong to pre-Seville generation. Four BRs (Rhon, Tonle Sap, Riverland and Fitzgerald) received both successful and less successful nominations.

Sixty BRs were nominated as successful examples in 28 countries representing all five regions of WNBR (Supplementary Online Material, Table 1). Thirty-seven BRs belong to the post-Seville generation and 23 sites belong to pre-Seville generation. The top 5 countries having the highest number of nominated successful BRs were Canada and Germany (8), Vietnam (5), Mexico, Spain and South Africa (4).

Thirty sites (10 post-Seville and 20 pre-Seville BRs) in 20 countries were nominated as less successful examples (Supplementary Online Material, Table 2). Australia (7) and Germany (4) are the countries having the largest number of less successful BRs. Interestingly, Rhon BR which was nominated in the set of most successful examples in the WNBR received one nomination as a less successful site due to a lack of staff.

Twelve nominated sites that belong to 10 countries of five regions within the WNBR were identified as the most common successful examples. Of these, five BRs received three or more