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Spatio-temporal dynamics of land-cover change in a multi-use conservation landscape: the case of the Kruger to Canyons Biosphere Reserve, South Africa

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Abstract

The Biosphere Reserve (BR) model of UNESCO€s Man and the Biosphere Programme (MAB) reflects a shift towards more socially accountable conservation, setting a basis for improving the relationships between people and their environment. The BR approach of •conservation€ and •sustainable development€ objectives is a long-term perspective that increases people€s ability to sustainably manage environmental resources into the future. By 2013 the MAB Programme had resulted in 621 sites designated globally since first inception in 1976, with 11 of these new listings since 2012. Yet regardless of this global spatial expansion, there are few examples of BRs successfully conforming to the MAB€s full criteria, as the reality of aligning conservation and development goals in this model has typically favoured one over the other, with examples of development objectives fuelling broad-scale landscape transformation and conservation objectives that have ignored socio-economic opportunities. However there are a number of case studies presented herein that have shown considerable success, and this thesis suggests that the potential opportunities inherent in the model may outweigh implementation challenges. This thesis critically reviews the history and evolution of the Programme internationally, and makes recommendations for the future of the MAB Programme.

In the South African context, the BR model has been applied to a regional conservation landscape in the north-eastern part of the country. The Kruger to Canyons Biosphere Reserve (K2C) is a long-established land-use mosaic of socio-economic juxtapositions, where nationally important economic sectors and world-renowned protected areas (e.g. the Kruger National Park) neighbour extensive, mostly rural, human populations that engaged in informal livelihood practices. These vast settlement expanses are artefacts of the former political system in South Africa, and have been prioritised by the South African National Government for urgent socio-economic upliftment.

Given that understanding the underlying land-use mosaic is essential for successful implementation of the BR model in any landscape, this thesis assessed land-cover change across the BR (1993, 2006, 2012), through the creation of land-cover classification maps, analysing spatial changes in cover relative to the MAB theoretical aspirations. It focuses on three consolidated land-cover cover classes: Intact Vegetation, Impacted Vegetation and Settlement,

that present a graduated scale of land-use intensities across the BR, acting as surrogates for the •environmental€ and •human utilisation€ aspects of the BR approach.

Results indicate that the spatial distribution of land-cover change in K2C bears little regard for the theoretical BR zonation and the relative limitation on •use€ that typifies successful BR implementation. The spatial expansion of Settlement cover replaced adjacent Impacted Vegetation, which in turn encroached in original areas of Intact Vegetation cover, increasingly fragmenting Intact Vegetation across K2C. The expansion of Impacted Vegetation has resulted in the spatial consolidation of communal use areas, which has likely serious implications for the long-term sustainability of current harvesting levels. Anecdotal field observations have indicated community responses to these concerns with the formal fencing of rangelands to secure ownership and control access.

Losses of Intact vegetation translate spatially into an area >4,000 km^2, with observed land-cover changes occurring beyond the transition zone, encroaching into the (fully-protected) core and (partially, protected) buffer zones. The increased rate of landscape change in the recent observation period (2.3%$_{1993-2006}$ versus 5.7%$_{2006-2012}$) poses challenges for landscape management, with future predictions of escalating transformation likely to undermine BR sustainability, as well as options for a regionally connected protected area network. Historical landscape trends predict a further 5.1% loss of intact vegetation in the next 6 years (2012-2018), yet this may overestimate the potential for transformation in this landscape. However the possibility of a similar loss over a longer temporal period, i.e. 12 years, is not improbable, with the unprotected matrix landscape of the transition zone having experienced comparable losses since 1993, i.e. 4.17%.

K2C has had substantial success with pilot socio-economic projects, and has received formal international recognition for the stakeholder engagement / alignment occurring in the subregion as a result of the BR€s listing here. Given these successes, and the considerable investment in its establishment, it is likely that the BR model here will endure. The results of this thesis contribute to improving implementation success long-term, informing policy and management priorities across the BR. These include contributions to i) a marketing approach for the BR, specifically the importance of a K2C •brand€ for enhancing cooperation and strengthening the BR€s regional identity, as well as ii) providing support for land-use planning and decisions related to land-use practices and BR sustainability.