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Constructing an Ecoagriculture Feasibility Index for a Transfrontier Conservation Area in Southern Africa

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Abstract. In landscape studies, indices are important for revealing underperforming dimensions of a landscape and for helping landscape managers to direct effort and resources accordingly. Indices also enable comparison across different landscapes. The present study was conducted in a peasant farming community within a transfrontier conservation area and which is recognised as a biodiversity hotspot. This is an area designated for balancing farming, natural resource utilisation and biodiversity conservation. This study demonstrates a method of constructing an index for estimating the feasibility of planning and implementing agriculture-biodiversity integration for livelihood improvement (known as ecoagriculture) within specified socio-economic and environmental conditions. Often, complex mathematical computations are employed in constructing feasibility indices. In this study an ecoagriculture feasibility index for a particular landscape is calculated based on evaluation of the landscape. The resultant ecoagriculture feasibility index is 5.90 (or 74%) implying a relatively high feasibility for systematic ecoagriculture implementation in the area. The criterion for quantifying ecoagriculture feasibility suggested here is intended to be as user-friendly as possible to enhance its adoption by peasant farmers and other end-users. The study brings up a new landscape evaluation tool useful to other researchers and practitioners seeking to promote more sustainable relationships between farmers and the biodiversity they depend on.

Keywords: landscape evaluation tool, peasant community, agriculture-biodiversity integration.

1. Introduction

Indices, for example, environmental performance indices or socio-economic status indices generally have a two-fold purpose. They facilitate the effective targeting of resources and they are useful in the monitoring and evaluation of policy outcomes [1]. In landscape management, indices can show the level of landscape performance and can help to direct effort and resources towards underperforming dimensions of the landscape. Indices also enable comparisons across different landscapes. Although useful, indices must be properly constructed and correctly interpreted or else they may mislead decision making or policy, especially if they are employed in feasibility studies.

A feasibility study looks at the viability of a proposed idea (e.g. a project, programme or plan) and it aims to identify potential problems and attempts to establish whether or not the idea works [2]. Calculation of feasibility indices has been done in certain instances. De Janvry et al. (1992) constructed an index of the political feasibility of rural poverty reduction policies [3]. Work by Heath and Li (2010) was on the construction of a race equity index for the United Kingdom [4]. The present study suggests an innovative way for estimating the feasibility index for ecoagriculture planning and implementation in a landscape that has been designated to integrate peasant farming, natural resource utilisation and conservation of wild biodiversity in a sustainable manner.

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The term ecoagriculture refers to "integrated conservation-agriculture landscapes where biodiversity conservation is an explicit objective of agriculture and rural development, and the latter are explicitly considered in shaping conservation strategies" [5]. Ecoagriculture aims to achieve a balance between food production, biodiversity protection and livelihood improvement goals on the same landscape. The term "landscape" is key in this definition and it conveys an idea of a relatively extensive heterogeneous area where several functions co-exist. Thus ecoagriculture creates multifunctional landscapes. Ecoagriculture has the potential to improve the natural assets of poor people by protecting wild species important to human health and livelihoods, by ensuring the provision of environmental services critical to the peoples' livelihoods and by supplementing incomes such as through biodiversity payments.

The present study was conducted in the Mathenjwa Communal Area (MCA), a peasant farming community within a transfrontier conservation area (TFCA) at the border shared by South Africa, Mozambique and Swaziland (26°48'S to 26°57'S; 32°00'E to 32°10'E). TFCAs are intended to simultaneously provide for food production, resource utilisation and biodiversity conservation. This area falls within the subtropical savanna biome, is characterised by endemic flora and is recognised at the global level as a biodiversity hotspot [6]. The inhabitants of the area are among southern Africa's poorest people who rely significantly on harvesting natural resources [7]. Thus there is a need to strike a balance between conservation and livelihood needs. The area comprises of mosaics of unplanned ecoagriculture involving spontaneous practices such as traditional tree-crop combinations, grass strip contours and hedgerows. As the human population density and greater demand for food and ecosystem services increase amid climate change and variability threats the sustainability of such *spontaneous* practices is not guaranteed (Figure 1). As such, there is need for planned or systematic agriculture-biodiversity integration practices.

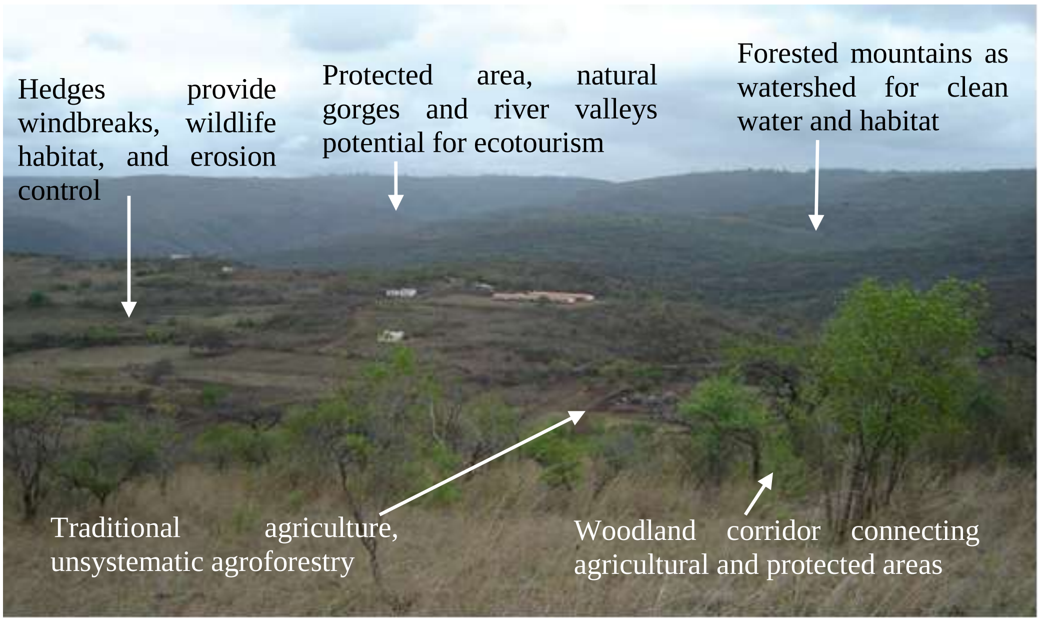

Fig. 1: Unsystematic agriculture-biodiversity integration in the MCA.

The present study aims to suggest and demonstrate a stakeholder-centred method of constructing an index for estimating the feasibility of implementing ecoagriculture in TFCA landscapes in systematic ways. This study is the first attempt to quantify ecoagriculture feasibility for a given area and the criterion used is original to the study.

2. Methodology

Often, complex mathematical computations are employed in constructing feasibility indices. However, in the interest of fostering local empowerment and self-reliance, the current study employs a relatively simple method which extension officers and lowly educated peasant farmers are expected to appreciate and adopt. This study suggests that an ecoagriculture feasibility index (EFI) for a particular area can be calculated using ratings (or scores) from an evaluation of a given set of attributes of the landscape (see Table 1 first column).

Through this method, a landscape can assume an EFI ranging from 0 meaning ‘not feasible’ to 8 implying ‘very feasible’. The scores for the attributes in Table 1 were drawn from the findings of preceding studies in the area under focus [8].

With regards to the attribute “recognised biodiversity hotspot, TFCA, protected areas (PA) or PA buffer zone” a score of 0.33 is awarded for each of the three conditions satisfied in the landscape (e.g. for being a recognised biodiversity hotspot). Scores for “perceptions of local farmers”, “perceptions of key informants” and the “willingness of local farmers” to plan agriculture-biodiversity integration derive from a stakeholder analysis study [9]. A rating for “landscape performance assessment” (LPA) is obtained from a participatory landscape performance assessment where the landscape was evaluated based on the four main goals of ecoagriculture, i.e., agricultural production, biodiversity conservation, livelihoods improvement and institutions. The score for the attribute “related to community's vision” comes from an evaluation of the local community’s vision for the desired future [10]. The vision is presented in form of charts and all the variables (items) on the charts are classified according to the major ecoagriculture goals and then quantified. A score for the attribute “percentage of area under natural vegetation cover” is generated from land cover analysis based on satellite imagery [11] while that for “policy environment” derives from an evaluation of policy affecting agriculture-biodiversity integration in the area [12]. The EFI for the landscape is obtained by adding the scores for all the attributes.

3. Results and Discussion

The EFI for the MCA landscape is presented in Table 1 together with the criterion followed to arrive at this index. With respect to the attribute “recognised biodiversity hotspot, TFCA, PA or PA buffer zone” the landscape scores 1.00 (which is the maximum score) because it satisfies the three conditions considered for scoring in this attribute. A landscape that meets two of these conditions for instance, would score 6.66 (i.e., 3.33 + 3.33).

Ninety-two percent of the local peasant farmers interviewed during a questionnaire survey were willing to adopt systematic ecoagriculture strategies. This result gives a score of 0.92 for the attribute “willingness of local farmers”. About 51% of the respondent farmers perceived ecoagriculture as a potential solution to socio-economic and environmental problems faced in the area. But a much higher proportion (88%) of key informants (made up of professionals and administrators) interviewed during the survey perceived ecoagriculture as a potential solution. The scores derived from these results are 0.51 and 0.88 for the two respective attributes. The difference in these scores can be explained by the farmers’ limited knowledge of the ecoagriculture concept compared to that of professionals and administrators and is expected to reduce as the level of awareness of ecoagriculture practices in the community increases.

About 65% of the variables in the local community’s vision for a desired future fall within the categories: livelihoods, food production or biodiversity protection. This gives a score of 0.65 for the attribute “related to community's vision”. This score shows that to a greater extent the future landscape envisioned by the local community members aligns with ecoagriculture goals. This is important for ecoagriculture to be acceptable to the farmers as a strategy to achieve the desired socio-economic and biophysical environment. An LPA score reflects the status of ecoagriculture practices across the landscape and helps to understand the effectiveness of existing land use management practices in protecting biodiversity and meeting the community’s livelihood demands.

Land cover analysis results show that about three quarters (74.5%) of the MCA landscape is under natural vegetative cover. This land cover gives us a score of 0.75 for the attribute in question. The MCA landscape is characterised by ‘used’ land (e.g. built-up, crop fields or roads) and inter-connected patches of natural forest, woodland and grassland. Given such land cover the landscape could support considerable wild and agro-biodiversity.

Based on the results of a policy analysis conducted as described in the methods section, the MCA score for the policy environment attribute is 0.6. According to the criterion used, this score implies that the existing policy environment is supportive to very supportive of systematic agriculture-biodiversity integration strategies. A supportive policy environment is essential for successful ecoagriculture implementation.

When the scores for all the applicable attributes are summed up, the overall EFI for the landscape under focus comes to 5.90. This score constitutes 74% of the possible score (i.e., 8.0). Thus the feasibility of systematically implementing ecoagriculture in this area is quite high.

Table 1. Ecoagriculture feasibility index for the MCA landscape

Attribute / Condition	Scoring Criteria	Score
Recognised biodiversity hotspot; TFCA; PA or PA buffer zone	Score 0.333 for each of these 3 conditions (or equivalent) applicable to the area	1.00
Willingness of local farmers	Percentage of willing respondents (92.3/100)	0.92
Perceptions of local farmers	Percentage of positive perceptions (51/100)	0.51
Perceptions of key informants	Percentage of positive perceptions (88/100)	0.88
Landscape performance assessment (LPA) score	Based on participatory LPA score (2.97/5)	0.59
Related to community's vision	% of vision classified under livelihoods or production or biodiversity (65/100)	0.65
Percentage of area under natural vegetation cover	Calculated from aerial photo or satellite imagery (75/100)	0.75
Policy environment	Score 0.1 to 0.4 = repressive to not supportive; 0.6 to 1 = supportive to very supportive; 0.5 = neutral. Judgement based on policy analysis results.	0.60
E. F. I.	Sum of scores (possible score is 8.0) Or as a percentage of possible score	**5.90** 73.75%

The contribution of the present study is three-fold:

1) It provides an EFI (i.e., landscape evaluation result) for a specific area, in this case the MCA. This index is a useful estimate of the extent to which systematic implementation of agriculture-biodiversity integration is likely to succeed in the area.

2) The suggested EFI is a landscape evaluation tool that other researchers or practitioners seeking to promote more sustainable relationships between agriculture and biodiversity can adopt.

3) Considering the identified ‘attributes’ or status of a landscape, the results from this study can be a basis for creating an ecoagriculture certification standard. The standard can be a tool to promote the sustainable management of integrated production and conservation landscapes. Initiatives certifying that producers adhere to set environmental and production standards have become popular and can create incentives for local farmers to improve their environmental and socioeconomic performance [13].

4. Conclusion

This study has shown that the feasibility of systematically implementing ecoagriculture in the MCA is quite high. As such, local or external stakeholders wishing to promote ecoagriculture strategies in the area could do so with a good chance of success. This study brings up a unique landscape evaluation tool useful to other researchers and practitioners seeking to promote more sustainable relationships between agriculture and biodiversity. The criterion for quantifying ecoagriculture feasibility suggested here is intended to be as user-friendly as possible to enhance adoption by peasant farmers and other end-users. The criterion enables spatial comparison of ecoagriculture feasibility for different landscapes, or for a particular landscape at different stages in time. However, the method has some limitations. For instance, it involves some degree of subjective judgement, particularly with respect to policy evaluation. Thus different evaluators could come up with different indices for the same area. The method also relies strongly on interview and questionnaire data but it is known that an index that depends on sample surveys shows inconsistencies in trends over time [14]. Such data must therefore be used with caution particularly in studies that assess changes over the long term. However the suggested method should not be considered rigid but open to improvement, flexible and modifiable to suit different socio-environmental circumstances. We hope that the concept of EFI will be a useful tool for enhancing sustainable landscape management.

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