Community participatory landscape classification and biodiversity assessment and monitoring of grazing lands in northern Kenya

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Abstract

In this study, we asked the Ariaal herders of northern Kenya to answer "why, what and how" they classified landscape, and assessed and monitored the biodiversity of 10 km^2 of grazing land. To answer the "why question" the herders classified grazing resources into 39 landscape patches grouped into six landscape types and classified soil as 'warm', 'intermediate' or 'cold' for the purpose of land use. For the "what question" the herders used soil conditions and vegetation characteristics to assess biodiversity. Plant species were described as 'increasers', 'decreasers' or 'stable'. The decreaser species were mostly grasses and forbs preferred for cattle and sheep grazing and the increasers were mostly woody species preferred by goats. The herders evaluated biodiversity in terms of key forage species and used absence or presence of the preferred species from individual landscapes for monitoring change in biodiversity. For the "how question" the herders used anthropogenic indicators concerned with livestock management for assessing landscape potential and suitability for grazing. The anthropogenic indicators were related to soils and biodiversity. The herders used plant species grazing preferences to determine the links between livestock production and biodiversity. By addressing these three questions, the study shows the value of incorporating the indigenous knowledge of herders into classification of landscape and assessment and monitoring of biodiversity in the grazing lands. We conclude that herder knowledge of biodiversity is related to the use as opposed to exclusive conservation practices. This type of knowledge is extremely valuable to conservation agencies for establishing a baseline for monitoring changes in biodiversity in the future.
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1. Introduction

The assessment and monitoring of the biodiversity of grazing lands in Africa in general face methodological problems in understanding how the exploitation of grazing lands contributes to the loss of biodiversity. Ecologists and conservationists often make two assumptions. The first assumption is that the traditional system of land use by livestock grazing contributes to the loss of rangeland biodiversity. The second assumption is that the assessment and monitoring of the changes in biodiversity of the communal grazing lands would require technical methods implemented by ecologists. In both cases, the information collected would assist conservationists to make management decisions or to test scientific hypotheses on the relationship between the status of biodiversity and the pressure of exploitation. However, there is a third dimension of biodiversity that is rarely considered by conservationists, namely the decisions taken by local pastoralists with regard to the management of daily livestock grazing. The wealth of knowledge that resource users gather from their daily assessment and monitoring of rangeland biodiversity for livestock grazing is seldom acknowledged.

The systematic indigenous knowledge of herders for assessing and monitoring the grazing lands could be incorporated into ecological methods for decision-making with regard to the status of biodiversity. Answering such questions as "why monitor", "what should be monitored" and "how to conduct monitoring or assessments" (Yoccoz et al., 2001) is relevant

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in understanding participatory assessment of rangeland biodiversity. The "why question" calls for rationalizing the reasons for monitoring biodiversity, the "what question" demands variables that need to be measured, while answering the "how question" would help resource managers to interpret the data collected in terms of management decisions (Yoccoz et al., 2003). By addressing the three questions, resource managers and conservationists will reach important decisions on how to combine the use of ecological methods and indigenous knowledge methods in order to promote community participation in biodiversity assessment and monitoring.

For herding communities throughout Eastern Africa, range management incorporates the mosaics of landscapes that comprise the vast grazing lands. Herders' knowledge of landscapes, which includes the broader traditional ecological knowledge of human–environmental relations (Barrera-Bassols and Zinck, 2003; Berkes et al., 2000; Hellier et al., 1999; Johnson, 2000; Jungerius, 1998; Turner et al., 2000), could be used to answer the three research questions (Fernendez-Gimenez, 2000; Scoones, 1989). Herders' knowledge of landscape plays an important role in livestock and biodiversity management, and answering the question of "why" could be relevant for understanding the purposes of landscape classification. In answering the "what question" for example, empirical data used for making decisions may vary between ecological methods and the variables (hereafter referred to as 'indicators') used by ecologists and herders. These ecological indicators are well known by scientists and standardized methods for measuring them exist. The pastoralists, for their part, use composite indicators that include both environmental variables (physical and biological) and anthropogenic indicators (Oba and Kotile, 2001; Oba and Kaitira, 2006). They use such indicators for making decisions with regard to livestock production, land use suitability related to conditions of soils, and value-weighted changes in plant species preferred by livestock for grazing. The anthropogenic indicators are value-weighted variables that use inferences from livestock production based on biological indicators, such as plant species. We suggest that ecological and anthropogenic indicators that could be used to address the "what question" could have complementary roles in assessing and monitoring biodiversity (Berkes et al., 1998). For example, pastoral herders are known to describe landscapes according to the physical characteristics of soil, landforms and vegetation (Oba et al., 2000; Verlinden and Dayot, 2005). These methods are also used in conventional landscape analysis (Fairbanks and Benn, 2000; Pressey et al., 2000). In addition, herders use vegetation and socio-cultural values of land use potential to reconstruct the effects of historical land use on landscape change (Sheuyange et al., 2005).

Our study used local landscape knowledge of the Ariaal pastoralists of northern Kenya to address the "why", "what" and "how" questions of grazing land classification, biodiversity assessment and monitoring. Based on previous research (e.g. Oba et al., 2000; Mapinduzi et al., 2003; Oba and Kotile, 2001; Sheuyange et al., 2005; Oba and Kaitira, 2006), we established herder knowledge of landscapes as being universal for range management. Thus, in addressing the "why classify grazing landscape" question, we tried to understand the indigenous range management knowledge, which has an impact on the way government departments should address conservation. For addressing the "what question for assessing and monitoring biodiversity" we were interested in understanding the indicators herders used, while for addressing the "how question" we were interested in the way herders used the physical and biodiversity indicators of the grazing lands to make livestock management decisions concerning landscape grazing potential (LGP) and landscape grazing suitability (LGS). In this regard our aims were: (1) to understand the criteria the Ariaal herders used for landscape classifications and their reasons for doing so (the "why" question); (2) to identify (with the help of the herders) the indicators that the community used for the assessment of biodiversity change (the "what" question); and finally (3) to understand how herders used ecological and anthropogenic indicators for decision-making with regard to livestock management (the "how" question).

2. Methods

2.1. Study area

The study was conducted in Karare on the southern fringes of Marsabit Mountain in northern Kenya (N 02°10′ and E 037°52′). The area is geologically of volcanic origin (Sinda, 1981) with Calcaric Regosols and Chromic Vertisol soils (Awere-Gyekye, 1984). The climate is sub-humid with bimodal rainfall, with long rains between March and May and short rains between October and November. The mean annual rainfall is about 600 mm yr^{-1} (Jatzold, 1995). The vegetation is classified as *Pennisetum/Bothriochloa* (perennial grassland) (Awere-Gyekye, 1984). The landscapes of Karare are presently threatened by bush encroachment (Roba and Oba, unpublished data). The Ariaal pastoralists manage cattle and small stock and conduct limited cultivation. Livestock stocking density in the settlement rangelands varies between 5 and 10 tropical livestock units/km^2 (1 TLU = 250 kg bovine). The settlement rangelands have been exploited for more than 30 years, more intensively since 1974 when the first batch of the families settled in Karare (Roba and Oba, unpublished data). Livestock management is based on herder landscape assessments and monitoring during daily herding activities. Seasonal livestock mobility takes advantage of heterogeneous landscapes and grazing resource monitoring. We selected a rangeland of 10 km^2 in the vicinity of Karare settlements for conducting the survey to address the "why, what and how" questions of landscape classification, biodiversity assessment and monitoring. The selected area is within the daily grazing distance with which the herders from Karare were most familiar.

2.2. Data collection

Between July and August 2004, four herders from the Karare and nearby settlements who were knowledgeable about the local landscapes joined our team to conduct rangeland