Tropentag 2006
Bonn, October 11-13, 2006

Conference on International Agricultural Research for Development

Local and Ecological Knowledge on Natural Resource Management – A Case Study from north-western Namibia

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Abstract

In today's complex web of socio-economic, political and environmental changes, natural sciences' approaches may offer insufficient understanding of the dynamics underlying socio-ecological systems. Local knowledge is an important key to understanding pastoralist strategies of resource management. It is particularly interesting to investigate how local knowledge is produced and used in a highly unpredictable system, characterized by non-linear dynamics. Pastoralism is the dominant form of land use and economy in the arid north-western parts of Namibia. The sustainable management of natural resources is therefore important to guarantee future livelihoods in this region.

Key words: Local Knowledge, Natural Resource Management, Range Ecology, Cognitive Anthropology, Savanna, Namibia

1 Background and Aim of the Study

In recent years the debate on essential factors for a sustainable use of natural resources in arid savannas has gained new momentum. For a better understanding it seems to be particularly promising to analyse local management strategies (Müller et. al. submitted). There are complex interactions between social, economic and non-linear ecological factors which implicate major challenges for an adapted management of natural resources.
Local knowledge is seen as a key to understanding pastoralist strategies of sustainable resource management (Kaschula 2005). It is particularly interesting to investigate how local knowledge is produced and used in a highly unpredictable system, characterised by non-linear dynamics. This study aims to compare and synthesize anthropological and ecological data on essential elements of pastoralist range management to gather new insights into decision-making processes.
As an example of local knowledge, we take the perception of fodder plants and ask the following questions:
i) Correlation: Are there differences between local and ecological ratings of fodder plants?
ii) Criteria: What are local criteria for assessing and ranking fodder plants?

1.1 Understanding and working with Local Environmental Knowledge

Local knowledge is embedded in power relations as well as in specific conditions, and is one framework in decision-making processes. It is situated in a broader cultural context and is

embedded in a set of meaning. Local knowledge can be realised in a specific place or environment, and it can be found with people and institutions; it is flexible and the consequence of practical engagement, reinforced by experience, trial-and-error tests and experiments (Ellen and Harris 2005:5, Schareika 2004: 271).
In this study we aim to investigate one important element of local management systems: Local Environmental Knowledge (LEK). We will refer to Scientific Ecological Knowledge as SEK.

Pastoralists in arid environments have to cope with a high variability of key resources in space and time. LEK enables people to deal with perturbations, variability and randomness, such as the lack of rain and variable amounts of biomass (Little 2003: 163). Pastoralists adopt and reject management options on the basis of perceived indicators. Since LEK is based on the perception of resources such as plant species and their productivity, our objective is to improve our knowledge on criteria and indicators guiding herdsmen in their decisions with respect to spatial and temporal aspects of range management.
Anthropological and ecological data are compared and synthesized to understand range management and decision-making processes. By contrasting the data on the insiders' and outsiders' view, the similarities and differences between SEK and LEK aspects can be shown. We focus on one core aspect of range management: the key resource “pasture”, in particular fodder plants. Thus we define three fundamental steps for working with LEK and SEK on fodder plants:

1. Compiling local and ecological inventories of fodder plants;
2. Investigating their local salience and ecological performance;
3. Comparing local and ecological rating of fodder plant species in order to identify parallels and congruencies.

2 Study Area

We concentrate our field work on a case study situated in an arid African savanna in the north-western part of Namibia. Rainfall averages 300 mm/a, its variability exceeds 30%. Vegetation is a secondary Mopane savanna. Research was conducted in a village of OvaHerero pastoralists who settle there permanently since the 1960s. Livestock herds mainly consist of cattle, goats and sheep.

3 Methods

3.1 Anthropological methods to assess local rating of fodder plants

One main challenge while working with local knowledge lies in the examination of mostly tacit knowledge, structures and classifications (Neubert and Macamo 2004: 95).
Collecting terminology about plants is only a first step while working with LEK. It is even more difficult to investigate where this plant knowledge is used and taken into consideration in the process of decision-making. To investigate the perception and cognitive classification of fodder plants, methods of cultural domain analysis such as Freelisting (e.g. listing of fodder plants) and Pile-sorting (e.g. classifying salient fodder plants) were used (Borgatti 1993, 1999). To gain insights into the application of knowledge, participant observation and interviews were conducted. The sample consists of 19 interview-partners. Here we present preliminary results based on anthropological Freelist data on fodder plants. Work on the application of knowledge, e.g. local assessment of pasture quality, is still in progress.

3.2 Ecological methods to assess fodder plant performance

Composition of vegetation, plant biodiversity and coverage were sampled in pasture areas around the village. The parameters were estimated on nine 1000 m² plots. On each subplot all species were identified, and percentage cover by species was recorded. The species recorded were assigned into one of the following life forms: trees (> 200 cm height), bushes (50-200 cm height) and shrubs (< 50 cm height) for woody species, and perennial grasses, annual grasses and forbs for herbaceous species.

3.3 Synthesis of anthropological and ecological data

Local and ecological datasets on fodder plants were directly contrasted by analysing them with Smith´s Index (Sutrop 2001), a weighted index of item salience. It determines the salience of an item (here: plant species) within the dataset. Our aim is to investigate whether local perception of species salience is in accordance with ecological data on species performance (plant cover). Smith's Index in Freelisting data determines the salience of the plant within its data set considering:

- the rank of the item in the Freelist of each informant;
- its frequency in all collected Freelists; and
- the individual length of the informant´s list (Sutrop 2001).

This approach is directly transferred to the ecological dataset:

- the ecological plot is taken as equivalent to the interview- partner;
- the species list of the monitoring plot is taken as equivalent to the Freelist;
- the rank- coverage of the species is equivalent to the rank in the Freelist.

For simplicity, Smith´s Index will be referred to as the “Weighted Rank”.
Ecological and anthropological fieldwork was conducted between April and June 2006.

4 Results and Discussion

Contrasting local and scientific ecological perception

A total of 71 plant species was recorded within the grazing areas around the village. The local informants named a total of 211 plant species. For data processing, only the most important species with an ecological and/or a local Weighted Rank > 0.02 were selected. Sixty species matched this criterion. The weighted ranks differ significantly ($R = 0.161$, $p > 0.05$). This means that ecological importance (i.e. above-ground biomass, measured as ground cover) and local salience of fodderplants do differ.

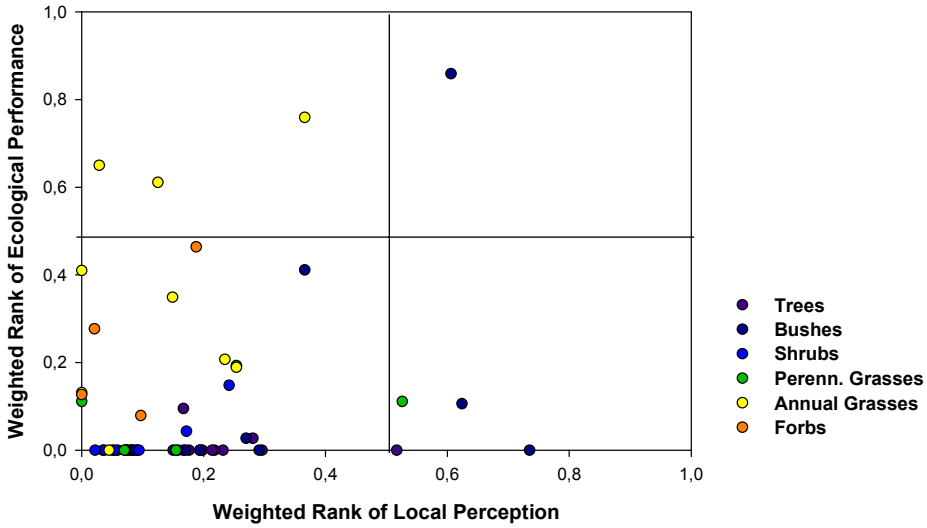

Fig. 1: Local vs. Ecological Ranking - Weighted Ranks of the 60 most important species (with local and/or ecological Weighted Ranks > 0,02).

There is only one plant species with both a high ecological and a high local value (Fig. 1, right upper quarter). Since ecological performance was measured as ground cover, this reflects local perception of natural resources: valuable resources are scarce. Thus we ask: What is the local criterion of a fodder plant for its rank?

There is a clear difference in life form distribution. While 81% of the most important plants of the scientific data set are herbaceous species, only 29 % of the most important plants of the local data set are herbaceous (Fig. 2**).**

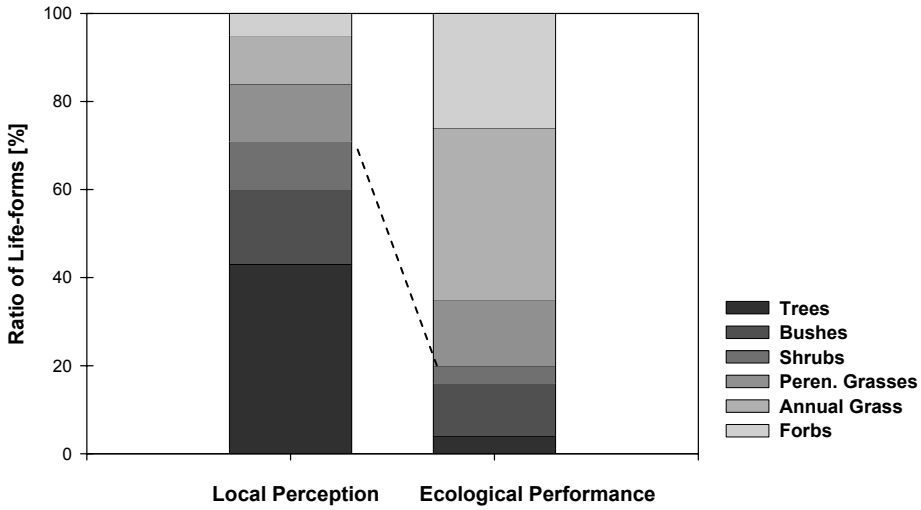

Fig. 2: Life form spectra - Local and ecological ratio of life forms (species classified into three woody and three herbaceous life forms; dotted line separates woody and non-woody species).

The higher proportion of woody species in local rating indicates a higher value of those life forms in local perspective. This leads to the question: What makes woody species important from a local perspective?

Local informants were asked to group different species in piles (Pilesorting) according to their importance for different kinds of livestock in the scarce time of the year (i.e. the late dry season).

Tab. 1: Local importance of fodder plants for different kinds of livestock in the scarce times of the year (late dry season).

[%]	Cattle	Goats	Donkeys
Woody species	72	88	72
Perennial grasses	14	6	14
Annual grasses	14	0	7
Forbs	0	6	7

The results in Table 1 show that woody species are seen as the main source of fodder in scarce times for all kinds of livestock. At least 72 % of the fodder species are either trees, bushes or shrubs. This is not so much surprising for goats and donkeys, as both livestock species are classified as being browsers or having a mixed forage behaviour. But even for cattle mainly classified as grazers, woody species are named as the most important fodder plants, at least in the late dry season.

5 Discussion of Differences

In this study species cover values are taken as a measurement for ecological performance. As there is no clear correlation between ecological and local ranking (Fig. 1), species performance is apparently not a main determinant of local rating.
In our study, local salience and ecological importance of fodder plants do not correlate because local land users perceive woody species to be more important than herbaceous species. This means that local actors see trees and bushes as essential constituents of their savanna environment. Thus local classifications and rankings do not directly mirror the coverage of the species as described with ecological methods.

Difference: Habitat Type
In this case study OvaHerero pastoralists present a very broad vocabulary of terms in the domain of fodder plants. They mention more species than are sampled in the ecological dataset. As common in range ecology, plots are located in plain pasture areas. In contrast, local peoples' iteration of fodder plants do often not refer to this habitat type, but to other habitats like mountains and riverbeds. Ecological data sampling should in future be extended to these habitats to represent spatial distribution of natural resources.

Difference: Scarce Times
In local perception woody species have a higher rank as fodder plants because they are an important source for animal nutrition in times of scarcity, like bushes, shrubs and trees as a reliable fodder source in a highly variable environment. Hence woody species are valued as more salient than grasses. Neither ecological performance nor the high importance of grasses in SEK is reflected by local people's perception in this case study. It is therefore not so much ecological performance or grazing value but relevance for livestock herding under stressful conditions which explains the local ranking of plants.

Difference: Cultural Background
It is also possible that the high local ranking of trees in the cultural domain point not only to relevant fodder plants but to culturally important functions of trees such as for example construction and ritual use. There is a need for further research concerning this question.

6 Conclusion

i) Not species performance, but relevance for livestock herding under stressful conditions is an explanation for local ranking of plants;

ii) Importance of grasses in SEK (Range Ecology) is not reflected by local salience and has to be re-adjusted for secondary savannas;
iii) Interdisciplinary approaches contribute valuable information for identifying local preferences and indicators.

7 Acknowledgements

The research is financed and supported by the VW Junior Research Group "Range management and sustainability - Economic and ecological success of different forms of savanna land use" and the collaborative research centre ACACIA- Arid Climate, Adaptation and Cultural Innovation in Africa, both located at the University of Cologne.

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