Use of Visual Material for Eliciting Shepherds' Perceptions of Grassland in Highland Peru

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Use of Visual Material for Eliciting Shepherds' Perceptions of Grassland in Highland Peru

People's perceptions of their environment in high mountain rangelands ultimately affect the fragile ecosystems on which they depend, and thus their welfare. This is especially true in developing countries, where the livelihoods of people living in such ecosystems depend on grazing livestock. The present study, conducted in the central mountain region of Peru, used photographs and Q methodology to investigate the criteria and preferences that shepherds and local administrators apply in making grazing management decisions. The results showed 2 different sets of criteria and preferences. In the first set of preferences the condition of the grassland, particularly the height of the vegetation, was the main criterion. In the second set, the color of the vegetation was the key criterion. We discuss implications for the further use of this methodology.

Keywords: *Grassland condition; visual assessment; Q methodology; photographic questionnaire; communication; natural resource management; Peru.*

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Introduction

The role of human factors in sustainable agricultural production systems is fundamental (van de Fliert 2003). People are key agents in preserving or degrading ecosystems such as rangelands. The decisions farmers and shepherds make about rangeland and grazing management contribute directly to the state of these ecosystems. These decisions are based on perceptions of the environment in which they live. As the livelihoods of rangeland inhabitants in many developing countries are based on grazing livestock, the productivity of rangeland ecosystems has a significant impact on their welfare.

Thus researchers have sought to assess the perceptions on which rangeland management decisions are based. Several methodologies (eg questionnaires, case studies, group interviews, aerial photography interpretations) have been used. Among these are surveys that ask participants to respond to photographs and visual representations (Swaffield and Foster 2000). Landscape planners and environmental assessment researchers regularly use visual representation methods to assess landscape perceptions (Craik and Feimer 1987) because they are cost-effective and easy to administer (Fairweather and Swaffield 2001). In addition, visual representation can be used as a 'common currency' for enhancing communication among diverse groups (Orland et al 2001). In developing countries, such methods could contribute greatly to knowledge transfer in natural resource management, as well as to research on the perceptions of stakeholders. The aim of the present article, therefore, is to assess the use of visual material in a Peruvian study aiming to elicit the perceptions of primary stakeholders—shepherds and local administrators—about natural resource management in the high mountain grasslands.

Study area and participants

The study was carried out in the Sociedad Andina de Inversiones Sub-Regionales (SAIS, ie Andean Sub-Regional Investment Association) Pachacutec, in the central mountain region of Peru. The study area is predominantly natural pasture. Intensive grazing, along with the biophysical characteristics associated with such mountain regions, results in a wide variation in pasture conditions across the area. To select zones representative of the major grassland regimes, we sought advice from researchers working in the area and from local administrators and shepherds. This consultation resulted in the selection of 6 zones (Table 1). Herbaceous biomass production and species composition were then estimated for each zone.

We interviewed 113 individuals involved in grazing management: 76 shepherds, 15 local administrators, and 22 others. The sample comprised 68 men and 45 women. All the participants spoke Spanish and 45% also spoke Quechua, the prehispanic native Peruvian language; 97% were literate.

Materials and methods

Visual (photographic) questionnaire

To develop the visual (ie photographic) questionnaire, we photographed 4 views of each zone from a vantage point (Figure 1). These points were selected by individuals identified by the community as having appropriate knowledge (eg a shepherd in charge of a paddock, or a person familiar with a zone and grazing management within it). Our aim was to select vantage points from which we could take photographs that would represent the main features of each zone.

The 24 photographs (4 photographs in each zone) that made up the visual questionnaire were taken with a digital camera at a resolution of 1600 x 1200 pixels. At each vantage point, the direction of the first photograph was chosen at random. The other 3 photographs were then taken by rotating the camera 90°, 180°, and 270° from the first (Daniel and Boster 1976). Each of

TABLE 1 Zones selected for the study and total estimated dry-weights (kg/ha) of herbage per zone.

Zone	Paddock name	Production unit	Coordinates	Altitude (m)	Estimated dry-weight (kg/ha)
1	Ordemal	Santa Ana	373130 E, 8744379 N	4029	7416
2	Chicrawain	Corpacancha	367513 E, 8750699 N	4207	6736
3	Tinyac	Corpacancha	367355 E, 8748855 N	4245	6575
4	Kuspicancha	Santa Ana	371360 E, 8744317 N	4031	4473
5	Yanacocha	Corpacancha	355848 E, 8747918 N	4460	4090
6	Ranramachay	Corpacancha	361985 E, 8747228 N	4557	975

the 24 photographs (15 x 20 cm) was labeled with a random three-digit alphanumeric identifier. The questionnaire was printed on photographic paper and laminated for protection during multiple evaluations.

Methodology

We used two methods to gather data. One was Q methodology, using the visual questionnaire. Q sort is a technique introduced by Stephenson (1953) for behavioral research. Participants rank order a set of items (the Q sample) under a specified condition of performance. The rank order assigned to items by each participant is called a 'Q sort' (Brown 1980). The technique allows people to explain the basis of their choices and also allows patterns in Q sorts to be examined by factor analysis (Brown 1980; Fairweather and Swaffield 2001). In its most typical form, the Q sample is made up of written statements (Brown 1980). Other authors have stressed the need to include, for example, images or recordings as sample items, but these are still rarely used. Some recent studies that combined images and Q methodology have been presented by Gabr (2004), Fairweather and Swaffield (2001), and Swaffield and Fairweather (1996).

After a pilot test, we chose a complete Q sort for this study. In the pilot test, we asked participants to rank the condition of grassland. The responses indicated that they were reluctant to assign low rankings, perhaps because they associated the condition of their grassland with their own performance in managing grazing. Given this, we decided on a complete Q sort to avoid any bias.

Survey interviews using the visual questionnaire were conducted in the Corpacancha and Santa Ana production units. Participants were asked to rank order the 24 photographs according to the suitability of the area shown in the photographs for grazing sheep. To do this, the participants were first asked to rank the photographs into 6 piles (the first representing the most preferred and the sixth the least preferred). Next, they were asked to rank order the photographs within each pile according to the same criteria. How participants assessed the condition of the area and decided on the best zone for grazing sheep was left to them. The participants were merely instructed to rank order the images based on what they could see in the photographs.

The second method was a survey of perceptions gathered by semi-structured interviews. The survey was based on a questionnaire—developed with the findings from preliminary interviews with administrators and some of the shepherds—that incorporated local concepts and terminology for grazing management. We interviewed participants and, using the questionnaire, asked them to describe the characteristics of the grasslands they preferred for grazing sheep.

Analysis and results

Q methodology

First we analyzed the rank orders for each photograph. Table 2 shows that the rank orders are highly dispersed, even for photographs in the same zone.

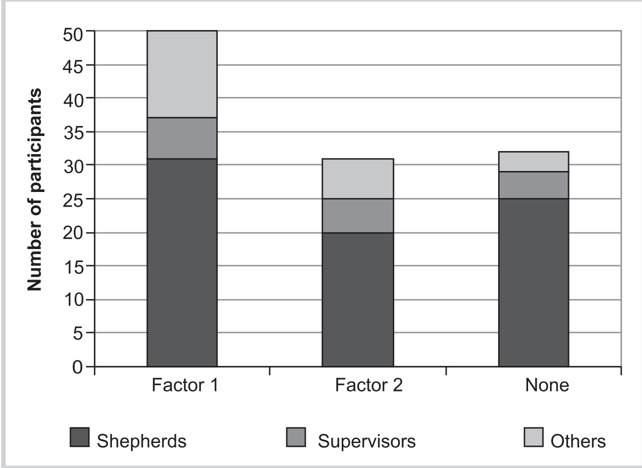
The 113 Q sorts were then correlated and rotated using the varimax option of factor analysis. The factors were defined according to the criterion that the loadings related to one factor had to be significant for only one factor (Fairweather and Swaffield 2001). For the Q sample in this study (24 photographs), the standard error for a zero-order loading was $1/\sqrt{N} = 0.20$ (Brown 1980). This means that the loading had to be at least

FIGURE 1 Examples of photographs taken in the 6 selected zones. (Photos by Mariana Cruz)

TABLE 2 Ranking of zones according to participants.

Zone	Factor 1		Factor 2	
	Median	Interquartile range	Median	Interquartile range
1	19	7	12	10
2	15	8	6	7
3	10	6	6	6
4	9	10	19	7
5	3	2	15	11
6	17	9	18	6

FIGURE 2 Number of participants per pastoral function for each factor.



0.20 x 2.58 = 0.52 at the 0.01 probability level (Fairweather and Swaffield 2001). We also analyzed the data at the 0.05 and 0.10 probability levels, but as there were no major changes in the composition of the factors, we decided to use the 0.01 probability level.

Two factors accounted for 53% of the cumulative variance in the rotated correlation matrix. Factor 1 accounted for 30% and Factor 2 for 23%. Q sorts contributed significantly to defining these factors in 81 subjects' responses (72% of the participants). Participants with different roles in grazing management were associated with each factor (Figure 2). This suggests that the profile of a participant who contributed significantly to a specific factor and shared similar preferences with the other participants contributing to that factor is not related to the person's role in the SAIS. The following interpretations are based on the 6 top- and the 6 bottom-ranked photographs for each factor (Fairweather and Swaffield 2001).

Factor 1

In the present study, 50 participants were associated with Factor 1, of whom 17 were women and 33 were men (Figure 3).

In the 6 top-ranked photographs in this factor, the predominant feature was the grassland in the paddock (tall grassland vegetation). The top 2 and the bottom 2 of the 6 top-ranked photographs were from Zone 1. According to the estimates of dry-weight biomass (Table 1), Zone 1 has the highest herbaceous biomass production of the 6 zones. However, the other 2 photographs in this factor (the third and fourth top-ranked photographs) were from Zone 6 (the zone with the lowest herbaceous biomass production). These photographs may have given a misleading impression of the vegetation in Zone 6 because of the angle and position from which they were taken with respect to the vegetation and slope of the ground. This means that visual sampling by randomly pointing the camera for the first photo may present problems in taking representative views of grassland areas. Nevertheless, the results suggest that the subjects based their preferences mainly on what they could see in the photographs rather than on any prior knowledge they might have had of the areas shown.

Of the 6 least preferred photographs for Factor 1, 4 were of Zone 5, and 2 were of Zone 4. These photographs showed areas that were not entirely grassland or, if they were, the vegetation was short and stony areas were typical.

The analysis of results for Factor 1 suggests that subjects with this set of perceptions base their grazing management decisions mainly on the height of grass-

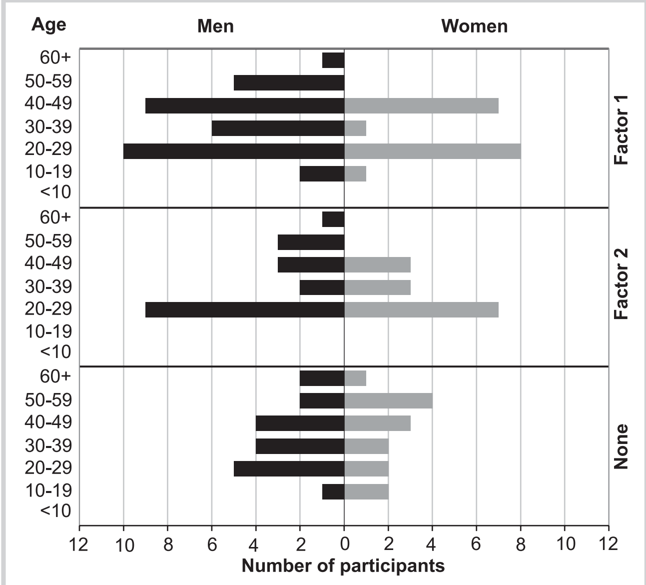
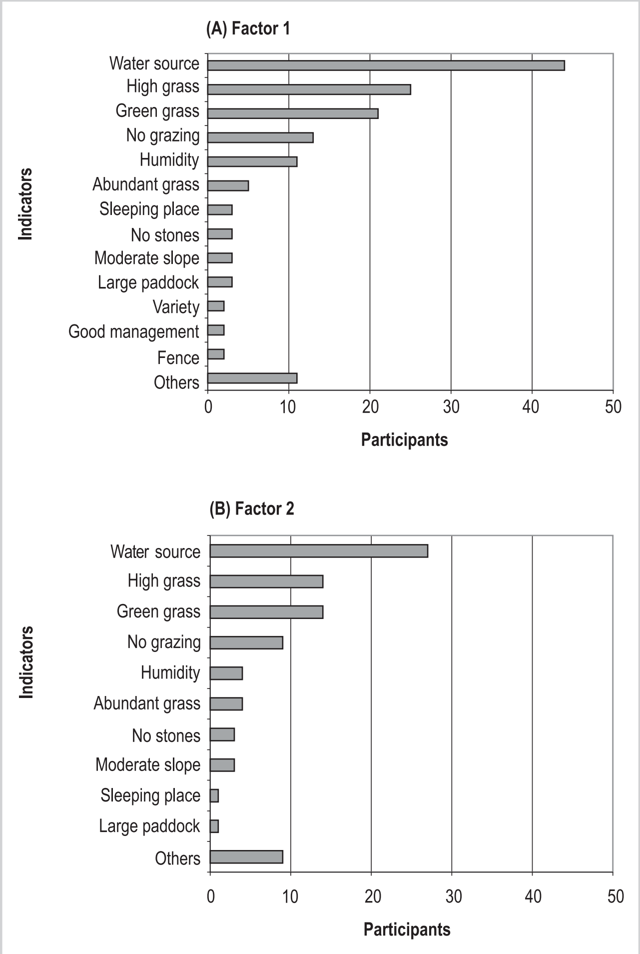


FIGURE 3 Number of participants for each factor by gender and age.

FIGURE 4A AND 4B Preferred indicators mentioned by participants in the verbal questionnaire. (A) Factor 1; (B) Factor 2.



land vegetation. The fact that the coordinator who led the establishment of the grazing management schedule was in the category with this factor shows that some subjects at all levels of the process shared his criterion. However, a second factor indicates that a second group of subjects did not share the same perceptions of the photographs as the subjects in Factor 1 and so did not establish their preferences in the same way.

Factor 2

The Q sorts of 31 subjects (18 men and 13 women) shaped Factor 2. The 6 top-ranked photographs for Factor 2 mainly showed open areas of grassland with short vegetation. The first, third and sixth ranking photographs in this group were taken in Zone 4, the second and fourth were taken in Zone 6, and the fifth was taken in Zone 5. Herbaceous biomass production in these zones was lower than in Zones 1 and 2. An overall green color, rather than short vegetation, was characteristic of the grassland in these 6 photographs. In addition, 2 of the 6 top-ranked photographs showed sources of water. The 6 top-ranked photographs in Factor 1 showed no water sources. The 6 bottom-ranked photographs for Factor 2 showed areas fully covered by grasslands of regular height. None of these showed sources of water and the vegetation tended to be yellow. Of the 6 least-preferred photographs, 3 were taken in Zone 3 and the other 3 were taken in Zone 2. This means that in this group, the color of the vegetation was more important to participants in assessing grassland condition and making decisions on grazing management than the height of the vegetation.

Interview results

Figure 4 shows grassland characteristics preferred by participants as determined by their responses to semi-structured interviews rather than to the visual questionnaire. While some of the preferred characteristics identified from the interviews were similar to the preferred characteristics identified from the visual questionnaire, there was an important difference. In interviews, subjects favoring either of the 2 factors indicated that the most important consideration in grazing management was water for livestock (lagoon, lake, river, irrigation ditch, or other large body of water). This could be because water is scarce in the study area by comparison with ecosystems at lower altitudes. In fact, the Program for the Improvement of High Andean Grasslands stresses, in its Plan of Forage Resource Management for the SAIS Pachacutec (Flores 2003), the importance of water conservation for increasing the production of the grasslands.

Nevertheless, when the interview responses were compared to the responses to the visual questionnaire, they differed in the Factor 1 group: the responses to the visual questionnaire did not identify water for livestock as the main consideration in grazing management. Indeed, the 44% of participants contributing to Factor 1 did not rank any photographs showing a source of water among their top 6. Furthermore, the photograph with the most obvious and largest source of water (a lagoon) was classified as one of the least preferred.

Conversely, participants in the Factor 2 group had similar responses to this variable both when presented with the visual questionnaire and when interviewed. Their most preferred photographs showed sources of water (the lagoon) or some feature related to a source of water (eg irrigation ditches), although this was not the only criterion for their preference.

Discussion

The results of this study show that direct stakeholders (ie shepherds and local administrators) have different preferences when assessing grazing in this area of the Peruvian central mountains. Some researchers argue that many factors contribute to human responses to native vegetation, some of them learnt and others innate (Williams and Cary 2001). People's preferences for certain types of grassland for grazing their livestock have been linked to factors such as their knowledge of an ecosystem or the value they assign to a grassland for agricultural production (Orland 1988; Williams and Cary 2001). The results of the present study suggest that inhabitants assess grasslands using visual criteria, but from different perspectives. Previous studies have also reported that different groups have different perceptions of rangeland conditions. For example, Wezel and Haigis (2000) showed that the perceptions of men and women in Niger differ because they perform different tasks. Such task-based differences were not observed in this study. Gender, function, age, experience, and prior knowledge of the study area were not related to Factors 1 and 2.

A review of the literature indicates that this is the first study in this area to use a visual questionnaire and Q methodology to assess perceptions. The ease of application and the interest aroused among the participants by the use of photographs means that this methodology could be a powerful tool for communication, especially with shepherds. The subjects in the pilot test (a verbal structured questionnaire) responded poorly to interviews and many refused to answer questions at all. In contrast, participants responded well to the photographic questionnaire, becoming involved and participating actively.

Moreover, the Q-sorts and analysis of responses to the photographic questionnaire showed clear differences in the most preferred indicators compared to the results of semi-structured interviews. Differences in responses to visual and verbal questionnaires have been reported in previous literature. Tahvanainen et al (2001) used visual and verbal stimuli to compare visual perceptions with preconceptions. In our study there may be other factors that influence the differences between responses to both types of stimulus. However, our results suggest that participants' assessments were based on what they could see in the photographs rather than on prior knowledge of the zone in question. Thus, further research is needed to validate the basis on which rangeland inhabitants make decisions on grassland management. This further research may take different approaches, such as using Geographic Information Systems and Participatory Multicriteria Decision Analysis.

In addition, concerns about the methods used to take visual samples of landscapes and the validity of visual questionnaires for perceptual research still have to be resolved. When the research objective is to compare perceptions of environments as shown in photographs with perceptions of actual environments, the method of taking visual samples of these environments is critical to the validity of the study. Previous studies suggest that visual samples must represent not only the physical components of the landscape but also the perceptual components that participants consider. The problem here, however, is how to establish these perceptual components at the outset. In this study, we partly relied on a participatory approach; we asked people with knowledge of the area to select the vantage points for the photographs for each zone. Despite this, the study shows that participants do not base their decisions on the same criteria. It would be preferable, therefore, if the method of visual sampling used in future studies took this into consideration.

Conclusions

The results of this study suggest that photographic questionnaires and Q methodology are promising tools for research on the environmental perceptions of people whose livelihoods depend on grasslands in the Peruvian central mountains. The study identified 2 sets of criteria for assessing the suitability for grazing of natural grasslands.

The results suggest that even if grazing management plans have been developed (as is the case in the study area), stakeholders do not necessarily share the same perceptions of the best grazing areas. Further research is needed to study the implications that such differences in the perceptions of stakeholders will have for daily decisions made in grazing management, as well as in terms of the long-term impacts of such management on grassland ecosystems and the welfare of their inhabitants.

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