# Visual obstruction of herb vegetation, defining standards for natural barriers

**Pieter Roovers, Barbara Dumont, Hubert Gulinck & Martin Hermy**

Laboratory for Forest, Nature & Landscape Research,
Catholic University of Leuven, Leuven, Belgium
pieter.roovers@agr.kuleuven.ac.be
barbara.dumont@agr.kuleuven.ac.be
hubert.gulinck@agr.kuleuven.ac.be
martin.hermy@agr.kuleuven.ac.be

Abstract: As a result of increasing impact of recreation on natural resources and visitor experiences, wilderness managers often want to control recreational use. However, most of the attempts to alter wilderness recreational use patterns, suffer from a lack of knowledge of visitors' behaviour they seek to influence. This study concentrated on the effects of ground vegetation on perceived obstruction to recreationists. The aim was to define marginal values for the structure of natural barriers. Ratings by participants ($n$= 131) on a five-point scale, measured perceived obstruction. These ratings were linked to vertical cover of the vegetation. Analyses indicated a significant exponential relationship between vertical cover and perceived obstruction. A marginal vegetation height of about 54 cm could be identified as having obstructive features. Also the condition of the soil and the presence of irritating species seemed to influence visitors' judgement. It was concluded that a more intensive use of natural barriers to control recreational use, is a functional alternative with economical and aesthetical advantages.

## Introduction

As a result of the impacts of visitor distribution on resources and visitor experiences, wilderness managers often want to adjust the location of recreational use (Lucas 1990). However, most of the attempts to alter wilderness recreational use patterns suffer from a lack of knowledge of visitors' behaviour which they seek to influence. In many cases the concern of managers towards resource protection does not match visitors' interests, whereas their respective priorities interact with differences in training, education and behavioural norms (Stankey & Lucas 1984). Also, visitors dislike to be constrained by rules and regulations, as they want to experience nature because of the specific lack of everyday constraints in life and freedom (Brown & Haas 1980).

In this study, we would like to focus on a specific aspect of visitor behaviour. The objective is to estimate marginal values concerning ground vegetation structure. Although earlier research indicated that structural barriers of natural materials like logs or brushwood seem to be less effective than artificial types like barbed wire, fences or notice boards (Bayfield & Bathe 1982), it is clear that general feelings as dislike and fear can motivate avoidance and therefore have an influence on visitor behaviour (Ulrich 1986). Research by Lehvävirta (1999) indicated that natural barriers out of living vegetation could be used to limit wear, even in intensively recreated urban woodlands. Moreover, they are cost-friendly and aesthetically less disturbing (Smith & Matthews 1972). It is preferred to create standards for an adapted management of trail edges, based on repellence of vegetation towards recreationists. In this way, visitor flow can be concentrated on the trail network, while sensitive locations stay protected without provoking visitors' dislike towards intensive regulations and human interference.

## Methods

### Questionnaire procedure

A group of 131 persons served as participants in a questionnaire that was executed on the field. All of these persons work as personnel for the Faculty of Agricultural and Applied Biological Sciences and have enjoyed diverse education (secretary, laboratory assistant, technician, student or scientist). Both sexes were equally represented and age ranged from 18 to 55 years.

Upon arrival, participants were handed over a questionnaire form and instructions were given to fill them in on the field. During two hours, participants followed a path through the nature reserve. On eight deliberately chosen locations, participants were asked to evaluate the effort needed to move through the terrain. The vegetation in question was marked with wooden piles. Visitors were asked to evaluate the vegetation from a distance of ten metres, where a

second pile was placed next to the path. This way, an optimal control was achieved about which vegetation is considered. Participants rated possible obstruction of vegetation on a five-point scale. Answer possibilities to the question 'how difficult would you experience it to walk through the indicated vegetation?', reached from 'very easy' to 'very difficult' on the questionnaire form. Hereafter, means of scale values (MSV) were deducted from the obtained pseudoreplications (Hurlbert 1984). The selected vegetation types were grassland (three times), tall herb vegetation (two times) and woodland (three times). Since we wanted to exclude differences in the perception of canopy (Nelson et al. 2001), the woodlots were of similar age and dominant tree species (*Populus x canadensis*). Also tree density (Lehvävirta 1999) seems to have a significant effect on visitor behaviour. Therefore stands of moderate density (ca. 156 trees/ha) were chosen, which do not have an explicit attractive or repulsive effect (Kaplan & Kaplan 1989). In order to set a standard for the consecutive judgements, the first vegetation encountered by the respondents was a grassland of very low height (less than 10 cm), which would obviously be evaluated to walk through very easily.

In addition, respondents were asked whether they think they were influenced in their judgement either by the height of the vegetation, vegetation characteristics of the wider surroundings around the wooden pile, humidity of the soil and the presence of irritating species. The latter are typified by characteristics like spines, thorns and other structures or secretions which can cause physical nuisance to humans when contact is made.

### Vegetation data collection

In order to evaluate the effect of structural features of the vegetation on penetration by recreationists, data collection was restricted to vertical vegetation cover. The vertical component of vegetation cover was estimated using a two meter high cover pole (diameter 2.5 cm), divided into 10 cm sections (Casaer 2003). Concealment of the cover pole was estimated from a distance of 10 meters for all species together. This method is commonly used for determination of hiding cover for wildlife (Guthery et al. 1981, Haukos et al. 1998), but it also gives a more general impression of visual obstruction. Measurements were executed September 2003 following the questionnaire.

### Data analysis

Respondents' rating of visual obstruction was tested for differences between vegetation types. The data were tested for normal distribution with a Kolmogorov-Smirnov test. Normality assumptions were not met and therefore non-parametric statistics (Friedman test for related samples with pairwise comparisons) were applied (Siegel & Castellan 1988). To avoid the incorporation of pseudoreplicate rating values, mean of scale values (MSV) have been related to vertical cover of the vegetation types by using regression techniques. MSV met normality assumptions. Most significant relationships were maintained. Deduction of marginal values for physical variables on the base of the obtained regression curves was based on the rating value of 3.7, which is considered to reflect the limit for 'high' ratings (Kaplan & Kaplan 1989). The influence of irritating species' presence on rating values was tested using a Mann-Whitney test. All analyses were executed using SPSS 11.0 (SPSS 2001).

## Results

Regression curve estimation revealed a significant exponential relationship between means of scale values (MSV) and vertical cover (Figure 1). The rating of obstruction is correlated positively with vertical cover (Spearman correlation coefficient = 0.89; $p<0.01$). As such, vertical cover is assumed to be relevant to the obstructive features of vegetation and marginal values for this variable can be deducted from the regression curve. On the five-point scale of ratings a mean of 3.7, which is considered to be the marginal value of what visitors experience as difficult to walk through (Kaplan & Kaplan 1989), leads to a vertical cover of 26.8%. In dense vegetation this would correspond to a marginal vegetation height of 53.6 cm.

Considering participants response to the factors influencing their rating, it is confirmed that height of the vegetation (92%) is assumed to be an important factor, as also the humidity of the soil surface (69%) and the presence of irritating species (79%) (Figure 2). Concerning the latter, it is remarkable that vegetation where irritating species are present, also has

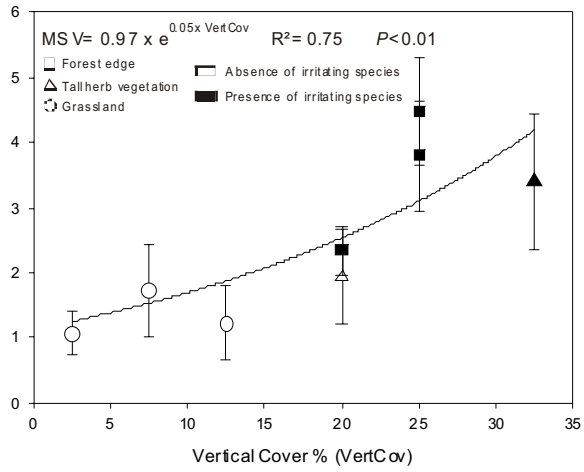


Figure 1. Scatterplot and regression between the means of scale values (MSV) for respondents' rating of obstruction and vertical cover measurements (VertCov) on nine locations of three vegetation types (forest edge, tall herb vegetation and grassland). Error bars indicate 95% confidence interval ($n$=131 for each MSV).

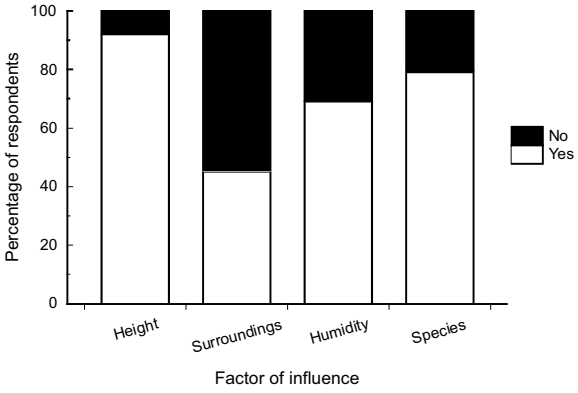


Figure 2. Percentages of respondents who assume that height of the vegetation (1), the wider surroundings of the wooden pile (2), humidity of the soil (3) and presence of irritating species (4) had an influence on their obstruction rating ($n$=131).

higher values for vertical cover (Figure 1), although no significant differences were observed. However, ratings significantly differed dependent on the presence of irritating species (Mann-Whitney test: Z= -2.21; $p$<0.05). Participants believe they were not influenced by the wider surroundings of the wooden pile when evaluating obstruction.

## Discussion

This study concentrates on the perception of obstruction by vegetation. Vegetation structure has a direct influence on the physical environment, as open space has visually disappeared. Hence, spatial factors like openness are very characteristic for the psychological classification of environmental scenes (Tversky & Hemenway 1983). In contrast, the experience based information is exclusively provided by the observer and could classically involve fear factors (Kaplan & Talbot 1988). In this context, specific reasons to cause fear and avoidance could be the presence of vermin or irritating species. Another emotional reaction which is provoked by the environmental setting is the sense of mystery. However, this should be avoided where recreation is not preferred, as it forms an attraction to walk further towards more information (Kaplan & Kaplan 1989).

Our results verify that vertical cover is a significant factor in the perception of obstructive features of vegetation. An important remark in this matter is the implicit incorporation of some 3-dimensional vegetation characteristics in the variable of vertical cover, as perceived vertical cover is partially determined by the overlap of plants in front of the cover pole. From the observed exponential relationship between vertical cover and respondents' ratings, we deducted a critical height value of about 54 cm for vegetation to cause substantial perceived obstruction.

As mentioned, the physical appearance of a vegetation type is also influenced by management actions, like the mowing of grassland or thinning of forest stands. In this way, management might have an important influence on visitors' preference for a certain setting. Therefore, attention must also go to the way human influence is positioned in the context of the natural setting. Natural environments with human intrusions are less preferred than others (Kaplan & Kaplan 1989). Hancock (1973) experimentally removed vegetation on campsites, both ground cover and screening shrubs. In contrast to the verbal preferences of the visitors, use of the treated sites increased. This indicates that visitors sometimes react more instinctively than they would assume. Earlier research showed that mosses and grassy undergrowth is strongly preferred (Smith & Matthews 1972), whereas dense understorey and weed invasion is disliked (Lamb & Purcell 1990). An important factor in the perception by visitors is the presence of specific species. Ratings for vegetation with irritating species present are significantly higher as visitors indicated consciously. In our study, an important influence is assumed to follow from the presence of *Urtica dioica* L. and *Rubus fruticosus* coll. L., of which can be assumed that they have visual obstructive capabilities for recreationists because of their high status and defence mechanisms (respectively stinging hairs and spines). The correspondence between the presence of both species and high vertical cover, is probably due to their competitive strategy (Grime et al. 1988). Competitive species strongly invest in growth and therefore develop a large habitus. Respondents also seem to be influenced by soil conditions. As users seek to circumvent muddy areas, poorly drained soils significantly contribute to excessive trail widening and increased susceptibility to erosion (Leung & Marion 1996). In this way, management and visitors both benefit dry conditions.

The key to avoid problems with the spread of use is to make on-trail walking the easiest alternative for the visitor (Hammitt & Cole 1998). Our results indicate that there are possibilities to enhance the use of natural barriers. However, we must consider the fact that rather low recreational pressure might be an important precondition, as the effectiveness of barriers is most critical when high recreation activity occurs (Lehvävirta 1999).

## References

Bayfield, N.G. & Bathe, G.H. 1982. Experimental closure of footpaths in a woodland national nature reserve in Scotland. Biological Conservation 22: 229–237.

Brown, P.J. & Haas, G.E. 1980. Wilderness recreation experiences: the Rawah case. Journal of Leisure Research 12: 229–241.

Casaer, J. 2003. Analysing roe deer habitat selection; methodological problems and possible solutions. PhD-thesis, KULeuven.

Grime, J.P., Hodgson, J.G. & Hunt, R. 1988. Comparative plant ecology, a functional approach to common British species. University Press, Cambridge.

Guthery, F.S., Doerr, T.B. & Taylor, M.A. 1981. Use of a profile board in sand shinnery oak communities. Journal of Range Management 34(2): 157–158.

Hammitt, W.E. & Cole, D.N. 1998. Wildland recreation: ecology and management. Second edition. John Wiley & Sons Inc., New York.

Hancock, K. 1973. Recreation preference: its relation to user behavior. Journal of Forestry 71: 336–337.

Haukos, D.A., Sun, H.Z., Wester, D.B. & Smith, L.M. 1998. Sample size, power, and analytical considerations for vertical structure data from profile boards in wetland vegetation. Wetlands 18(2): 203–215.

Hurlbert, H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54(2): 187–211.

Kaplan, R. & Talbot, J.F. 1988. Ethnicity and preference for natural settings: a review of recent findings. Landscape and Urban Planning 15: 107–117.

Kaplan, R. & Kaplan, S. 1989. The experience of nature: a psychological perspective. Cambridge University Press, Cambridge.

Lamb, R.J. & Purcell, A.T. 1990. Perception of naturalness in landscape and its relationship to vegetation structure. Landscape and Urban Planning 19: 333–352.

Lehvävirta, S. 1999. Structural elements as barriers against wear in urban woodlands. Urban Ecosystems 3: 45–56.

Leung, Y.F. & Marion, J.L. 1996. Trail degradation as influenced by environmental factors: a state-of-the-knowledge review. Journal of Soil and Water Conservation 51: 130–136.

Lucas, R.C. 1990. How wilderness visitors choose entry points and campsites. Research Paper INT-428(1), Ogden, UT: USDA For. Serv., Intermountain Research Station. 33 p.

Nelson, T., Johnson, T., Strong, M. & Rudakewich, G. 2001. Perception of tree canopy. Journal of Environmental Psychology 21: 315–324.

Siegel, S. & Castellan, N.J. Jr. 1988. Nonparametric statistics for the behavioral sciences. Second Edition. McGraw-Hill Inc., Singapore.

Smith, J.H.G. & Matthews, J.R. 1972. Environmental tolerances and visitor preferences for some forest recreation habitats in British Colombia. Forestry Chronicle 48: 133–137.

SPSS 2001. SPSS 11.0. SPSS Inc., Chicago.

Stankey, G.H. & Lucas, R.C. 1984. The role of environmental perception in wilderness management. Unpublished paper. USDA Forest Service, Missoula.

Tversky, B. & Hemenway, K. 1983. Categories of environmental scenes. Cognitive Psychology 15: 121–149.

Ulrich, R.S. 1986. Human responses to vegetation and landscapes. Landscape and Urban planning 13: 29–44.