Where Dutch recreationists walk: path design, physical features and walker usage

Ramona van Marwijk, David G. Pitt

Abstract — A comprehensive understanding of visitor use is fundamental for effective park management. This paper explores recreational spatial behaviour in a protected nature area with a focus on the physical environment. The current research is carried out in Dwingelderveld National Park in the north-eastern part of the Netherlands with approximately 2 million visitors a year. A total of 400 walkers carried a GPS to record their movements. We related spatial patterns to the (visible) physical environment. We characterized the physical environment in (1) the path network and (2) the surrounding environment. The environment is defined by use, experience, and narrative value variables. Hierarchical regression analyses show the importance of the use value variables signage and placement of parking areas as predictors for spatial behaviour. Experience and narrative value variables are less important. For recreational quality purposes, managers should clearly communicate recreational opportunities for each parking area to the public.

Index Terms — environmental values, outdoor recreation, spatial behaviour, physical environment

1 Introduction

Insight and understanding of visitor use, including temporal and spatial distributions, is necessary for sustainable recreational use and effective park management. The Netherlands is the third most densely populated country in the world (after Vatican City and Bangladesh) with consequently high recreation needs. The 20 National Parks in The Netherlands are facing increasing visitor numbers every year and expect this trend to continue. Together they form the core areas basis of the Dutch national ecological network.

R. van Marwijk is with the Socio-Spatial Analysis and Forest & Nature Conservation Policy groups at Wageningen University, the Netherlands. E-mail: ramona.vanmarwijk@wur.nl.

D.G. Pitt is with the Department of Landscape Architecture, University of Minnesota, Minneapolis MN 55455. E-mail: pittx001@umn.edu.

Although the exact negative impacts of recreational visitation are difficult to monitor, the general notion is that recreation negatively impacts ecological values. However, the objectives of Dutch national parks focus not only on the protection and development of nature and the landscape, but also on outdoor recreation.

Nature managers can influence recreationists' spatial behaviour by several 'steering measures'. Those measures differ from one another on two dimensions: the impact on the recreationist's sense of freedom and the character (social or physical) of the measure. In this paper we focus on the physical environment, including physical measures such as the marking and the placements of concentration points. Although in recent decades the role of the physical environment (or context) in influencing individuals' behaviour has gained a lot of attention among researchers, most of this research is from a phenomenological perspective [1]. The limited number of published studies on the influence of the

physical environment on physical activity focus mainly on urban environments (e.g. [2], [3]) and health issues [4], [5].

The aim of this paper is to explore the importance of physical features in a protected natural environment for recreational walking[1]. We will begin with a presentation of four environmental values that help categorize physical features. Next we will describe the method of collecting and computing data for our study area, Dwingelderveld National Park, in the north east of the Netherlands. We will conclude with an analysis of important landscape features for hikers that are relevant for protected nature area design and management.

2 THEORETICAL CONTEXT

Lengkeek *et al.* [6] introduced four concepts to analyse human-environment relationships:

- Use value: instrumental or economic value, this value refers to human function and use of environment;
- Experience value: this value refers to stimuli for the perception of the environment and its evaluation in terms of beautiful or ugly, hilly or flat, etc.;
- Narrative value: this value refers to the specific stories and interesting facts about an area or elements in an area; and
- Appropriation value: the intensity of being mentally attached to the environment.

While the first three values can be linked to elements in the physical environment, the appropriation value is a strong (personal) emotional bond – also known as place attachment [7]. As a result we focus in this paper on the use, perception and narrative values only that may be ascribed to a protected nature area.

[1] This paper is part of the PhD project of Ramona van Marwijk that aims to theoretically and empirically ground relationships between the value of landscape characteristics and patterns of visitor use, in order to improve a management tool for effective ecosystem management (2005-2009).

3 METHODS

3.1 Study area

Dwingelderveld National Park (DNP) is a nature area in the north eastern part of the Netherlands. It contains 3,700 ha and consists of wet heath land (1550 ha) and a mixture of native deciduous and pine forests (2000 ha). The DNP receives 2 mln day visitors yearly. It is a typical Dutch nature recreation area with an extensive recreational network for both short strolls (60 km marked trails that are each less than 7 km in length) and long walks, for cycling ('normal', racing, ATB) and for horse riding. Visitors to DNP are obliged to confine their hikes to only designated paths. A follower of a 'marked trail' is one whose visit takes place on a trail that is identified and designated by managers. We use the term 'browsers' for people who explicitly state that they did not follow marked trails.

3.2 Data collection[2]

A survey was carried out to investigate re creational use in DNP. The survey consisted of two instruments: (1) a questionnaire to explore visitor characteristics and (2) a geographical position system (GPS) device that was carried by the visitors during their visit. The GPS registered their spatial behaviour. The survey population was targeted at hikers as they form the largest part of visitors to Dutch National Parks.

Visitors have been asked to participate in the research at five different entrances in the park: two main entrances close to a visitor or information centre, and three smaller ones. The survey was carried out during 7 days (weekend and working days) in spring and summer in 2006. The total research sample consists of 461 hikers, including as many men as women (age 17-85 years). The re-

[2] see [8] for detailed description of data collection

sponse rate of the survey is 63%. A total of 65% of the visitors walk a marked trail (so 35% are browsers).

3.3 Variables

Table 1 lists the set of use, experience and narrative value variables in this study. A spatial database was compiled to describe the physical environment if DNP. The data structure was based on the path network available for use by visitors. The variables were measured objectively.

Based on several resources [9], [10], [11] we decided to divide the environment next to the path segments in a fore- middle- and background. The foreground is the area between 0-50 meters off the path, the middle ground is from 50-1200 meters and the background is further than 1200 from the path.

3.4 Data analysis

We analyzed the data using SPSS. Without knowing a priori which landscape variables have a significant influence, we aim to construct a model which minimizes redundancies between them. Consequently, we applied stepwise regression which minimizes colinearities between explanatory variables. Moreover, we applied a hierarchical multiple regression in which the order of entry is based on logical and theoretical considerations. Visitor density on each path segment was treated as a dependent variable. As independent measures, we entered the use value variables first (without them recreation is not possible), second the experience value variables (that are supposed to cater for a general pleasurable experience), and third the narrative value variables (for an extra experience).

We devised several hierarchical regression models for different subgroups of visitors. In order to compare the groups, we calculated standard z-scores to describe the distribution of standardized regression coefficients within a regression model. This permits mutual comparison between the groups.

TABLE 1

Independent variables used in the study

	Mode of measurement	Scale
	Use value variables	
Connectivity	To how many other paths does this path connect?	Total N
Path density	Path segment length /adjacent area	m/m2
Pole path	Is the path part of a designated pole route?	1-no; 2-yes
Leaflet path	Is the path part of a designated leaflet route?	1-no; 2-yes
Surface	Is the path unpaved or paved?	0=unpaved, 1=paved
Length	Path segment length	Meters
Bench/picnica	Total number of benches/picnic	Total N
Signposta	Number of signs	Total N
Distance to parking	Network distance to nearest parking area	Meters
	Experience value variables	
Sinuosity	Path segment length /Euclidean distance between start & end points	m/m
Width	What is the width of the path?	0 <2m 1= >2m
Slope[a]	% area slope >12%	Percentage
Facilities[a]	Total number visitor facilities	Total N
Water[a]	% area water	Percentage
Forestv	% area all forest	Percentage
Heath[a]	% area heath	Percentage
Old forest[a]	% area forest >80yrs	Percentage
Young forest[a]	% area forest <40yrs	Percentage
Open foreground	Foreground % area in open cover	Percentage
Open middleground[b]	Middleground % area in open cover	Percentage
Open background[c]	Background % area in open cover	Percentage
Expressway [d]	Distance to expressway	Meters
Regional Hwy [d]	Euclidian distance to regional highway	Meters
Cateringe	Distance to catering	Meters
	Narrative value variables	
Radiotelescope[e]	Distance to radio telescope	Meters
Sheep farm north[e]	Distance to sheep farm North	Meters
Davidsplassen[e]	Distance to Davidsplassen	Meters
House Benderse Berg[e]	Distance to House Benderse Berg	Meters
Lookout holtveen[e]	Distance to Lookout Holtveen	Meters
Sheep farm south[e]	Distance to Sheep farm South	Meters
VC south[e]	Distance to visitor center south	Meters
VC north[e]	Distance to visitor center north	Meters

[a] In near path environment (<50m) (=foreground)
[b] from 50-1200 meters from path (=middleground)
[c] Further than 1200 meters from path (=background)
[d] Measured in Euclidian distance (the Euclidian distances to expressway and regional highway are added because they are expected to form a disturbance factor)
[e] Measured in network distance

4 RESULTS

From the questionnaire we learned that 65% of the walkers walk a marked trail. Therefore, we expected pole paths (coloured poles mark the route) are important variables.

TABLE 2

STANDARD Z SCORES OF VISITOR DENSITY REGRESSED ON USE, EXPERIENCE & NARRATIVE VALUE VARIABLES FOR ALL VISITORS & BROWSERS

	All visitors	Browsers
r^2	**0.53**	**0.29**
Use value variables		
Pole path	2.75	1.03
Distance to parking	-1.47	-1.78
Leaflet path	0.47	0.46
Bench/picnic[a]	.29	1.05
Experience value variables		
Facilities	0.45	0.79
Background open	-0.79	-
Dist reg hwy	0.43	0.70
Narrative value variables		
Benderse berg	-	0.55
Lookout Holtveen	-.75	-
Sheepfarm south	-	-2.48
VC south	-1.15	-

Table 2 shows that indeed pole path is the most important variable in forecasting visitor density on paths (z-score of 2.75). However, pole paths are less important for browsers. A second strong variable is the network distance to the parking. The negative number indicates that people tend to stay in the relative vicinity of the parking. The same accounts for the sheepfarm for the browsers and the visitor centre for all visitors. To a lesser extent the vicinity of facilities is an important variable for both groups.

Table 3 shows the two most important variables for regression models. Pole paths are most important at the first parking area. They are less important for the parking area 2 (Fig. 1 and 2), where a large part of the visitors only visit the sheep farm and do not follow a marked trail. Moreover, visitors tend to stay more in the vicinity of parking area 2 than area 1.

TABLE 3

STANDARD Z SCORES OF VISITOR DENSITY REGRESSED ON TWO MOST IMPORTANT VARIABLES FOR FIVE PARKINGS

Parking	1	2	3	4	5
r^2	0.33	0.33	0.28	0.21	0.19
Pole path	2.46	0.96	1.50	0.93	1.05
Parking	-1.33	-2.32	-2.02	-2.06	-2.17

[1] Large parking, very accessible (along highway)
[2] Large parking, less accessible, close to visitor centre and sheep farm
[3] small parking, no facilities close by
[4] small parking,
[5] small parking, small parking,

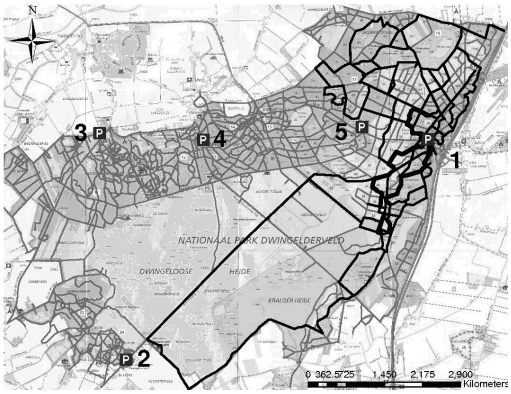

Fig. 1. Visitor distribution from parking 1 (large, very accessible)

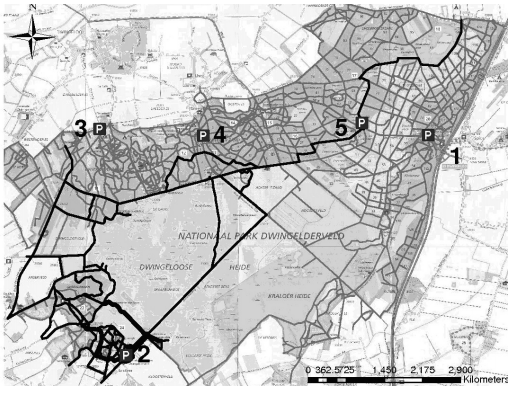

Fig. 2. Visitor distribution from parking 2 (large, less accessible)

5 Discussion and conclusion

The regression models showed the importance of the use value variables 'pole path' and 'distance to parking'. However, the explicative power of the model for browsers is less than that of the model for all visitors (which includes marked trail followers). Experience and narrative value variables tend to be less predictive of visitor density . People tend to visit whatever is in their reach. These findings are important for nature managers and researchers. First, nature managers should clearly communicate the recreational possibilities for each parking area to the public. Second, simulation modelers should be aware if the low importance of spatial goals (such as specific facilities) in predicting behaviour. Marked trail and the placement of parkings are the major influences.

References

[1] R. Kumar, P.M. O'Malley and L.D. Johnston "Association Between Physical Environment of Secondary Schools and Student Problem Behavior: A National Study, 2000-2003," *Environment & Behavior,* vol. 40(4), pp. 455-486, 2008.

[2] J.-C Foltête and A. Piombini, "Urban layout, landscape features and pedestrian usage," *Landscape and Urban Planning,* vol. 81, pp. 225-234, 2007.

[3] S. Handy, "Methodologies for Exploring the Link between Urban Form and Travel Behaviour," Transp. Res.Pard D 1 (2), pp151-165, 1996.

[4] B. Giles-Corti and R.J. Donovan. "The Relative Influence of Individual, Social and Physical Environment Determinants of Physical Activity," *Social Science & Medicine,* vol. 54, pp. 1793-1812, 2002.

[5] A.D.A.M Kemperman and H.J.P. Timmermans "Influence of Socio-Demographics and Residential Environment on Leisure Activity Participation," *Leisure Sciences,* vol. 30(4), pp. 306-324, 2008

[6] J. Lengkeek, J.W. te Kloeze and R. Brouwer "The Multiple Realities of the Rural Environment: The significance of tourist images for the countryside" . In H. de Haan & N. Long (Eds.), *Images and realities of rural life, Wageningen perspectives on rural transformations*. Assen: Van Gorcum, 1997.

[7] Davenport, M. D., & Anderson, D. H. "Getting from sense of place to place-based management: an interpretive investigation of place meanings and perceptions of landscape change," *Society and Natural Resources, 18*(7), pp. 625-641, 2005

[8] R. van Marwijk, B.H.M. Elands and J. Lengkeek, "Experiencing nature: The recognition of the symbolic environment within research and management of visitor flows," *Forest Snow and Landscape Research, 81*(1/2), 59-76, 2007.

[9] J.G. Granö, "Pure Goegraphy. Londen, The Johns Hopkins University Press. 1997.

[10] M.J. Vroom, "The perception of dimensions of space and levels of infrastructure and its application in landscape planning," *Landscape Planning* Vol. 12, pp. 337–352, 1986.

Ramona van Marwijk holds a BSc in Rural Development Studies (2000) and a MSc in Land Use Planning (Recreation & Tourism, 2003). She started as junior researcher at Socio Spatial Analysis Group, Wageningen University until end 2004 and then started her PhD at Forest and Nature Conservation Policy Group, Wageningen University. Her MSc-thesis ("A small contribution? Small tourism entrepreneurs and sustainable development in Malindi, Kenya") received the Ed van Thijn Thesis Award in 2004. In 2006 she received the Storm vd Chijs award (promising female PhD student of Wageningen University). Her current research interests are nature based recreation and tourism, sustainable tourism development, recreation quality, leisure experiences, place attachment and meaning, tourist types.

David G. Pitt has a BA in Geography, an MLA in landscape planning and a PhD in Renewable Natural Resources Studies. He is a professor of landscape architecture at the University of Minnesota and was a guest researcher at Wageningen University in 2007. He has published numerous research papers in various journals and presented papers at several research symposia. His research interests focus on: a) spatial modelling of perceived landscape values; and b) decision support systems for landscape planning.