Assessing recreation in the Danish nature – present experiences, towards a future monitoring system

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Abstract: Research on Danish forest recreation reaches back to the mid-seventies. Two major surveys have been conducted: The Forest and Folk in 1975 and the Outdoor Life '95-'98 project. The latter was, in terms of overall objective and chosen methodology, a repetition of the first. Both surveys aimed at collection of base-line information about the recreational life and preferences of Danes and the pattern of use in the Danish nature. Both used a combination of household questionnaires – combined with verbal-statement-cards and photographs – and counting of cars combined with handing out questionnaires at parking-lots in the nature. The present paper presents and discusses the projects and campaigns of the past and looks forward, providing an outline of a future setting of a system for collection of statistical information regarding recreational use of the nature.

Key words: Outdoor recreation, recreational use estimates, forest preferences, general public, questionnaire, Denmark.

Introduction

Research on Danish forest recreation started in reality in 1975 with the Forest and Folk project, which conducted extensive surveys of the forest recreation activities and preferences of the general population. A research project aimed at producing a better basis for decisions in the field of forest recreation. The surveys are published in four parts: Parts I, II, III and IV of Forest Recreation in Denmark (Koch 1978, 1980, 1984, Koch & Jensen 1988).

In the mid 1990's a new series of surveys was initiated – the Outdoor Life '95-'98 project. Some of the aims of this project were: (1) to update the previous surveys of recreational forest use and preferences of the general population; (2) to analyse the trends between the 1970s and 1990s; and (3) to study new issues related to outdoor recreation – inclusive expansion of the area from only forest areas to cover the whole countryside. The surveys are published in four parts (Jensen & Koch 1997, Jensen 1998, 1999, 2003).

The Forest and Folk project developed methods for surveying the outdoor life of the Danish population. The surveys in the Outdoor Life '95-'98 project were based on these methods, to retain the best possible basis for comparisons between the two projects and thus analyse the trends.

The surveys of the past have influenced policy, planning, administration and management of Danish recreational resources (Jensen & Koch in press). Despite of this, there is an increasing need for higher frequency of the surveys. 20 years appears to be too long. Therefor the methods of the past must be assessed. A renewed approach is needed. The present paper provides some premature ideas and lays out a baseline for discussion of the matter.

Danish projects and experiences up to date

National household surveys of forest use patterns

Two national household forest use surveys has been completed in Denmark: Part I from the Forest and Folk project in the mid 1970s (Koch 1978) and the Outdoor Life '95-'98 project in the mid 1990s (Jensen & Koch 1997, Jensen 1999).

Method

Data were gathered in two national postal questionnaire-based surveys in 1976/77 and 1993/94, each involving some 3,000 people representing the adult Danish population. For representative purposes the mailing of the questionnaires was distributed over a period of one year (one portion each month).

The Danish population is required to register births, marriages, deaths, changes of address, etc. This provides a very reliable sampling frame (the Civil Registration System, Ministry of the Interior) from which a systematic gross random sample consisting of respectively 3,087 and 2,916 persons has been drawn in 1976 and 1993, representing the adult Danish population, 15–76 years. The samples (and

the collected responses) were controlled for representativity (age, gender and county). No significant differences between the samples and the defined population were identified.

The following measures were taken to increase the response rate: (1) care in the design of the visual appeal of the questionnaire package; (2) care in the design of the verbal prompts; (3) a stamped, addressed reply envelope; (4) a relatively brief, simple questionnaire; (5) a potential personal gain for respondents (lottery – only in the 1976/77 survey); (6) the use of up to three reminders, mailed after 2, 3 and 5 weeks. The response percentage was 91.4% for the 1976/77-survey and 83.7% for the 1993/94-survey.

Selected result

Among the many obtained results, it can be concluded that the forests attract a considerably higher percentage of the adult Danish population than other leisure options like cinemas, libraries, and concert halls (both in 1976/77 and 1993/94). During the period between the two surveys the forests have been able to maintain (strengthen) their position as a very significant recreation option for the public. Despite of the fact that leisure options in the period have constantly increased.

In both 1976/77 and 1993/94 about 90% of the adult Danish population spent some time in the forest at least once a year. The average annual number of forest visits per individual has grown by 15% from 1976/77 to 1993/94. This corresponds to a rise between 1976/77 and 1993/94 of just under 25% in the number of visits to the Danish forests by persons between the ages of 15 and 76 – allowing for population growth. It should be emphasised here that one of the great disadvantages of collecting information from questionnaires is the risk of exaggeration. The exaggeration factor is estimated to be in the order 2. Totally the annual number of forest visits in 1993/94 for the adult Danish population, is estimated at some 75 million.

In general, the uses of the forest by the Danish population over the period 1976–1994 have remained relatively stable – although some changes has been detected, including an increase in the number of visits to the forest, and a decrease in the duration of the visits, in transport time, transport distance and group size. Finally, it was recorded that more forest visitors walked or cycled to the forest rather than driving there by car in 1993/94 than in 1976/77.

The connection of forest use with transport time, distance and type leaves the following main impression: the shorter the transport time/distance to the forest, the more frequent visits. The shorter the visit to the forest, the fewer participants in the group and the rarer the use of a car to get to the forest – an impression which at the same time illustrates the general direction in which Danish forest recreation has developed over the last 20 years.

For more results and details on the methodology, see Koch (1978), Jensen & Koch (1997), Jensen (1998) and Jensen (1999).

National household surveys of forest and nature preference

The Forest and Folk project included the first nationwide survey of Danish forest preferences (Part IV by Koch & Jensen 1988). As for the national forest use studies, also the preference studies was renewed with the launching of the Outdoor Life ‘95-‘98 project (Jensen & Koch 1997, Jensen 1999).

Method

Data were gathered in two national interview-based surveys in 1977/78 and 1993/94, each involving some 3,000 people representing the adult Danish population (15–77 years old). Contact was established by means of mailed questionnaires followed by up to three reminders, and several measures were taken to increase the response rate (see above). The response percentage was 89.4% and 83.7% respectively. The samples and responses were controlled for representatively as described above. The questionnaires were distributed over a period of one year, since the season is assumed to be a factor that influences forest preferences. In choosing the topics to be assessed by the selected persons, we attached considerable importance to the following factors: (1) whether the topic was likely to have impact on the experience of the forest visitor; (2) whether it had any commercial or socioeconomic significance; and/or (3) whether the conditions described could be regulated by the forest manager.

In the Experimental Method, respondents assess black-and-white photos which taken in pairs or groups only differ by a single factor. In addition, a series of less ambiguous subjects, only described verbally, were assessed. This method, which was developed by Koch (1974, 1977a and 1977b), is distinctive in its experimental design and its ability to cover many survey topics. An additional method – The Scenic Beauty Estimation Method – was modified by Koch (1977b) and used in the 1977/78 survey as well. 189 respondents assessed 80 colour slides representing broadleaved forest, coniferous forest, the countryside and facilities for forest recreation.

A total of 52 black-and-white photos were assessed in the 1977/78 survey and 64 in the 1993/94 survey. The reader may refer to Jensen & Koch (1997), where the photos are reproduced in the same size and quality as those mailed with the questionnaires. When the photos were taken, great care was taken to ensure that photos in a given “block” appeared as uniform as possible.

A total of 100 verbal stimuli were to be assessed in both surveys. They were printed in green, on yellow cards of the same size as the black-and-white photos (98 x 134 mm). To enable cross-checking

certain survey topics were assessed on the basis of both a photo and a verbal stimulus.

The following techniques were used to elicit the population's preferences:

Black-and-white photo questions: Of the total of 52/64 black-and-white photos of different forest environments, 7 photos were randomly selected for each interviewee and appended to the questionnaire in a red envelope. Guided by explanations printed on the questionnaire and envelope, interviewees were asked to rank the 7 photos according to the criterion "Which woodland environment do you prefer to visit?".

Verbal stimuli questions: Of the total of 100 verbal stimuli, 7 cards with verbal stimuli were randomly selected for each interviewee and appended to the questionnaire in a blue envelope. The interviewees were asked to rank the text on the 7 cards according to the criterion "What do you prefer to meet in the woods?"

Thus the survey produced a series of independent rankings, by a representative sample of the population, of a number of different topics (presented as black-and-white photos and/or verbal stimuli), in a number of different, randomly selected combinations. On average, each photo was ranked about 335 and 260 times and each verbal stimulus about 175 and 165 times by the respondents in the two surveys respectively. And thus a basis was obtained for comparing the internal ranking of the photos and the verbal stimuli.

Results

The results from the 1993/94 survey show that it has not been possible to detect major changes in the preferences of the general Danish population over a period of more than 15 years. Minor changes have been found in relation to a few topics, like in preferences as regards natural regeneration; large/small unit forestry; the age of the forest stand; the use of herbicides and fertilisers; paths and visitor facilities; the provision of information; and meeting other forest visitors.

It is difficult to sum up these minor trends in Danish forest preferences in a single formulation; but one could say that management measures which are alien to a natural environment are judged more and more negatively by the Danish population. For results and details on the methodology, see Koch & Jensen (1988), Jensen & Koch (1997), Jensen (1999).

Specific surveys of destination-areas

Part II of the Forest and Folk project

What is the geographical variation in the intensity of forest recreational use in each region (county) of Denmark? To answer this question – and to give exact data for the manager of the specific forest area, Part II of the Forest and Folk project was initiated.

The yearly number of visitor hours and visits was estimated for 446 forest areas with a total area of 187,000 ha in 1976/77. Questionnaire results for the car-borne use regarding length of stay, group size, activities, travelling time and distance were obtained as well. The basic data collection consisted of 28,652 instantaneous, manual counts of parked cars and the delivering of 44,846 questionnaires. The response percentage for the questionnaires was 53.7% (impossible to use follow-ups). Nearly all state forests and many private forest properties participated voluntarily in the basic data collection. It is assumed that the more intensively used forests are over-represented in the investigation. Detailed instructions for the fieldwork was elaborated. The recording was carried out at 20 stratified randomly selected times and at 2 subjectively selected times at peak use. The stratification took the seasonally, weekly and daily variation into account.

Different models for the relationship between the instantaneous counts on each individual area and permanent automatic recording have been considered. (See the description of the permanent counting stations below). The rather simple multiple linear regression model was chosen. If the regression estimate was not significant, or if the regression estimate deviates significantly from the sample estimate, the sample estimate for the area in question has been used (based only on the 20 registrations at randomly selected times). Calculating the questionnaire results is only possible by sample estimates.

The total number of visitor hours was estimated from the number of car-borne visitor hours, the questionnaire results regarding the car-borne visitors' travelling distance distribution in each forest area, and the relationship between the percentage of the Danish forest visitors who travel to the forest by car at a give travelling distance. The total number visits were estimated from the average length of stay per visit (car-borne/non-car-borne ratios from the national household forest use surveys in Part I).

The results show a large variation in the intensity of use. In most counties it is found that some forests are used up to about a thousand times more intensively than others. In Koch (1980) detailed descriptions of the different methodological aspects are presented as well as the results.

The Outdoor Life '95-'98 project

As described for the national use- and preference-surveys, a need for updating the results was found. Due to this, the Outdoor Life '95-'98 project was initiated and a new data collection on the specific areas was accomplished in 1996/97.

The data collection in the Outdoor Live '95-'98 project follows the same outline as described above for Part II in the Forest and Folk project in 1976/77, although some extensions and limitations was introduced:

- Other nature areas than forests were included (e.g. beach areas).
- Instead of 446 areas divided into 1419 sub-areas in 1976/77, the surveyed area in 1996/97 consisted of 592 forest/nature areas (of 2159 sub-areas), with

an area of approx. 201,000 ha (174,000 ha forests).
- A total of 85,673 questionnaires were delivered and 46.7% was returned.
- The questionnaire-based survey was extended to include e.g. aspects of crowding as well as use of and preferences for a number of visitor facilities.
- Due to economic constraints regression estimates were not performed – only sample estimates.

The comparison between the two surveys shows the same tendency as found in the national household surveys of the general public: An increase in the number of visits. The geographical variation in use intensity as described for the 1976/77 survey is more or less retained. For more detailed results and more methodological aspects, see Jensen (2003).

Permanent automatic counting stations

Part III of the Forest and Folk project

Four permanent counting stations have been in use since 1976. These registrations have a two-fold aim:
1. To form the basis for the specific area surveys described above (Part II of the Forest and Folk project), and
2. To describe the time-dependent variation and the trends in the extent of the recreational use of selected locations.

The counting stations operate according to the ”net count procedure”. I.e. all cars entering and leaving an area (which is only served by a single road for cars) are counted individually, and the results are recorded at the same time and very frequently (every 15 minutes). If the counting is precise, the following variables can be determined:
- Number of cars present at an arbitrary time (difference between the summed up number of entering and leaving cars)
- Number of car visitor hours (with round-error depending on registration-interval)
- Number of car visits (directly from the separate in- and outgoing traffic)
- Mean length of stay per car visit (estimated from two last-mentioned variables).

The counting stations are still operating. The practical work of inspection and collecting the data is carried out in cooperation with the Danish Road Directorate. See Koch (1984) for detailed results of time dependent variations and trends in the car-borne recreational use of the four selected forest areas. Also detailed description of the methodology and discussion of counting errors are given.

Problems of the past – possibilities of the future

In brief the problems of the projects of the past can be related to the following issues:
a) Each campaign appeared to be very costly and time-consuming
b) A too low possible repetition rate
c) The selection of nature- and forest-areas was based on voluntarily enrolment which could introduce a bias in samples
d) Selection of nature- and forest-areas on the destination-side and respondents on the origin-side was set up to report on the general situation rather than specific thematic topics. Therefore it was not based on stratified sampling.

Due to a) a high prize per campaign it was not possible to remain a repetition-rate higher that one per approximately 20 years (b). This might be appropriate for national, gross-figures but might lack temporal accuracy when special cases (spatial or thematic) are to be assessed. The destination-areas were enrolled voluntarily; managers of forests and nature-areas included, regarded participation as a gain for the management of their areas. From a local-participation-point-of-view this of course definitely encloses advantages. Further, the facilitation of staff for the surveys by local managers was of course highly appreciated. But it introduced a source of bias to the data collected: The tendency was that areas that frequently visited were more likely to be part of the survey than those of lower visit-rates. Moreover, state forest were enclosed to a higher extent than privately owned areas. Since both destination-areas and respondents were not selected due to specified strata (d) it was hard later to investigate pattenrs related to specific relations between characteristics of respondents/areas and activities/visit-frequency. E.g. the relation between social character of respondents and nature-preference or the between accessibility of a nature-area and the actual number of visitors.

Introduction of new technologies as well as data-sources and concepts provides some new possibilities, including:
a) Introduction of systematic, digital handling of geographical data (GIS).
b) Monitoring of geographical indicators in terms of grid cells is becoming a national standard in Denmark.
c) New technical approaches are now available for data-collection, especially on the visitor-count and behaviour side.

Regarding a) GIS is still more used for assessment of recreation in the nature. Key-areas of application lists inclusion of existing (GIS-) data, analysing and modelling as well as presentation of results. For a review of application types see Skov-Petersen (2002). Over the past 5 years collection and distribution of spatial/statistic information based on square grid cells (b) is becoming more and more used (Sommer et al. 2004, Kort- og Matrikelstyrelsen 2002). Even the Danish Forest Inventory (NFI) is based on a square grid layout of sampling sites (Söderberg 2000). This enables a higher degree of integration of recreational data – both in terms of data-collection and analysis – with data from other sources. New tracking equipment, including GPS,

Mobile telephones, video-equipment sensitive to movement etc. have provided methods for data-collection earlier not available.

Towards a future systematic approach

The present chapter is a presentation of some of the consideration a future system could be based on. It is not the intention to provide the full picture, nor the final design of a future system. It can be read as the authors' present state of ideas. Its takes its point of departure form breaking down monitoring and modelling recreational activities into issues related to *demand, supply and the mutual location of the two, with respect to the available transport system* (see e.g. Coppock & Duffield, 1975).

To facilitate planning of – and for – the recreational use of the nature, a monitoring scheme must address the facilities i.e. the nature areas as well as the users. *From a facility or destination point of view* it is interesting to know in specific how much a certain nature area is used or in general how much given nature types at given levels of accessibility is used. Levels of usage can e.g. be provided in number of visitors, per ha, per year. Seen *from a users or origin perspective* it has to be addressed how frequently the inhabitants of a given dwelling area are attending activities in the nature. Yet again, given general types of neighbourhoods can be focused on, rather than specific areas. In that case, measures can, as an example, be made in the number of yearly visits per inhabitant. Whereas the destination-orientated approach is the main interest of the *facility-manager or -planner*, the user-oriented approach is more the concern of the *urban planner*. Never the less, none of the two approaches can stand by it self. The nature-manager needs to know the potential number of users from surrounding dwelling areas (whether being planned or existing). The urban planner needs to understand the recreational capabilities of potential nature areas.

In the present context recreation as a phenomenon is understood as a chain of causally linked elements going through:

- Social and physical base-line structures, which leads to
- human behaviour, preferences and activities, which eventually leads to
- effects and consequences on the nature areas or the users

The *base-line structures* include the mutual location of origins and destinations taking into account their qualitative characteristics. That is e.g., the type of dwelling areas (average income, car-ownership or predominant building-type) and the type of nature (vegetation-type, presence of freshwater or terrain form). The mutual location can be included in terms of transport-options – typically public- or private transport-networks - and the transportational mobility of the population. The *human behaviour* – can for example be the frequency of making the decision to go to the nature (which can be seen as an attribute of the point of origin or a person). Likewise, on the destination side, the accumulated number of visitors actually entering a nature. Finally, *the effects* are the possible consequences of the human behaviour. It can – on the origin side – be effects related to health or attitudes to ecological issues. From a destination-point of view, it can be the wear of paths or disturbance of wildlife.

Some of these causal elements are inherently recreational. Some are not: Social structure, even though it is a possible indicator for certain recreational behaviour or attitude, is not specific to recreation. Table 1 provides a schematic presentation of examples of recreational indicators based on the distinction between the origin/destination approaches on one axis and structure/behaviour/effect on one on the other.

Monitoring is repeated collection of comparative data over time. That is, data ought to be collected for units of measure, which can be compared when measures are repeated after a number of years. Most classical approaches to establish data-collection-tracts suffer from a lack of temporal stability. Parishes, zip-code zones, named forests or nature areas are not guarantied to be demarcated the same way through all times. Municipalities and parishes are fused, forests changes demarcation lines etc. Hence, an ideal setting would be based on temporal stabile zones. One of the reasons for applying *regular grid cells* is this temporal stability (Skov-Petersen, 1999). An example of this is registration in square grid cells which are being used increasingly for a variety of statistical applications. Numerous countries are supplying population and workplace information as square cells of 100 m – 1 km grids (Sommer et al. 2004, Kort- og Matrikelstyrelsen 2002). As part of the Danish National Forest Inventory (NFI) a regular grid system is applied (Söderberg 2000). Clusters of 4 sites (spaced 200x200 m) located in a 2x2 km grid is laid out. All sites that fall in forest are selected. Approximately 1/3 of these sites are permanent sites whereas the remainder 2/3 are temporary. Permanent sites will be revisited every 5'th year. Temporary sites will be relocated after each 5-year cycle. At each site, which are circles of 15 metres radius, information regarding the stand (size, density, health etc.), the soil and topography is recorded. A proposal for inclusion of data related to recreation has been proposed but not implemented (Söderberg & Johannsen 2000). Given the general setting of the scheme the proposed recreational data-collection only addressed stationary items like facilities (public toilets, benches, fireplaces etc.), accessibility (trails, roads and parking lots) and visible signs of wear, waste and vandalism. Accordingly, issues related to the actual use (number of visitors, number of cars, type of users etc.) of the forests are not proposed.

Table 1. Schematic presentation of *examples of recreational indicators* and related methods.

	Origin-orientated indicators	Destination-orientated indicators
Base-line structure	**Indicators:** • Amount of green space per inhabitant • Distance to the closest beach • Number of ha nature within 15 minutes drive by car **Methods:** • Direct use of GIS and statistical information • Mobility modelling by means of e.g. GIS-based network modelling	**Indicators:** • Number of inhabitants per area unit of nature • Distance to closest urban area • Number of people that can reach the nature area within 15 min. drive by car **Methods:** • Direct use of GIS and statistical information • Accessibility modelling by means of e.g. GIS-based network modelling
Behaviour, Preference or Activity	**Indicators:** • Frequency of visits to the nature • Attitudes and preferences for different types of nature **Methods:** • Household interviews • Household questionnaires • Telephone-based surveys	**Indicators:** • Number of visitors • Types of visitors **Methods:** • In nature-interviews • In nature-questionnaires • Automatic counts of visitors (infrared sensors, video, 'stepping boards' etc.) • Registration of actual, spatial behaviour (sketching on paper-maps, GPS, registration of mobile telephones)
Effect or Consequence	**Indicators:** • Health issues • Attitude to ecology **Methods:** • Interviews/questionnaires • Use of central registers on e.g. health or house prising	**Indicators:** • Wear of paths • Amount of litter **Methods:** • Registration of biodiversity changes • Registration of soil runoff

As a sampling strategy – like the one of the NFI – and to ensure comparability over time it is proposed that sites of investigation are laid out in a square grid system. That is, a number of square grid cells are selected, both on the demand- and the facility-side. The selection of cells should be stratified to cover certain aspects regarded significant for attitudes and levels of activity in relation to recreation. On the demand-site (the inhabited areas) sites could be stratified to cover classes of social structure (indicated by e.g. average income and demography) and classes of access to recreational opportunities (amount of opportunities within a given transport-time). The facility-sites (the nature) could be stratified to cover e.g. different types of nature (types of forest, heater, beach etc.), topographic characteristics, closeness to water and accessibility (closeness to inhabited places, number of people that can reach the place within a given transport-time, local accessibility etc.). To facilitate monitoring some of the cells will be permanent. Others will be included permanently, when new dwelling- or nature-areas appears or temporarily when special issues or demands emerges.

Within the selected demand-sites individuals for interviews or questionnaires can be selected from the Danish Civil Registration System (CPR). On the facility-side registration based on square cells might provide some practical problems. Therefore it might be feasible to include the entire nature area that the cell lies within or touches, this of course jeopardises the temporal comparability mentioned above. It is therefore important that the collected data are 'fed back' to the grid cell as a post-process.

Potential users, potential applications

When designing a system for the future it is obviously important to thoroughly investigate the potential uses, their administrative level and the type of application resulting data will be used for. This includes:

a) Administrative level.
b) Type of user.
c) Type of application.

Regarding a) options include uses at supernational, national, regional and local level. Since

information at higher administrative levels often are more aggregated that those for the lower levels indicators ought to be set up in a hierarchically system, enabling aggregation of groups. Regarding b) user-types can include governmental institutions, owners/managers, NGO's and individual layperson, all having their specific needs and requirements. Application type (c) can e.g. include plain statistics, monitoring (statistics over time), mapping (requiring data and results to be geocodable) and modelling in terms of inferential statistics or predictive modelling for assessment of future situations.

Conclusion and perspectives – the way forward

The present paper has presented in brief the Danish experience in relation to collection of recreational information. Further a range of premature ideas of a future system have been presented. As is apparent the work of designing is in its initiate phase. The further development of the system will proceed through:

- Dialog with potential users of collected data (as well as collectors),
- appraisal of the present international knowledge and experience and
- further development of the present methods and techniques developed at Forest & Landscape, Denmark (including use of GIS).

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