Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Standardisation of Visitor Counting– Experiences from Finland

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Abstract: In 2000 we started to test visitor counters for the Natural Heritage Services of Southern Finland, in the Teijo Hiking Area. At the same time we tested both an appropriate method for visitor counting and counting equipment. Encouraged by this experience, we started systematic visitor counting in nine southern national parks in 2001.
Traditional everyman's rights (right of public access) guarantee all people - Finnish or otherwise - free access to Finland's forests, whether the forests be privately or publicly owned. This makes reliable visitor counting difficult, but at the same time extremely challenging.
The main reason for visitor counting is the fact that the total number of visitors is not known well enough in protected and recreational areas. We also need to have comparable and reliable visitor information from different types of area and in the long run we need to know the trends as regards the number of visitors. Besides being very important for Metsahallitus itself, the reliable estimates we are able to produce are also of great regional significance.
Visitors can be counted by electronic and mechanical counters of different kinds. We have four types of counter in use. Three electronic types can be used in trail and traffic counting and also indoors. In addition there is one mechanical type which can be used indoors, for example.
At the moment the Natural Heritage Services of Southern Finland have about 40 counters in use. Each counter calculates visitors somewhat differently, depending on the installation of the counter, its placement and the quality of the counter. Also, different weather conditions may affect the counters. For these reasons, each counter must be calibrated independently, after which each counter has its own coefficient. After calibration one can calculate the counter's final result. Thereafter it is possible to calculate the estimated total number of visitors in a specific area.
Metsahallitus also carries out visitor counting in other parts of Finland, but not yet as systematically as in southern Finland. Naturally there is a connection between visitor surveys and visitor counting, as both qualitative and quantitative information is important in planning and management processes.
This paper presents practical experiences of visitor counting from the Finnish perspective. The presentation deals with the process of planning visitor counting, the special equipment needed in counting and ways of transforming the figures from the calculators into estimates of the number of visits in a specific area. In addition, the results of a pilot study from the Teijo Hiking Area are presented as a case.

INTRODUCTION

In Finland the number of visitors to protected and recreational areas has almost doubled during the past ten years. Now it is estimated that about two million visits are made annually to national parks and other recreational areas. This assumption is based on different ways of estimating the number of visits. Earlier, the estimates were based on trail logs, examination of footprints and deterioration of the trails, various permits and best estimates made by personnel working in the areas.

Traditional everyman's rights (right of public access) guarantee all people - Finnish or otherwise - free access to Finland's forests, whether the forests be privately or publicly owned. This makes reliable visitor counting difficult, but at the same time extremely challenging.

During the past two years Metsahallitus has begun to count visitors to the areas more

systematically and consistently. Some counters were already in use in the mid-1990s, but insufficient use was made of them. More accurate estimation of the number of visitors was made considerably easier by the publication of a manual on visitor counting in Finnish (Horne et al. 1998), which has been widely applied in practice. Other good manuals on visitor counting have been published, for example, in Scotland and the United States (e.g. Dales et al. 1993 and Yuan et al. 1995).

The problem has been and still is to some extent the lack of systematic and sufficiently reliable visitor statistics. Reliable estimates of the number of visitors are extremely important for planning and managing the use of the areas in question. On the basis of such estimates, it is possible to gain a clearer picture of the use of the area and the sites where visitor traffic is heaviest. Information on visitor numbers help the people responsible for managing the areas to control the flow of visitors, for example, by directing them to routes that cause less deterioration to vegetation and landscape. In addition, visitor counts also help to maintain and develop services so that they better correspond to the real number of visitors to the area (e.g. firewood supply and waste disposal). Furthermore, reliable visitor statistics are needed, together with other information gathered from visitor surveys, for evaluating the effectiveness of the area's own activities and for monitoring changes (see Erkkonen & Sievänen in this publication).

Visitor counting involves the following distinct stages:

- Careful planning of the visitor count
- Installation of counters in the terrain
- Monitoring of counters in the terrain
- Defining the correction coefficient for the counters
- Counting the number of visits

Visitor counting thus provides statistics on the number of actual visits that have been made to an area. When this information is combined with information gained from visitor surveys, it is possible to estimate the number of visitors, i.e. how many people visit the area.

METHODS OF VISITOR COUNTING

Both electronic and mechanical counters are used in visitor counting. The counters usually comprise infrared photocell sensors, reflectors, a power source and a counter with delay circuits and a housing. The power source is generally an enclosed lead or nickel battery, which is selected to suit the counter and its application. The mechanical counters used are generally Mechanical Stroke Counters, which are built into the structure of a door or its lock (bolt), for example. In addition, visits can be estimated with the help of guest books, permits, various types of surveillance equipment, admission fees, observation by personnel and questionnaires.

Installation of counters

The site for installing visitor counters should be chosen so that it gives the most representative picture of the movements of visitors in the area. In selecting the site, the focuses of visitor traffic in the area must first be defined. At the beginning this is done by using the best available local knowledge.

The counters are placed as far as possible in places that are protected and not readily discernible to the public. Vandalism directed at counters or intentional manipulation of statistics can at worst render the count useless and cause considerable financial loss.

The careful installation of counters, combined with careful servicing and reading, is the cornerstone of visitor counting. At least the following factors must be considered at the installation stage: installation site, height of installation, width of the passage, mounting of the counter parts and direction of sensors. The installation site is selected to suit the characteristics of the type of counter to be used. The sensor and a reflector, if used, should be placed about one metre from the ground. This height corresponds roughly to waist height and prevents (at least) double counts caused by counting the legs of visitors separately. Depending on the distance at which the counter operates, reflector or sensors should be placed 4–10 metres from each other. The formation of overlong sensor lines should be avoided as this may cause disturbances and unreliability of the equipment. The best installation sites are at gates, duckboards, or narrow passages where the sensors can be installed without a reflector and visitors are not able to walk side by side.

Choice of the counter model and type is influenced by the characteristics of the site and the amount and quality of the information needed. The features of the installation site include the width of the passage, the possibilities for reading, monitoring and installing the counter, and the electricity supply available. The choice of counter depends above all on the quality of information required. This is basically a question of whether the information is needed all the year round or not. The need for year-round information is greater the more frequently visited the area.

Reading and servicing of counter

The information produced by counters is still at present collected from the installation site. The counters should be read and serviced regularly. When reading the counter, the time of day, date and reading are recorded. The difference between successive readings constitutes the reading interval i.e. the information on the number of visits between readings. The reading interval is influenced directly by the accuracy of the available information or the

data needed. The more accurate the data needed, the more frequently the counter must be read. For collecting particularly accurate information the counter should be read at the same time of day on different days. Reading and accuracy of reading can probably be improved by introducing new equipment (see further development of counting methods).

In connection with reading, the functioning of the counters, the direction and camouflaging of the sensors is checked, and batteries are changed if necessary. The interval for changing batteries depends on the power consumption of the equipment used, and the capacity of the batteries, varying from two weeks to a couple of months. During servicing, possible sources of error are also checked. There should be no branches, grass or brushwood in the line of the counters. Errors in readings have often been found to be due to grass or brush that has grown during the summer. In practice such intervals have to be omitted or an estimate made of the visits during that period.

Systematic training

In order to ensure quality and commensurability of the results, the personnel participating in the counts should be trained in almost identical situations. By the beginning of November 2001, three training sessions have been held, and one is still being planned. The training deals with the basic elements and aims of visitor counting as well as counter technology and installation techniques. In the context of basic elements and aims, efforts have also been made to influence attitudes. Attitudes are very important for the success and development of visitor counting. The training also includes teamwork covering the installation of various counters, calculation of coefficients and checking of results using visitor counting in the Teijo Hiking Area as a case. The instructors were Senior Planning Officers Joel Erkkonen and Heikki Iisalo together with Planning Officer Jere Rauhala.

Correction coefficients of counters

The readings given by counters describe the number of visits at best as relative changes in readings between counting intervals. In order to establish the actual number of visits, the counters have to be calibrated. A qualitative and technical correction coefficient is defined for each counter separately because the counters give erroneous readings. Technical errors are caused by characteristics of the counter and the installation site. Such errors are caused, for example, when visitors are side by side or too close to each other, especially when the passage is wide. In addition, weather conditions (misting or ice) may cause technical problems. Qualitative errors are caused by movements that do not represent real customers or visitors. These include movements of servicing and other personnel, animals (for example reindeer in northern areas) and any other unfounded or unauthorised movements in the area.

The counters are calibrated by monitoring the counting stations at different times of day (and at different times of year, if the area is one that is used all the year round). Metsahallitus has a standardised monitoring form so that every counter is calibrated on the same basis. During monitoring, the times at which the observation period began and ended, the passers-by, their number and direction of movement and (other) factors that might affect the counter's results (such as visitors going round or passing the counter several times or walking side by side with another person) are recorded. All factors that have been observed are recorded during the one-hour observation periods. For each calibration interval there should be at least 4–6 hours of observation. In order to calculate correction coefficients, several calibration intervals are required, preferably 4–6. The more calibration intervals are included in the coefficient, the more accurate the results.

The correction coefficient is defined for each counter on the principle that, as far as possible, only "genuine" visitors are registered and preferably only once. The coefficients help to eliminate sources of error. The counter-specific coefficient is made up of technical and qualitative factors, for example, as follows (Horne et al. 1998):

Correction coefficient **0.51**

=	1.12 (technical corr. coefficient)
X	0.92 (other than personnel)
X	0.96 (no passing back and forth)
X	0.52 (visitors entering)

CASE: TEIJO HIKING AREA

The Teijo Hiking Area is in the southernmost part of Finland, about an hour's journey east from the city of Turku, and two hours' distance west of the capital, Helsinki. The area covers a total of 3000 hectares, is formed of the recreation area itself and two adjoining nature conservation areas. The area borders on the sea and in addition it encompasses four lakes, with a total area of approx. 300 hectares.

The Teijo Hiking Area has a strong cultural-historical aspect. The region has been inhabited for a relatively long time and both the area itself and its natural features have been influenced by the activities of three ironworks, which began to operate at the end of the 17th century. All three of the ironworks were either situated within the Teijo Hiking Area or adjoining it. Three of the area's four lakes were formed by dams built during the 17th and 18th centuries. There are many old wooden buildings in the area and signs of charcoal burning in the forest. Water power was obtained from the dammed lakes and fuel from the forest, and the effects of these activities are still to be seen in the area today.

The Teijo Hiking Area was founded – like all six other recreational areas in Finland – on the

grounds of the Act on Outdoor Recreation. The area was established by law in 1991 and its activities started in 1992. The site will be ten years old in summer 2002. The purpose of the area is to improve and guarantee opportunities for outdoor recreation. For example the Recreation Area can be used for forestry, fishing, hunting and other forms of outdoor exercise. The normal right of public access applies to the area, except for some protected areas.

Metsahallitus has organised fishing and other outdoor recreation services in the area. There are some 45 kilometres of trails in the area, some of them artificially constructed, several campfire sites, covered campfire sites and lean-to shelters. In addition, there are sites in the area reserved for scout camps. Fish have been introduced into the fishing grounds of Lake Matildanjärvi, primarily salmon. For fishing there are about 30 boats for hire. In addition, there are buildings providing accommodation in the area, the oldest of them dating back to the 18th century. In the immediate vicinity of the Teijo Hiking Area there is a golf course, a downhill skiing centre, a marina and accommodation services. Tourist services are provided in the area by several local businesses and also by some entrepreneurs from outside the area.

The Teijo Hiking Area plays a very important role as a natural tourist attraction in the region, and is popular with a large clientele. There are many regular visitors and at the same time new customers continue to discover the area. A visitor survey was carried out at the site in 1996 (Ovaskainen et al. 1999), and on the basis of the survey it was calculated that the area brings in a total of about 1.41 million € annually. About half of this sum (46%) has an impact on the immediate surroundings (Kangas et al. 1998).

Due to the difficulty of estimating the number of visitors, an overall count was started in the year 2000. The decisions and preliminary plans for starting the count were made in 1999. The objective was to establish the total number of visitors or the total number of visits to the Teijo Hiking Area, in order to provide a basis for calculating future trends, regional impacts and earnings and to measure the effects of action carried out. Other aims were to discover possible sources of error, and to gather experience of servicing and management. The planning of further development of counting methods was also begun immediately.

The counting stations were decided on the basis of experience, making use of local knowledge. It was decided to install four electronic counters, which were distributed around the area at the busy sites shown on Map 1. One of the counters is a traffic counter and the others are trail counters. All the trail counters are similar in structure. The counting stations are the same in 2001 as in 2000. In 2001 mechanical stroke counters were installed on the bolts of doors of outdoor toilets. In addition pressure mat counters were tested, installed in the same outdoor toilets as the mechanical stroke counters. Altogether seven counters have been in use in 2001. In the Teijo Hiking Area the electronic counters are not used in winter, because their batteries cannot withstand hard frost. Also, because of the seasonal nature of the area's use, it has been considered necessary only to keep the counters operative on the main route – Matildanjärventie – which is best suited for year-round visitor counting.

Counting was begun in May 2000 on the same day throughout the area. The reading interval was fixed at one week and one person was trained at this stage and made responsible for reading and servicing the counters. This person's normal duties included all the maintenance and servicing jobs in the area, as well as supervision of statutory compliance.

In order to implement the calibration plan, a temporary employee was trained for the summer. The calibration dates are shown in Table 1. In 2001 the calibration employee was available only on a few days. However, correction coefficients were checked for the most important counting stations and especially for the Matildanjärventie route. Even on the basis of the results for year 2000, it was possible to show that the Matildanjärventie counting station was the most heavily used counter, as experience had also suggested.

Site	Calibration days			
	2000	2001	2002 *	2003 *
Matildanjärvi	4	2	3	3
Luonnonpuisto	3		3	
Kirjakkala	4	1	2	
Nenusta	3		3	
Total	14	3	11	3

Table 1. Counter calibration days in Teijo Hiking Area. (planned)*

From the readings and calibrations we can calculate and estimate the total number of visits. In cycles of a week we can draw curves showing the development trends in the use of the area. The readings and number of visits are shown in Table 2.

Site	Counter readings		No. of visits	
	2000	2001*	2000	2001*
Matildanjärvi	21203	28797	26609	48954
MS Counter 1.	-			
MS Counter 2.	-			
Pressure mat 3.	-			
Luonnonpuisto	5389	7613	4026	5686
Kirjakkala	5641	4500	4430	3533
Nenusta	2023	5439	1123	3018

Table 2. Visits to Teijo Hiking Area in 2000–2001 (preliminary information).*

Before counting was started, the annual number of visits was estimated at approx. 30 000 visitors a year. The earlier figure was based on information from fishing permits, visitors to the visitor centres and camping sites. In addition to the sum of these

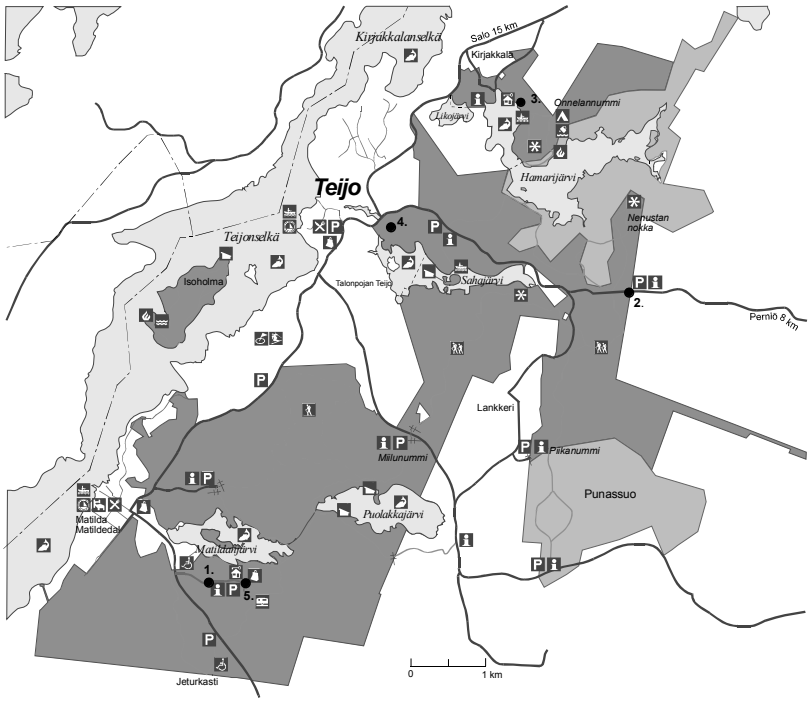

Figure 1. Map of theTeijo National Hiking Area. Location of the counters is marked from 1 to 5.

figures, an estimate was made of the number of visitors who were not recorded at all.

Even after the count, it will still be necessary to estimate the total number of visits. The total figure is made up of the readings of the four counters described above, the number of visitors to the customer service point and the people who enter the area by other routes than those covered by the counters. In addition it is necessary to estimate the number of visits outside counting time at those stations where the counters are out of use in winter. The total estimate of visits is thus not directly calculated from the sum of the results of the four different calculators. It must also be borne in mind that the same people may pass one or more counters several times during the same visit. These cases also have to be estimated (in the case of the Teijo Hiking Area), because the information from the visitor survey of 1996 does not show the relative distribution of visits between the different sites. This will be established in the Teijo Hiking Area visitor survey II to be carried out in 2002, which will also make it possible to compare changes in other factors with the situation seven years ago.

On the basis of the figures shown in Table 2 and considering the facts presented, the number of visits for 2000 was estimated at 40 000. For 2001 a preliminary estimate of 60 000 visits has been made. The rapid relative growth is explained by the fact that counting was carried on throughout the whole year in 2001 and the estimate for 2000 was perhaps fairly conservative. Another reason for the strong relative growth is also a real growth in the number of visitors and the popularity of the area.

Even before counting was started, there had been a distinct shift of focus in the use of the Teijo Hiking Area away from the visitor centre to recreation in the terrain. The most popular site was the Lake Matildanjärvi fishing grounds and their immediate surroundings. After the first year of counting, it was possible to verify this by the regional distribution of use.

On the basis of the visitor count it was decided to modernise the whole customer service concept and to build a customer service point in place of the present nature centre, which had operated in rented premises (about five kilometres away from it). This new service point is to start operating in summer 2002 in the context of the area's tenth anniversary. At the same time it was decided to build a sauna on the shore of Lake Matildanjärvi, since the number of visitors is as high as 40 000. When the number of visitors is known it is considerably easier to decide on the services needed and to anticipate the personnel requirement for the next season.

CONCLUSIONS

In practice, determining the correction coefficients of the counters has proved to be the most difficult aspect of using the counters and estimating the number of visits. This has been due partly in the past to the fact that there were no clear instructions on this. If coefficients are not defined the result is an estimate of how the number of visits develop at a counting station, but not a very reliable estimate of the number of visits at the station.

Recent experience of standardising visitor counting has, however, been very encouraging. It seems that the methods can be standardised throughout the country. Equipment, tasks and responsibilities have been defined clearly enough to allow the creation of a functioning system.

So far, however, a number of problems have been observed, and the possibilities for influencing them vary. Practice has shown that the servicing and reading of the equipment often causes problems. The reasons may be the remote and scattered location of the counters and the shortage of personnel in relation to the tasks. Employing more personnel is a serious problem costs wise. The reliability of the counters is technically very good, and very few functional defects have occurred. There have been some defects in the counter components, which seem to be repeated and to be expected, but they are few in number. Functional defects are often connected with faulty installation. Careful installation also has an impact on error sources through camouflaging. When the equipment is well concealed for example in structures, the counter cannot easily be manipulated or vandalised. As the cost of the equipment is approx. 420 €-800 € per unit, vandalism can cause considerable losses.

Training can be used to eliminate the above mentioned errors. The attitudes of personnel are also crucial for the success of visitor counting. If the issue is considered important, the employees are more committed. Weather conditions cause problems that cannot easily be influenced in the more northerly latitudes. However, in Southern Finland, snow and sleet cause fewer problems than in the north and so far they have not caused any notable damage. The impact of frost affects the whole country, but the choice of equipment is important for the functioning and reliability of the counters, especially in year-round counting. Some of the counters are designed only for summer use and these are only used from early spring to late autumn.

DEVELOPMENT PROSPECTS

Development work is being carried out at present with three counter types and arrangements that function all year round in indoor use. The counters are maintenance-free and thus economical to use but they are not yet suitable for use as trail counters. Mechanical devices are extremely economical compared to electronic ones, costing only about 50 € per unit. Two pressure mat counters are in use. These may operate for several years having a power source built into the counter component, but frost may evidently prevent the mat from working. The price of the mats varies depending on their size.

Perhaps the biggest development is; however, the electronic counter type based on a data logger and wireless gsm data transfer technology. The counter is equipped with a gsm telephone for the logger's data transfer. The recorded data can be read via a data interface in office conditions, or the counter can be read automatically by computer servers at the desired intervals. Three counters of this kind have been installed for trial use by Metsahallitus during November 2001. They are used to monitor three sites with heavy visitor traffic in the Nuuksio National Park, the Häme Visitor Centre and the Teijo Hiking Area. The Visit system (VisitLog, VisitNet and VisitSoft) Data logger and gsm-based counter software developed by the Finnish company Teknovisiot Oy (see www.teknovisio.com) is still under development, but it is already possible to use it with given criteria for automatic reporting, and the production of statistics and prognoses. According to a preliminary view, this kind of counter system could be installed in the busiest and thus most important sites. Even with the introduction of new counter types, it will still be necessary to calibrate and service the counters, though.

With the present equipment and the devices in trial use and with the current methods it is possible to achieve the aim of making visitor counting a part of normal operational routines. The significance of visitor statistics for planning the use of the areas in question and for developing tourist services is very considerable. These statistics will enable more informed decisions to be made in both the private and the public sectors.

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