SILVA FENNICA VOL. 12, 1978, *N:o* 3: 179—186

RECREATIONAL POTENTIAL OF A FOREST STAND

SEPPO KELLOMÄKI

SELOSTE:

METSIKÖN ULKOILUPOTENTIAALI

Saapunut toimitukselle 1978-06-10

The recreational potential of a successional stand has been assessed on the basis of the potential of the stand for different recreational activities and the trampling tolerance of the ground cover. Relationship between selected recreational activities and the stand volume has been determined. These functions have been utilized in determining the potential of the successional stand for different recreational activities. Combining this information with trampling tolerance gave criteria for determining the recreational potential of a stand. The results emphasize the importance of varying the distribution of age classes in a recreation area.

INTRODUCTION

PITKÄNIEMI (1972) emphasizes the role of user satisfaction in the management of forest areas for recreation. User satisfaction is affected by a large number of different factors, *e.g.* the environment and the facilities needed in different recreational activities. Special emphasis should be set on developing the recreation area in such a way that user preferences and recreation environment coincide with each other (KELLOMÄKI 1975, HEIKINHEIMO *et al.* 1977).

A forest area is a changing entirety consisting of stands in different phases of succession. Development of the different stands changes the character of the environment and therefore the optimum conditions for a particular recreational activity can only be maintained for a short time in the absence of active management (cf. PITKÄNIEMI 1972). This assumption implies, however, that there really are optimum conditions for different recreational activities and that the recreational activities can be correlated with certain characteristics of the forest environment (cf. LOVEN 1973). If this is true, then the relationship between different recreational activities and forest succession can be tentatively presented as in Fig. 1.

The effect of the type of recreation in question on a forest environment must also be considered in the management of a recreation area. Above all rubbish accumulation and trampling can rapidly destroy the quality of the environment. Trampling

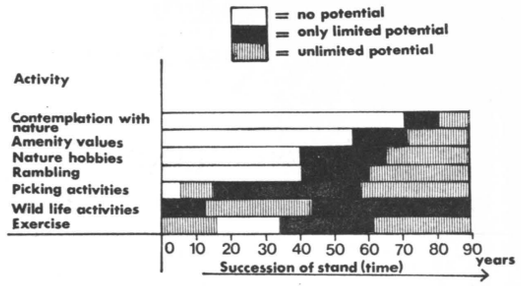

Fig. 1. Hypothesized relationship between selected recreational activities and forest succession according to HEIKINHEIMO *et al.* (1977).

can also be dangerous ecologically, and great problems are encounted in restoring trampled areas. Therefore it is of primary importance to determine the trampling tolerance of a stand in relation to forest succession (cf. SAASTAMOINEN 1972, KELLOMÄKI and SAASTAMOINEN 1975, KELLOMÄKI 1977). In conclusion, both ecological and behavioral information must be introduced into management processes to provide satisfying recreational experiences (WAGAR 1964, HENDEE *et al.* 1968, KELLOMÄKI 1975).

The aim of the present paper is to study the relationship between forest succession and the optimum conditions for selected recreational activities as hypothetized in Fig. 1. In addition, the trampling tolerance of the ground cover has been introduced into the analytical procedure in order to determine the recreational potential of a developing stand.

MATERIAL AND METHODS

Table 1. Overall picture of the interview stands according to KELLOMÄKI (1975).

Number and location of stand	Site type	Development class	Predominant tree species	Height m	Basal area m^2/ha	Density 0–9	Volume m^3/ha	Additional information
1 Central Park	OMT[1]	1[2]	mä[3]	20	6	2	50	Football pitch in sight
2 »	MT	4	mä	23	18	6–7	180	Ground vegetation deteriotated
3 »	VT	0	—	—	—	—	—	Stand partly on rocky terrain, electricity power line
4 »	VT	2–3	mä	7	16	9	60	Stand partly on rocky terrain
5 »	MT	1	mä	2	1–5	8	10	
6 Luukkaa	VT	1	mä	2	1–5	9	10	
7 »	MT	0	—	—	—	—	—	Harvesting residues and aspen saplings
8 »	MT	2–3	mä	22	24	7	240	View of lake

[1]) Site type
OMT = Oxalis-Myrtillus type
MT = Myrtillus type
VT = Vaccinium type

[2]) Development class
0 = Clear cut area
1 = Seedling stand
2–3 = Middle aged stand
4 = Mature stand

[3]) Predominant tree species
mä = Scots pine
ku = Norway spruce
ko = Birch

The present material is partly based on a questionnaire survey carried out in 1971–1972 in Keskuspuisto and Luukkaa recreation areas, in the vicinity of Helsinki city. Several stands were selected in both areas representing spruce and pine stands at different successional stages (Table 1). Each stand was located near to a popular recreation trail. The sampled persons were asked to describe how well they considered a particular stand was suited for skiing, exercise, orientation, nature hobbies (e.g. bird watching) and berry picking. The following alternatives were available: very unsuitable, rather unsuitable, indifferent, rather well and very well. Altogether 1326 questionnaires were obtained, representing 13 forest stands in all seasonal aspects. Only the pine stands, however, were included in the present material. The methods used for data collection and the data are described in detail by JAATINEN (1973) and KELLOMÄKI (1975). In addition, the material was supplemented with the results concerning the amenity values of the same stands as presented by KELLOMÄKI (1975). The trampling tolerance of the stands was estimated from the results presented by KELLOMÄKI and SAASTAMOINEN (1975) and KAUPPI *et. al.* (1978) as described later.

RESULTS

Relationship between recreational activities and stand volume

It is supposed that there is an optimum environment, as regards stand characteristics, for each recreational activity. Let x denote the potential for how well a stand is suited for a particular activity, *i.e.* suitability, and B a particular stand characteristic, then

(1) $x = x(B)$.

Different stand characteristics were related to recreational suitability as indicated by the questionnaire. The best results were given by the stand volume. The suitability of the stand for different recreational activities are presented as a function of volume in Figs. 2a–2f. Each point represents the mean of at least 160 replies.

Stands with high volume are preferred for nature hobbies, and they received a high amenity value. The recreationists seem also to be accustomed to finding berries in stands of high volume. The suitability for skiing, exercise and orientation is low both in seedling and mature stands. The optimum volume for these activities seems to lie within the range 80–200 m^3/ha.

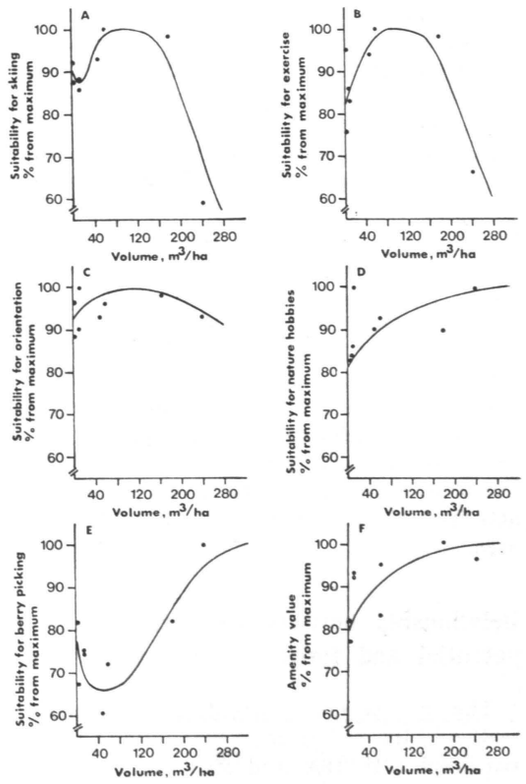

Fig. 2. Relationship between stand volume and a: skiing, b: exercise, c: orientation, d: nature hobbies, e: berry picking, f: amenity value.

Relationship between recreational activities and stand succession

The volume of a stand is closely correlated with the stand age, and hence Figs. 2a—2f outline roughly the dependence of recreational activities on forest succession. Let t denote the age of stand, then

(2) $B = B(t)$.

The equation (1) can now be written as follows

(3) $x = x(B) = x(B(t))$.

The present material does not represent a complete successional series. Therefore the successional series for repeatedly thinned pine stands of *Myrtillus* site type was utilized when the functions presented in Figs 2a—2f were transformed into time dependent functions (cf. Koivisto 1959). The approximations for the dependence of different recreational activities on the age of stand are presented in Figs 3a—3f.

The suitability of a stand for recreation varies in time as hypothetized. In particular, mature stands are preferred among recreationists. Furthermore, the present material also emphasizes the role of young and middle-aged stands in recreation areas. In fact, this kind of stand seems to play a more important role than was hypothetized. It is, however, evident that all recreational activities do not have the same role in determining the value of a forest area for recreation. Unfortunately, the present material is not sufficient for studying the emphasis which should be given to different activities in the management of recreational area.

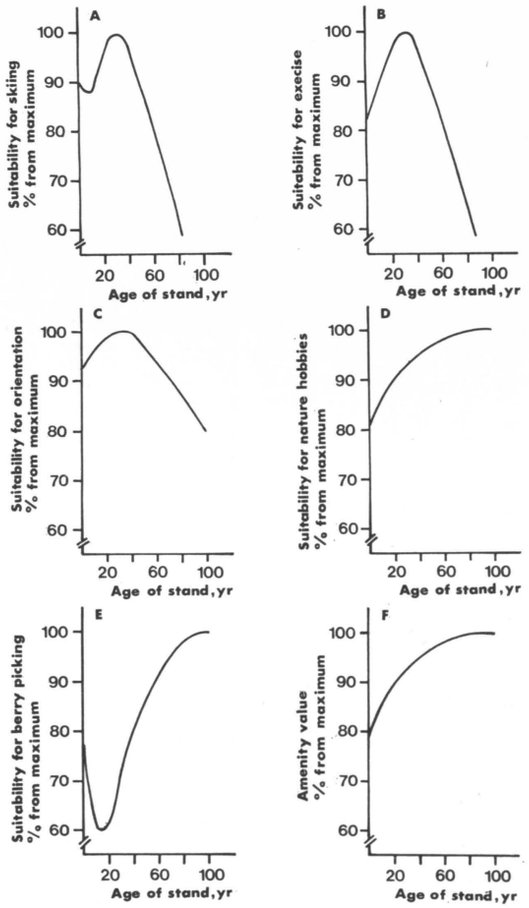

Fig. 3. Relationship between stand age and a: skiing, b: exercise, c: orientation, d: nature hobbies, e: berry picking, f: amenity values.

Belationship between recreational potential and forest succession

The recreational potential of a stand includes its suitability for different recreational activities and its trampling tolerance as argued earlier. The contribution of such suitability to the recriational potential is called the preference component of recreational potential and the contribution of trampling tolerance the ecological component, respectively. The recreational potential (rp) of a stand can be presented as a function of the preference component (p) and the ecological component (e) as follows

(4) $rp = rp\ (p, e)$.

The preference components are assumed to be consist of orthogonalized subcomponents which are additive. If the subcomponents are determined by the suitability of a stand for different recreational activities (x), the preference components can be presented as follows

(5) $rp = b_1x_1 + \ldots + b_nx_n$,

where $b_1, \ldots, b_n$ are coefficients for the suitability of a stand for different recreational activities. In the present study the coefficients presented by Lovén (1973) have been utilized in determining the values of the preference component for different phases of a forest succession. The results are presented in Fig. 4.

The ecological component of recreational potential was determined in two phases. In the first step the proportion of herbs, grasses, dwarf shrubs, mosses and lichens in the ground cover was estimated for each phase of succession from the material of Kauppi *et al.* (1978). In the second step, each group was given a coefficient describing its relative trampling tolerance as determined by Kellomäki and Saastamoinen (1975). The ecological component (e) can be presented as a function of species groups as follows

(6) $e = k_1c_1 + \ldots + k_n\ c_n$,

where $c_1 \ldots c_n$ are coverages for each species group and $k_1 \ldots k_n$ coefficients for trampling tolerance. The ecological component

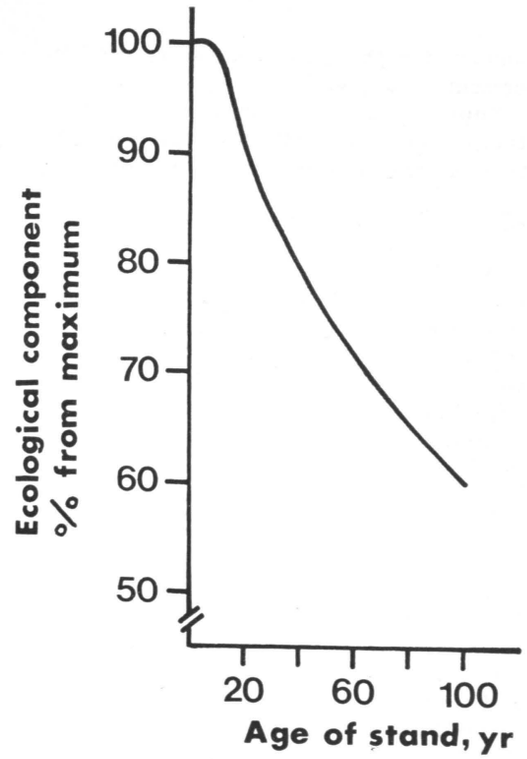

Fig. 5. Relationship between stand age and ecological component of recreational potential.

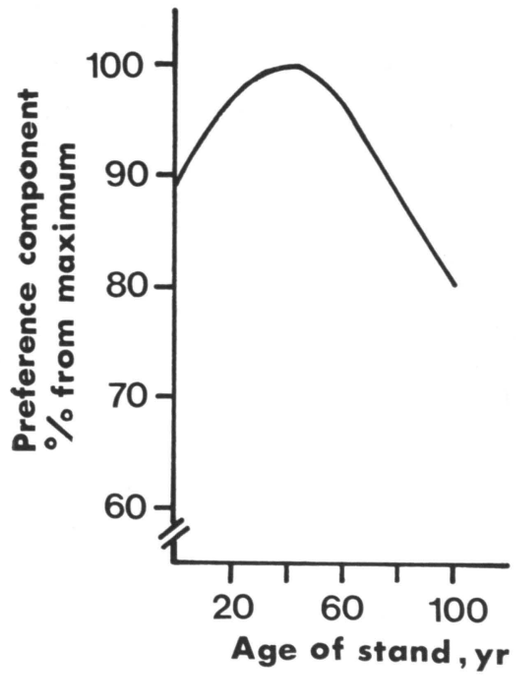

Fig. 4. Relationship between stand age and preference component of recreational potential.

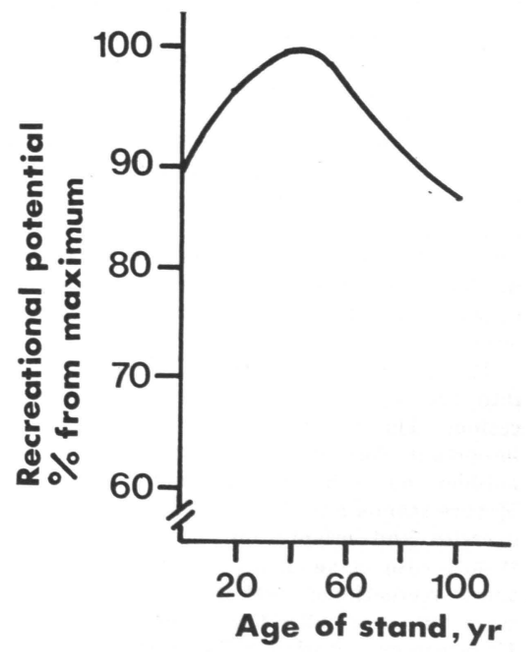

Fig. 6. Relationship between stand age and recreational potential of a stand.

ponent for the hypothetized succession is presented in Fig. 5.

Suppose that preference and ecological components are multiplicative. The equation (4) can now be written as follows.

(7) $pr = p \cdot e.$

As there is no material available for evaluating the relative contribution of each component to recreational potential, both components have been given the same emphasis when calculating the recreational potential of stands in different successional phases. The results have been presented in Fig. 6.

The recreational potential has its highest values in relatively young stands. The introduction of trampling tolerance to the analytical procedure emphasizes the role of young and middle-aged stands in recreation areas. On the other hand, additional emphasis on young and middle-age stands is also given by the suitabliity for recreation motivated by a desire to keep fit. The effect of these activities on the preference component seems to characterize totally the dependence of recreational potential on forest succession.

DISCUSSION

The present material is limited as regards the number of stands and the range of variation they represent. In addition, there are shortcomings in the measuring accuracy and sampling procedure, as demonstrated earlier by JAATINEN (1973) and KELLOMÄKI (1975). The measuring level and measuring accuracy in particular, may make the interpretation of the results difficult. In fact, the measurements have only been ordinative even though the data has been treated as quantitative (cf. VALKONEN 1972). Thus, there is no possibility of interpeting the results in absolute terms. Therefore the results are more theoretical than empirical. They emphasize, howener, many important problems in the management of recreation areas, and suggest possible ways of integrating psychological and ecological information. This is considered to be of primary importance in the management of recreation areas.

The recreational activities seem to fall into two categories as regards forest succesion. The mature stands proved to be important for berry picking and nature hobbies as well as for amenity values. Mature stands are also important for skiing, exercise and orientation, but middle-aged stands also gave many opportunities for these recreational activities. The results seem to agree with the hypothesis set by HEIKINHEIMO *et al.* (1977), that the recreational activites can be grouped according to the role which they posses in satisfying recreational needs. For skiing, exercise and orientation the forest environment seems to have only instrumental value. Also for berry picking, nature hobbies and amenity values the forest environment is an instrument but also the object in itself. In other words, in the latter case the interpretation of the environment seems to give recreational activities the type of meaning. In skiing, exercise and orientation the activity is an instrument to obtain or maintain good physical condition.

The relationship between forest succession and nature hobbies, berry picking and amenity values was that expected. The value of young and middle-aged stands for skiing, exercise and orientation was, in turn, much greater than hypothesized. This pattern is the same in each case and therefore the role of random factors may not be important. At first sight this kind of dependence is not logical, since the density of the stand decreases during the course of succession, which should provide better facilities for activities motivated by a desire to keep fit. The mature stands may, however, be experienced as oppressive and not easily accessible (cf. JACSMAN 1971). Thus, purely psychological factors may give a low preference for these stands, even though good visibility and easy orientation are characteristics of mature stands. New and more comprehensive material is, however, needed for validating this assumption.

The concept of recreation potential approaches the concept of carrying capacity. Thus, the ranking of stands can be carried out using both behavioral and ecological information. The results emphasize the high capacity of young and middle-aged stands as a result of their high trampling tolerance. On the other hand, the present consideration is partly based on management practices which are aimed at timber production. Thus, proper management might increase the trampling tolerance of mature stands and hence their value in recreation activities. This may also be true as regards user preference for stands of all age classes.

The present results also emphasize the importance of variation in tree species composition and age classes in a recreation area, as demonstrated earlier by HAAKENSTAD (1972), PITKÄNIEMI (1972), LOVÉN (1973), MIKOLA (1973) and KELLOMÄKI (1975). As opposed to earlier results the present paper sets, however, considerable emphasis on the role of young and middle-aged stands. Especially, the differences between recreation activities in relation to forest succession have proved to be of considerable magnitude. Therefore each age class seems to have some sort of recreational value. This fact ought to be taken into account in the management of recreation areas.

The present results deal only with pine stands of the *Myrtillus* site type. The stand succession has been assumed to coincide with the series presented by KOIVISTO (1959). Therefore the application of the results is valid only within these limits. In principle, the present approach can, however, be generalized to cover also other tree species and sites. Production of such a material should faciliate a more comprehensive evaluation of the allocation of forest resources to different purposes. This kind of material is also needed in developing management practices for multiple use forestry.

REFERENCES

HAAKENSTAD, H. 1972. Skogsbehandling i et utfartsområde. En opinionundersøkelse om Oslomarka. Summary: Forest management in an area of outdoor life. An investigation of public opinion about Oslomarka. Meld. fra Norges Landbrukshøgskole Vol. 51, Nr. 16.

HEIKINHEIMO, L., JAATINEN, E., KELLOMÄKI, S., LOVÉN, L. & SAASTAMOINEN, O. 1977. Metsien virkistyskäyttö Suomessa. Esitutkimusraportti. Summary: Forest recreation in Finland. Pilot study. Folia For. 321.

HENDE, C., CATTON, W., MARLOW, L. & BROCKMAN, F. 1968. Wilderness users in the Pasific Northwest — their characteristics, values and management preferences. U.S.D.A. Forest Serv. Res. Paper. PNW-61.

JAATINEN, E. 1973. Recreational utilization of Helsinki's forests. Seloste: Helsingin ulkoilualueiden virkistyskäyttö. Folia For. 186.

JACSMAN, J. 1971. Zur Planning von Stadtnahen Erholungswählern. Zürich.

KAUPPI, P., HARI, P. & KELLOMÄKI, S. 1978. A discrete time model for succession of ground cover communities after clear cutting. Oikos 30: 100—105.

KELLOMÄKI, S. 1975. Forest stand preferences of recreationists. Seloste: Ulkoilijoiden metsikköarvostukset. Acta For. Fenn. Vol. 146.

— » — 1977. Deterioration of forest ground cover during trampling. Seloste: Tallaamisen vaikutus metsikön pintakasvillisuuteen. Silva Fenn. 11 (3): 153—161.

— » — & SAASTAMOINEN, V.-L. 1975. Tarmpling tolerance of forest vegetation. Seloste: Metsäkasvillisuuden kulutuskestävyys. Acta For. Fenn. Vol. 147.

KOIVISTO, P. 1959. Kasvu- ja tuottotaulukoita. Summary: Growth and yield tables. Commun. Inst. For. Fenn. 51.

LOVÉN, L. 1973. Metsäympäristön viihtyvyystekijät. Summary: Amenity factors in forest environment. Helsingin yliopiston metsänarvioimistieteen laitos. Tiedonantoja 3.

MIKOLA, P. 1973. Metsätalouden ympäristövaikutukset ja niiden merkitys metsien käyten suunnittelussa. Helsingin yliopiston metsänhoitotieteen laitos. Tiedonantoja 9.

PITKÄNIEMI, N. 1972. Helsingin kaupungin ulkoilualueiden metsäluonnon hoito. Toimenpideohje 1972. Helsingin kaupungin kiinteistöviraston metsäosasto. Moniste. Helsinki.

SAASTAMOINEN, O. 1972. Saariselän—Itä-Kairan

alueen virkistyskäyttö. Konekirjoite Helsingin yliopiston kansantaloudellisen metsäekonomian laitoksessa.
VALKONEN, T. 1971. Haastattelu- ja kyselyaineiston analyysi sosiaalitutkimuksessa. Helsinki.
WAGAR, A. 1964. The carrying capacity of wild lands for recreation. For. Sc. Monogr. 7.

SELOSTE:

METSIKÖN ULKOILUPOTENTIAALI

Työssä on teoreettisiin ja empiirisiin näkökohtiin perustuen pohdittu eri kehitysvaiheissa olevien metsiköiden soveltuvuutta ulkoiluun. Tarkastelussa on otettu huomioon sekä metsikön tarjoamat mahdollisuudet eri ulkoilutoiminnoille että pintakasvillisuuden kulutuskestävyys. Tulokset korostavat kehitysastevalikoimaltaan monipuolisten metsäalueiden arvoa ulkoilussa.