Recreational Quality and Importance of Landscape: An Approach Beyond Scenic Aspects

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Abstract: Based on a literature review and compilation of frequently used approaches we developed an assessment scheme which clearly separates recreational value, recreational potential and recreational importance of a landscape. It suggests a multi-criteria matrix approach, which includes and combines infrastructure provision, disturbance and attraction, as well as local and touristic demand as additional dimensions. The approach can be applied on a national scale at a high spatial resolution of the input data and the calculated results. The approach leads to maps which can be used both in regional and national planning.

Keywords: Recreation, GIS, landscape assessment, scenic landscape quality

1 Introduction

For physical and landscape planning it is a must to include recreational qualities when assessing landscapes. Outdoor recreation is a key in health care to reducing the risk of chronic disease and disorders, improving mental health, increasing cognition, and decreasing stress (e. g. WARBURTON et al. 2006, BARTON & PRETTY 2010, BRATMAN et al. 2015). So, a lot of approaches exist to quantify recreational benefits as landscape services. Most of them consider scenic landscape quality as a key issue, and some of them consider scenic landscape quality as the one and only correlate between landscape performance and recreation. In contrast, a cultural ecosystem service (CES) approach often separates aesthetics and recreation, a position which rather impedes deeper insights. OPDAHL (2018) concludes, that "…perceptions of landscape aesthetics and key land cover types were associated with reduced salivary cortisol concentrations in hikers after recreating" and ZHANG et al. (2014) conclude that "…we should not only encourage individuals to develop a sense of connection with nature but also encourage them to become attuned to nature's beauty in order to improve their personal well-being". Evidence from hormonal balance as well as from interviews suggest we may assume that there is a very close relation between recreation and landscape beauty sensation. This is also indicated by results from the background project of this contribution. A correlation analysis of a survey reported in ROTH et al. (2018) shows a Pearson correlation of 0.86 between individually assessed landscape beauty and individual assignment of suitability of landscape for recreation.

To build up an approach which can be applied on a national level, the question arises of which factors must be considered in an overall assessment of the recreational services of a given landscape besides scenic landscape quality. And it is important to clearly specify the assessment perspective and the item to be valued. In our approach – which covers strolling, hiking, biking or comparable recreational activities – we distinguish between:

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- recreational value as valuation by people;
- recreational potential, as ability of landscape to provide recreational options, and;
- recreational importance of landscape, as a result of valorization/exploitation by demand of visitors.

Fig. 1 gives an overview of the approach which hereafter is explained in detail and applied on a national scale (FRG) at a high spatial resolution of input data and calculated results.

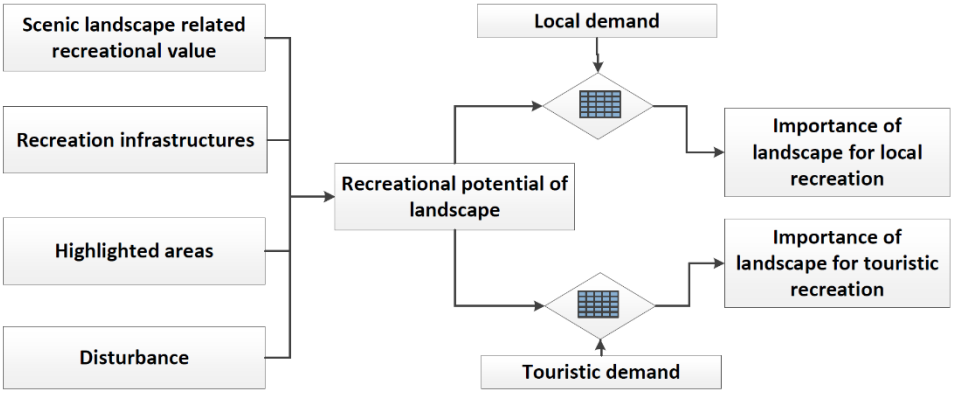


Fig. 1: General approach

2 Input Data

ROTH et al. (2018) demonstrate a method for the assessment of **scenic quality of landscape** on a national level at a resolution of a 1km*1km raster-cell grid. The visually perceived landscape determines the landscape experience to a high degree, thus the assessment of recreational value of a landscape section can be closely linked to the assessment of landscape images. So, landscape-image related recreational value of perceived landscape was taken from a survey (ROTH et al. 2018) which asks for a rating of photo-graphically depicted landscapes. The survey included a question to the respondent about the suitability of the depicted landscape for his individual recreation. The respondent had the choice to assign a grade to the picture out of the interval (1 [lowest] – 10 [highest]). Like the answers to the questions in the survey on the beauty, diversity and uniqueness of the landscape, this question on the recovery value of the landscape was subjected to a regression analysis. As dependent variable, the regression analysis sets the grade assigned to an image, averaged over all respondents. From preliminary and theoretical considerations predictors (1) are expected to describe relief or the relief energy, (2) are related to disruptive landscape features, (3) perform landscapes that are commonly associated with recreational landscapes and (4) indicate common associations with nature. From the same set of possible predictors set up as described in ROTH et al. (2018) the predictors of the regression model were determined using statistical analysis software IBM SPSS 23. The selected predictors are documented in table 1.

The regression model was then used for spatial extrapolation of the results of the survey to the extent of Federal Republik of Germany (FRG) by a GIS procedure (described in ROTH et al. 2018).

Table 1: Standardized regression coefficients of predictors in regression model for scenic quality related recovery mean score of a picture, evaluated by 3557 persons (r^2 = 0,607, N = 822, sig. of coefficients < 0.05)

Predictor	**… as perceived in a distance of … [m]**	β
Degree of hemeroby	0 – 2.000	-,390
Range of elevation asl	0 – 10.000	,212
Potentially disturbing land-cover [%]	0 – 500	-,204
Density of roads [m/km²]	0 – 500	-,203
Density of transmission lines [m/km²]	0 – 2.000	-,137
Density of borderlines between differen land-cover [m/km²]	0 – 10.000	,134
Share of grassland times share of forest	forest: 0 – 10.000 grassland: 0 – 2.000	,116
Share of forest [%]	0 bis 2.000 m	,092
Share of lakes times share of forest	forest: 0 – 10.000 lakes: 0 – 2.000	,080
Lakes, sea, tidal plane [%]	0 - 500	,079
Area dedicated for nature protection [%]	0 – 10.000	,073
Creeks and rivers in [%]	0 – 10.000	,064

A review of existing assessment approaches confirms that an infrastructure supporting landscape experience can be linked with a high influence on the suitability of a landscape section as a recreational area. Such **recreation related infrastructures** serve for orientation and supply, facilitate the accessibility of the landscape, promote experience of and knowledge about landscape or they can be visited as a cultural or experience-related attraction. Information on recreation related infrastructures is contained in topographical leisure maps, which facilitate the planning and contribute to ensuring the "success" of a landscape-related recreational activity. KOMPASS GmbH provides such maps and owns corresponding geo-data. In a close cooperation, density maps of different types of recreation related infrastructures (hiking and cycling trails, nature experience, cultural experience, leisure facilities for ground or water related activities) were generated. A classification, depending on average and standard deviation of facilities and points of interest (POI) densities, leads to a classification which characterizes locations as being equipped on average (AV), are partly very well equipped (W1) or are comprehensively well equipped (W2).

Regional dedications that increase the recovery potential of a section of a landscape are considered. Large protected areas, i. e. national parks and biosphere reserves as well as nature parks, were assumed to have **attractiveness** and recreational effects as **highlighted areas.**

As we learned from the research of existing approaches the lack of **disturbance** is a key for successful recreation. Visual disturbance is addressed by scenic landscape quality and included in the considerations and data described above. Olfactory issues are not considered in our approach. So only noise from road traffic as disturbance factor that impair the recreational potential of a landscape and the remoteness from built-up infrastructures, which increases the recreational potential of a landscape, was considered. The nationwide calculation of traffic noise is based on data provided by BfN in 2013 on traffic load. The calculation implements the methodology applied by ESSWEIN & SCHWARZ-V. RAUMER (2004) to generate isophones. The methodology simplifies the "Richtlinien für den Lärmschutz an Straßen RLS-90 (BMV 1990)" and was developed at LfU-Bayern. Remoteness from built-up infrastructures is indicated by so called "Unzerschnittene Verkehrarme Räume" (UZVR; undissected low-traffic areas), which are nationwide delimited and monitored as an indicator for landscape development by BfN (2012). Using the data as described a layer was created which represents the following typology: "Extremely quiet and un-fragmented area in which the absence of noise and fragmentation leads to an increase in the value of the recreational potential (Type Q)", "Area with a moderate, everyday noise level, which does not reduce or increase the value of recreation (Type M)", "Slightly noisy area in which noise emissions have a recreational value reducing effect (Type N1)" and "Strongly noisy areas in which the annoyance of noise leads to a high devaluation of the recreational potential (Type N2)".

Input data for recreation demand is described below.

2.1 Aggregation Rules

The **recreational potential** of landscape at a raster-cell results from a matrix aggregation, which includes the four factors as described above and which is documented in Fig. 2.

The final evaluation step assigns the **importance** of a landscape **for recreation** according to recreational potential and demand for recreation. We distinguish between the demand for touristic recreation and demand for local recreation. The two forms of recreation demand differ in regard to the expectations and activity patterns of those seeking recreation and are therefore considered differently in the assessment procedure. Based on data provided by authors of HERMES et al. (2018), an inhabitant of cities and trip distance related classification was achieved which separates low, moderate, high and very high demand for local recreation. The overnight stays and arrivals per municipality per year were used as indicators for touristic demand. The first step was to sort out overnight stays that did not serve the purpose of landscape related recreation. Overnight stays in densely populated municipalities were excluded from further analysis and only stays of three or more days were considered. The overnight stays were transferred to spatially explicit data by a core density function related to the centers of the municipalities. The combination of recreational potential and demand levels is made for both categories of recreation demand via the matrix in Fig. 3.

2.2 Results

The first map presented in Fig. 4 shows the result of spatial extrapolation of suitability of landscape for recreation as received from the survey and perceived by people. This map represents the same general pattern as that of scenic beauty, but in regional details the specific regression model for recreation assigns some differences. As in the map for scenic beauty,

published in ROTH et al. (2018), urbanized areas are assessed as being less attractive for recreation and in turn hilly and mountainous regions can be considered as hotpots.

The second map in Fig. 4 shows how recreation related infrastructures, mentioned dedications and level of disturbance alters the pattern. We can identify regions which suffer from lack of infrastructures or from being disturbed by road noise and dissection despite there are land characteristics which promise from people's judgment to be suitable for recreation. This map clearly highlights the mountainous areas in Germany where we have a lot of hiking and biking infrastructures, a reduced density of transportation network and a top evaluation by people concerning recreation. The map also demonstrates that coastal areas in Germany suffer in an attractive hinterland.

Dedication	Disturbance	Infrastructure		
		W2	W1	AV
No Dedication	Q	I1	I1	I1
	M	I1	I1	N
	N1	I1	N	D1
	N2	N	D1	D1
Nature Park	Q	I2	I2	I1
	M	I2	I1	N
	N1	I1	N	D1
	N2	N	D1	D2
Biosphere Reserve / National Park	Q	I3	I2	I1
	M	I2	I2	N
	N1	I1	N	D1
	N2	N	D1	D2

D2	very diminished
D1	diminished
N	neutral
I1	increased
I2	very increased
I3	extremely increased

Visual quality related recreational value	D2	D1	N	I1	I2	I3
1	1	1	1	2	3	4
2	1	1	2	3	4	5
3	1	2	3	4	5	6
4	2	3	4	5	6	7
5	3	4	5	6	7	8
6	4	5	6	7	8	9
7	5	6	7	8	9	9
8	6	7	8	9	9	9
9	7	8	9	9	9	9

Final evaluation matrix for recreational potential of landscape

Fig. 2: Evaluation of recreational potential of landscape (1 = low, … , 9 = high level)

Recreation potential (refer to Fig. 2)		low = rank 1,2,3	medium = rank 4,5,6	high = rank 7,8,9
Demand	Not existing	rarely existing	very low	low
	low	very low	low	medium
	moderate	low	medium	high
	high	medium	high	very high
	very high	high	very high	extraordinary high

Fig. 3: Assignment of "Importance for recreation" combining recreation potential and demand

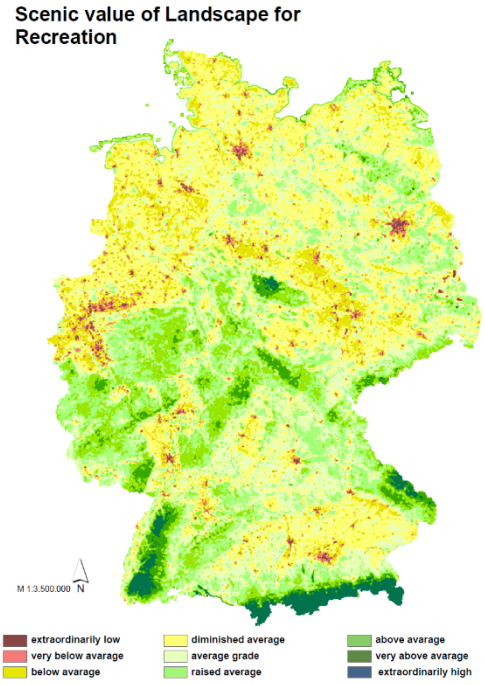
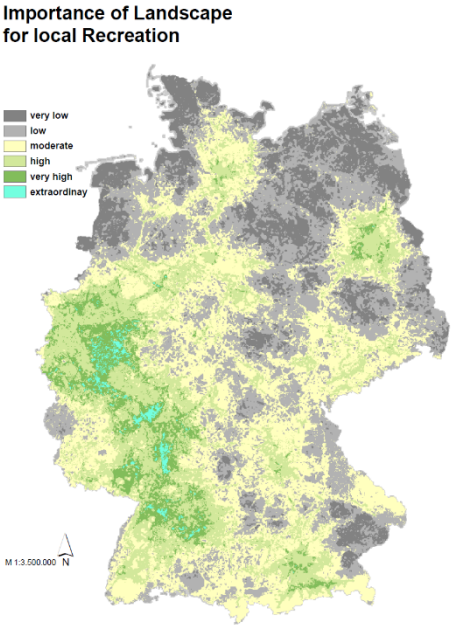
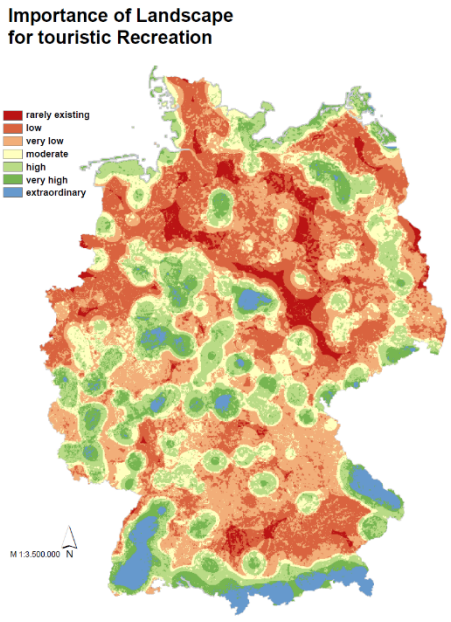


Fig. 4:
Scenic value of landscape for recreation (left); importance of landscape for local (lower left) and touristic (lower right) recreation





Third and fourth maps in Fig. 4 show the results of demand driven assessments. There exists a set of extraordinarily important regions where a good potential for recreation meets accessibility from population core areas. On the other side, touristic demand is mostly coincident or located in direct neighborhood areas of scenic beauty and/or high recreation potential. The pattern of the fourth map is also driven by locations of health resorts with mineral springs in which we have a lot of long-lasting overnight stays.

2.3 Discussion

To use nice landscapes for recreation is an invention of the 19th century and went through a lot of different shades of instrumentalization. Since the transition period from agricultural to industrial human habitat, social welfare provision articulated the necessity to guarantee compensation for unhealthy environments. In the sixties and seventies of last century, physical, urban and landscape planning set to take care for recreation as a paradigm. In parallel the development and use of quantitative methods was set as a paradigm and thus we have a broad fundus of approaches from that period which tries to quantify the "value" of landscape for recreation or to delineate priority areas for recreational purposes. Two lines of modern development of paradigms must be added (1) simplification by millennium ecosystem assessment and (2) democratization through big data. To briefly summarize: our approach combines data which can we get from a huge sample with a more traditional approach to set normative evaluations based on putative sound judgements of planners. In the case of scenic sensation related assessment evidence comes from the sample statistics, in the other cases from plausibility and non-contradiction to common sense. Like in the case of recreational ecosystem service (RES) mapping the approach applied here neglects – except when postulating that scenic quality of landscape and recreation are per se inseparable – that landscape should better be considered as a whole and that quantification reduces landscape to a small segment of aspects, to those we can grasp by numbers or other formal systems.

When comparing our approach with others, the big difference is, that landscape properties are not fed directly into the assessment, like RES mapping or a wide range of methods used in practical landscape planning do. Most of such approaches use GIS-Data, social media or small interview samples. In our case the key factors are determined and weighted as perceived by people of a large sample. The list of predictors in Table 1 repeat factors which often can be found in normative RES or planning approaches. Concerning RES HERMES et al. (2018) presents an actual overview.

Concerning the differences between potential for and importance of recreation we must point out a key question: There are landscapes which are not attributed by any "importance" because they are not in demand due to their location or the lack of touristic marketing, but they could be very beneficiary for recreation – they could include the last wilderness areas: How to handle such areas in planning? Our approach doesn't take into account specific management options which organize and control recreational activities. An overall assessment of the landscape with regard to its worthiness to be protected for recreation is not fully clarified by the approach presented here. And the sensitivity to interventions, i. e. the reduction of the recreational potential, e. g. through further infrastructure development, also requires further considerations.

The intention of our contribution is to present our method and not to discuss the results presented in Fig. 4. However, some traps of misinterpretation must be mentioned. We only consider open landscape related recreation, so cities and urban areas do not appear as being important for recreation and tourism even if they attract lots of tourists indeed. Importance for local recreation takes demand for recreation and thus population density into account, this leads to widespread grey areas in Fig. 4 (down left). In addition: there is strong cohesion of the results to the online survey. Local or sub-national approaches can lead to different results.

3 Conclusion

The authors conclude a high potential of the approach to unify planning data and methods on a regional and national level. The results can be used in particular for network planning of transmission lines.

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BfN = Bundesamt für Naturschutz (Federal Agency for nature conservation)

BMV = Bundesminister für Verkehr

FRG = Federal Republic of Germany

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