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Measuring the attractiveness of Dutch landscapes: Identifying national hotspots of highly valued places using Google Maps

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A B S T R A C T

In a Cost-Benefit Analysis (CBA) or an Environmental Impact Assessment (EIA), determining the value that the general public attaches to a landscape is often problematic. To aid the inclusion of this social value in such analyses, a Google Maps-based tool, called the HotSpotMonitor (HSM), was developed. The HSM determines which natural places are highly attractive by having people mark such places on a map. The definition of attractiveness remains open to avoid having marker placement being influenced by preconceived thoughts. The number of markers an area receives is considered to indicate its social value. Six regions were selected, and from these, stratified samples were drawn (total $n = 3293$). Participants placed markers at three spatial levels: local, regional and national. This paper focuses on the markers at the national level. The first research question is whether the HSM can produce an accurate map of highly attractive places at a national level. The results indicated that while in principle HSM can produce such a map, the spatial representativeness of the sample is important. The region of origin of the participants influenced where they placed their markers, an effect previously termed spatial discounting. The second research question considers which qualities the participants associate with the marked places. These qualities were very similar at all three spatial levels: green, natural, presence of water and quiet were often selected out of the fourteen suggested qualities. The third, and more exploratory, research question concerns which characteristics of an area predict its attractiveness. Natural and forest areas had higher marker densities than water surfaces or all other types of land use combined. The discussion evaluates the potential of the HSM to generate input on social landscape values for CBAs and EIAs.

Introduction

Growing importance of social landscape values

The evaluation of diverse spatial functions, interests, values and desires is important for spatial planning (Dramstad et al., 2002; Vizzari, 2011). In many urbanized regions, both cultural and natural landscapes are increasingly appreciated as leisure commodities (Jacobs & Buijs, 2011). Some of the major international conventions, including the Convention on Biological Diversity and the European Landscape Convention, explicitly demand that the social values of landscapes be monitored (Antrop, 2005). As a result, landscapes need to be assessed not only according to their biodiversity (Green et al., 2005) or agricultural productivity (Strumse, 1994) but also according to their social and emotional value (Buijs & Lawrence, 2012). Moreover, given the multiple functions of the landscape, decisions on proposed spatial interventions or other developments in land use require the ability to assess trade-offs between these different functions. For example, does added landscape attractiveness outweigh the loss in agricultural production capacity? Quantifying the social value of spatially defined landscapes is an important step in facilitating processes such as Cost-Benefit Analysis (CBA) and Environmental Impact Assessment (EIA) (Boardman, Greenberg, Vining, & Weimer, 2011).

There are few tools to help decision-makers take social values into account (Bryan, Raymond, Crossman, & Hatton MacDonald,

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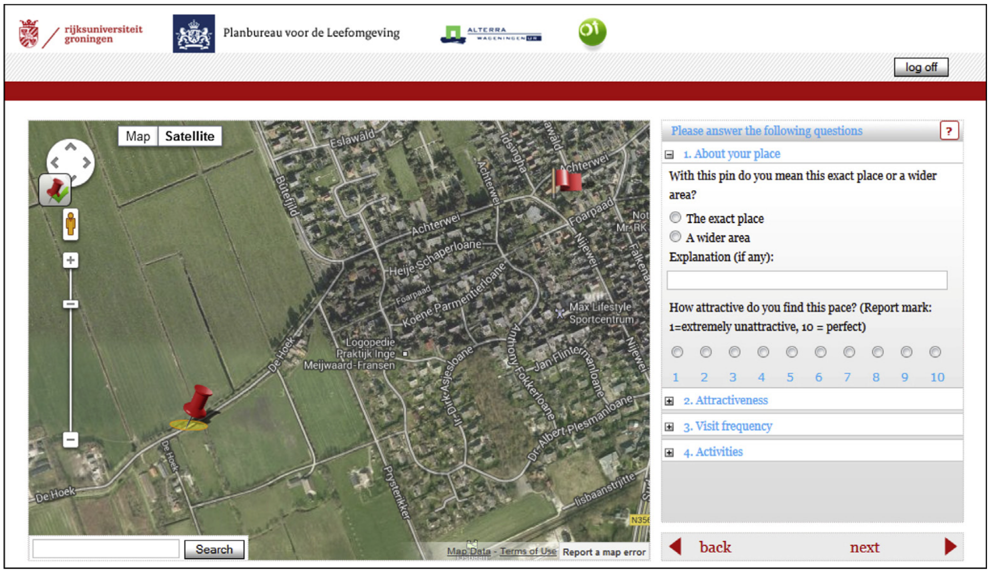

Fig. 1. Screenshot of the HSM at the moment a marker is placed.

2010; Sijtsma, Daams, Farjon, & Buijs, 2012). Especially at the national level, a valid and efficient methodology to measure social landscape values is absent (De Vries, Roos-Klein Lankhorst, & Buijs, 2007). Traditional questionnaire-based methods to collect data on the supra-regional or national level are not feasible. One reason for this lack of feasibility is the cost of collecting a sufficient amount of data to cover the entire area or country with a sufficient level of spatial detail. Another reason is the methodological challenge to allow each respondent to focus on the area of his or her choosing (Brown & Brabyn, 2012). There are some examples of tools to upscale locally collected data to the national level, usually by relating the local data on valuable spots to the physical landscape features, such as landform and land cover, on which data are available nationwide (Brown & Brabyn, 2012; De Vries et al., 2007). However, not all types of places that are available at the national level are also available at the local level. The most valuable place at the local level may be less valuable when put in a national context, even if the qualities on which the assessment is based are the same.

Measuring social value by a PPGIS using Google Maps

At the start of this century, participatory mapping emerged as a new type of tool to capture spatial information on social landscape values. Many of these tools involve the use of a Geographic Information System (GIS), giving rise to the term Public Participation GIS (PPGIS) (Brown & Reed, 2012). Social value mapping is a type of PPGIS that combines the mapping of place-based social values with GIS techniques (Brown & Raymond, 2007). Typically, a representative sample of residents or tourists is asked to locate places in a predefined area that score high on a specific value, as defined by the researchers. Such map-based measures can provide information about at which places a certain value is perceived to be strongly present and according to how many people (Brown, 2005; Brown & Brabyn, 2012). By composing density maps of the places marked by the respondents, empirically based *hotspots* of social landscape values can be identified (Alessa, Kliskey, & Brown, 2008). Recent technological developments, such as Google Maps©, have created new possibilities for measuring social landscape values and preferences (Bearman & Appleton, 2012; Brown & Reed, 2012). Google Maps applications enable respondents to mark values and special places directly on GIS-based maps, rather than on paper versions of maps, which must be subsequently digitized (Miller, 2006).

Thus far, spatially explicit social values have only been collected at the local to regional level (Brown & Brabyn, 2012; Brown & Reed, 2012). Our goal is to contribute to the development of a valid and practical methodology for identifying social landscape values at the national level that can eventually be used in CBAs and EIAs. In line with this goal, the tool will ask for an overall or integral valuation of landscapes from an individual perspective: it is up to the individual to decide which value or values he considers to be important, and how important they are. The tool focuses on the valuation of the present situation. However, for planning purposes, it is also relevant to know how people value possible future situations. Therefore, we will investigate the following three questions:

1. Can the tool be used to generate an accurate map of highly attractive natural places in the Netherlands at a national level?
2. Why do people consider the areas with a high density of markers (hotspots) to be attractive?
3. Which objective characteristics or combination contributes to the attractiveness of such areas?

Regarding the first question, Brown and Brabyn (2012) described the theory of spatial or place-based discounting: humans tend to discount both across time and space, placing higher value on places that are more proximate. As the distance from one's place of residence increases, the chance that a spot will receive a marker decreases. This may have to do with both familiarity and the value generated through personal use of the place. Faraway places are less likely to be known, and even if they are known, they are less likely to be visited frequently due to higher travel costs and/or intervening opportunities. This effect of distance implies that the markers at the national level may differ depending on where one lives. The second question is important precisely because we did not predefine the values and/or qualities that people should look for when placing their marker. The third question is a first step towards determining what makes a place highly attractive and, therefore, which interventions are likely to make it more or less attractive (to Dutch people). In other words, this step is important for ex ante evaluations. In this paper, the question will be dealt with in an exploratory manner.

Table 1
Qualities and their description.

Quality	Description
Green	A lot of green cover
Quiet	Few other people
Natural	Nature can run its own course, no human interference
Presence of water	Attractive water surface, river, lake or sea
Open	Panoramic and open views
Recreation	Good opportunities for recreation
Silence	Few disturbing sounds
Variation	Variation in type of vegetation, land use and between seasons
Non-urban	Little skyline disturbance, built-up area, roads etc.
Personal	Place has a special meaning to me
Historical	Many recognizable elements from the past
Ecological	Special animals and/or plants
Cohesion	Not fragmented or (visually) cluttered
Economical	Good opportunities for entrepreneurs (e.g., farming, tourism)

Methods

Description of the HotSpotMonitor (version 1.2)

We developed a Google Maps-based tool to measure the social landscape values on a national scale and named it the *HotSpotMonitor*, or HSM for short (Sijtsma et al., 2012, 2013; see www.hotspotmonitor.eu). An important feature of the HSM is that people are not asked to indicate which places possess a certain predefined value to a high degree, but are asked to indicate which places they find highly valuable or attractive, regardless of their reasons for doing so. Using the tool, people are asked to place a marker on a map, indicating the location of a highly attractive place. An important constraint on the choice set is that the place should qualify as natural in a broad sense: with vegetation and/or (natural) water. The choice does not have to be located in the countryside and can be a green area within a city or village. It is not required that one has visited the place oneself.

The HSM has a location-based design (see Fig. 1). The starting point indicated by the HSM is the place (house or street) where people live, which is marked by a red flag. People are free to mark their own places by dragging a pin to the map. The moment the respondent places a marker on the map, there is an auto-zoom of two 'steps' in the Google Map zoom ruler. This application of the auto-zoom is meant to contribute to the spatial precision of the response. The marker can always be moved. The participants are asked to identify the natural places that they find attractive at the following three spatial levels:

(i) Local: within 2 km of their home;
(ii) Regional: within 20 km of their home; and
(iii) National: the entire Netherlands (twice).

The circles of (i) and (ii) are shown on the maps presented to the respondents as a transparent gray area over the Google Maps view (standard satellite view). The first level is a typical distance for walking the dog and other everyday recreational activities close to home. The second level is, in the Netherlands, often viewed as the operationalization of one's "living environment": people often commute, go to school, do their shopping and engage in more recreational activity within that range. The third level is geared towards policy, culture and evaluation: for many Dutch national policy choices, it is crucial to know the preferences of Dutch people for places within the Netherlands. After the participants place a marker, they are asked what qualities or values were important for them to qualify this place as highly attractive. The set of potential values (see Table 1), from which several could be chosen, is based on Coeterier (1996) and Brown and Reed (2000). The respondents are also asked to explicitly rate the attractiveness of the place, on a scale from 1 to 10 (i.e., from extremely unattractive to perfect).

Additional questions for each placed marker are how often people visited the selected place and what activities they participated in at this location. After the participants place all four markers and answer the marker-specific questions, they are asked some more general questions on their perspectives on nature, recreational motives, and some demographic characteristics (age, gender, education and length of residency). In this paper, we will primarily focus on the markers placed at the national level.

Survey method

We selected six regions that we considered to differ substantially in landscape character (see Fig. 2). This selection of regions allowed us to investigate to what extent one's region of origin influences the placing of the markers, especially at the national level. We attempted to select a large, medium and small municipality within each region. The sampling within each of the regions was stratified to reflect the number of people living in each size class within the region. The aim was to have 600 completed surveys for each region. To minimize content-related non-response, the survey was conducted among the members of an Internet panel of a marketing research agency (GfK). The required minimum age of the participants was 18 years. Initially 5361 members were approached. For a small municipality in one of the areas (Over-Betuwe), the panel contained too few members; the other two municipalities in this area were oversampled to compensate. A more detailed description of the study design is given elsewhere (Langers et al., 2013).

The selected panel members received an invitation to participate by email. The invitation contained a short description of the study and an individual link to the tool. After one week, a reminder was sent to the selected members who had not yet completed the survey. Because the target numbers had not yet been reached, an extra sample of 1493 members was selected. With 3616 participants, the overall response was 53%, somewhat lower than the anticipated 60%. Some markers were placed outside of the requested boundaries. The respondents who placed one or more markers clearly outside the boundary involved were removed from the database. Some of the areas within the local and regional boundaries were partially located abroad, either in Germany or Belgium. Although in valid locations, the markers placed abroad could not be enriched with GIS-data on the characteristics of the landscape. Therefore, the respondents placing such markers were also removed from the database. The final database contains 3293 participants and 13,172 markers: one at both the local and the regional level, and two at the national level for each participant.

Participants

Females are slightly overrepresented in the pool of participants, especially in the study areas of Amsterdam and Twente (see Table 2). The age distribution is quite similar in all six areas; however, Twente differs slightly, with the proportion aged 50 years and over being somewhat lower. Regarding the educational level, Groningen and Amsterdam have a clearly larger proportion of highly educated people than the other four areas. On average, the respondents have lived at their present address for twelve years, ranging between 10.2 and 13.4 for the regions of origin (not in the table).

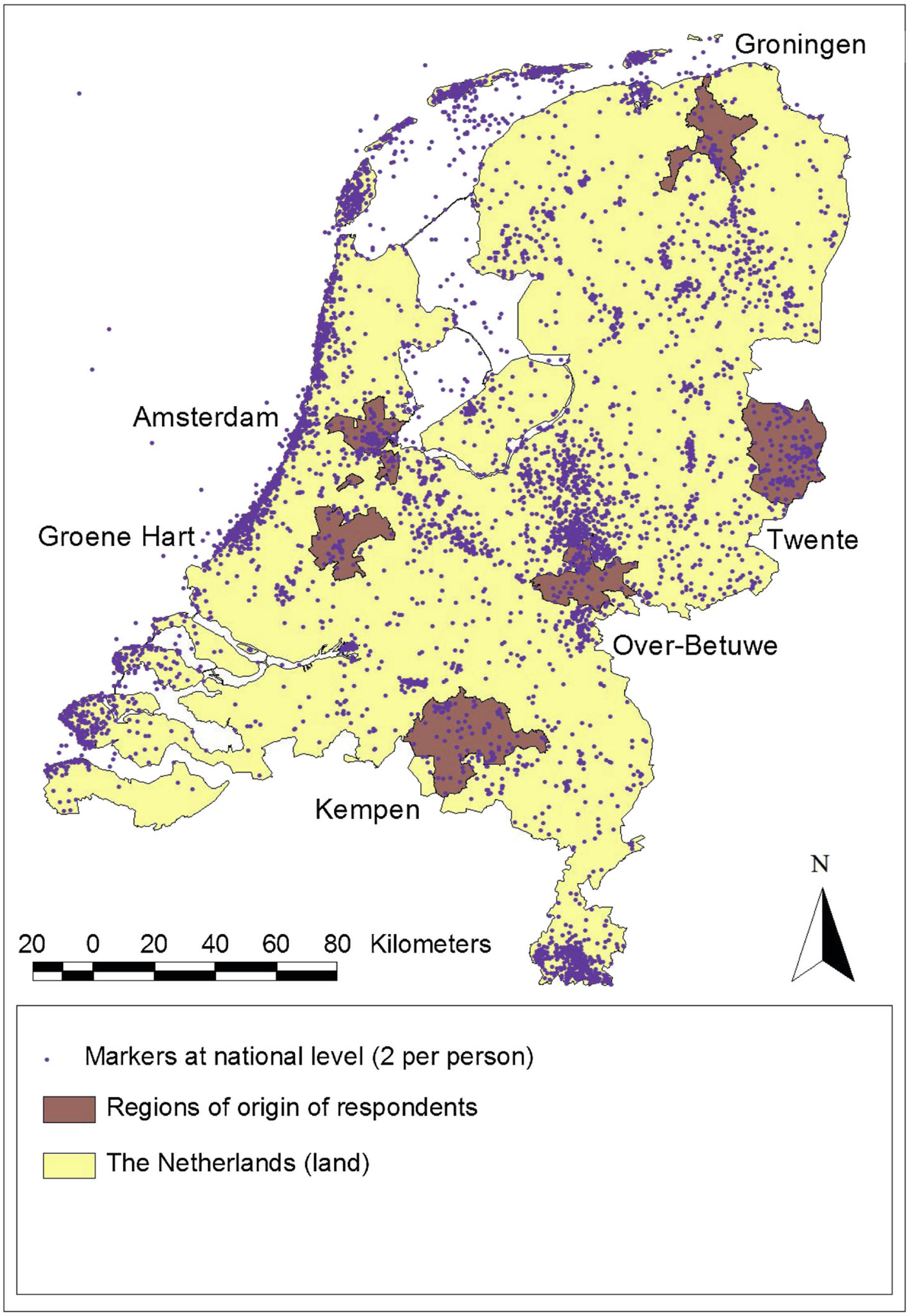

Fig. 2. Map with regions of origin and markers (2 per person) at the national level.

Table 2
Background characteristics of participants by study area.

		Groningen	Twente	Over-Betuwe	Amsterdam	Groene Hart	De Kempen	Total
Gender (%)	Male	49.5	43.8	47.8	42.5	51.8	49.0	47.5
	Female	50.5	56.3	52.2	57.5	48.2	51.0	52.5
Age (%)	18–34 years	32.0	31.3	26.2	25.4	27.1	28.6	28.4
	35–49 years	32.0	37.5	36.3	36.4	36.0	33.0	35.2
	>= 50 years	36.1	31.3	37.5	38.2	36.9	38.4	36.5
Education (%)	Up to lower secondary	9.6	11.3	13.9	12.8	15.3	15.7	13.1
	Higher secondary	9.1	10.9	7.6	11.1	11.5	9.2	9.9
	Medium vocational	17.9	27.6	25.0	18.2	26.8	26.9	23.6
	Higher vocational	30.9	34.7	38.5	30.4	33.3	34.0	33.6
	Academic	32.6	15.5	15.1	28.5	13.2	14.3	19.8
Number of participants		560	496	569	561	583	524	3293

Results

Identifying hotspots at the national level

Location of the markers

Fig. 2 shows the location of the two national markers. The hotspots were empirically defined by a) creating a 250-m raster of marker density using a 5-km radius and b) using a cut-off point to delimit the hotspots. Somewhat arbitrarily, the selected cut-off value was 0.4 markers within the 5-km radius; the areas with densities at or above this level were delimited. This cut-off value resulted in a number of areas that was too high to describe individually (see Fig. 3). We selected four major hotspots: Wadden Islands, North Sea coast, Veluwe and Southern Limburg. The first two of these hotspots consist of several non-contiguous areas. We grouped these areas and treated them as a single hotspot partially because they are separated by larger water bodies and partially based on our preconceptions regarding their similarity. Both the North Sea coast and the Wadden Islands are characterized by beaches, dunes and sea. Southern Limburg is well-known throughout the Netherlands for its small-scale, hilly landscape (note that this hotspot also includes the city of Maastricht). The fourth major hotspot, Veluwe, is an area located slightly east of the center of the Netherlands and mainly consists of forest and heath. Veluwe is the largest contiguous natural area in the country and includes the best-known national park in the Netherlands. Together, these four hotspots contain almost half of the national markers.

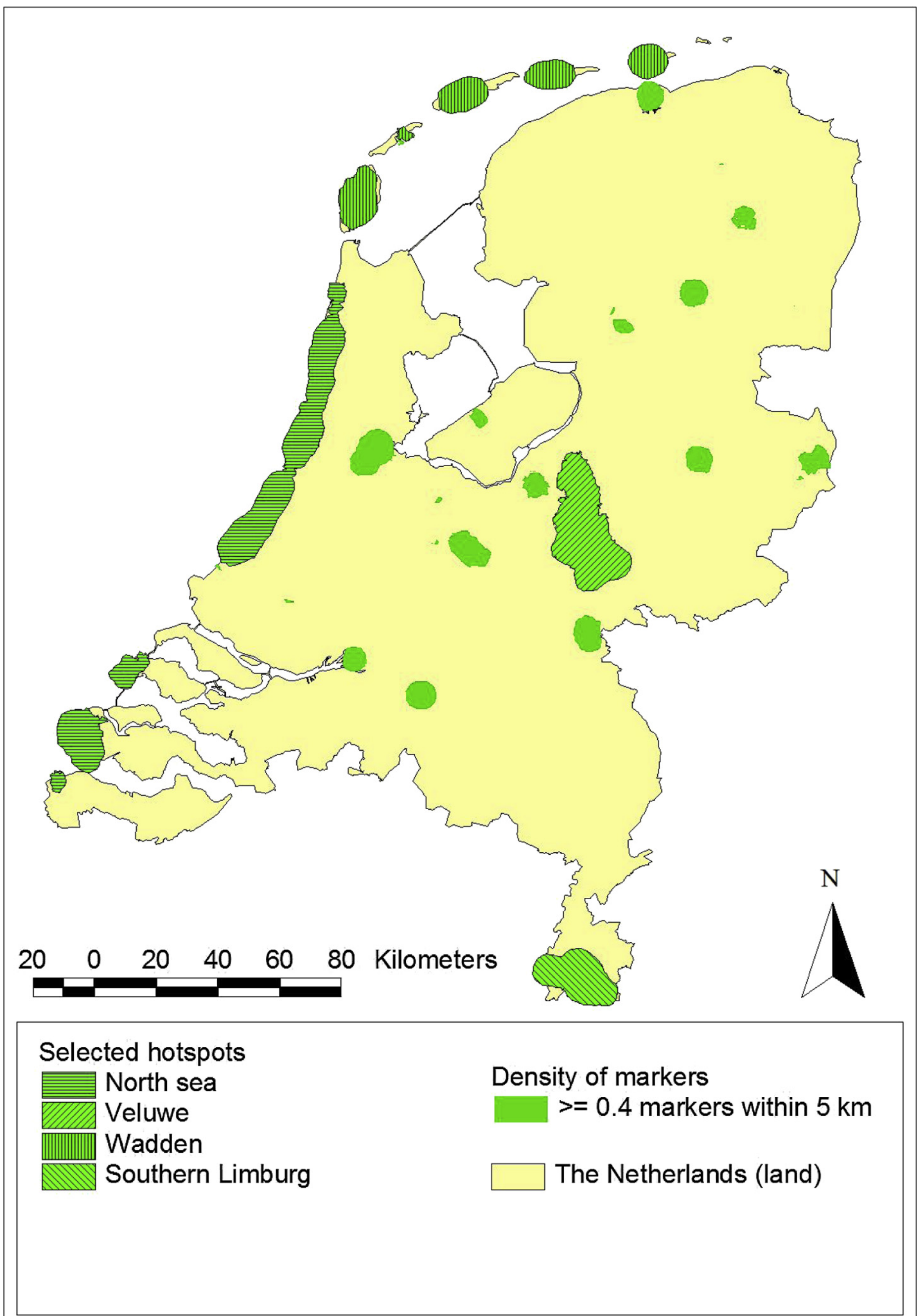

Fig. 3. Empirically defined hotspots, based on marker density map.

Table 3
Average attractiveness score per spatial level (scale 1–10).

Level	Average score	Standard deviation
Local	7.9	0.95
Regional	8.2	0.92
National highest	8.6	0.87
National second highest	7.9	0.94

NB: national highest = national marker with the highest score at this level.

Size of the area that a marker refers to

The participants were asked whether the marker identified an exact spot or whether it was indicative of a larger area. The participants could describe the area in their own words, but were not asked to draw or otherwise indicate the size of this larger area in geographical terms. The results show that the markers were quite often said to be indicative of a larger area, somewhat more so at the national (85%) and regional level (82%) than at the local level (76%).

Rating of the marked places

Because the participants were asked to mark highly attractive places within the choice set, it is not surprising that average scores are quite high (Table 3). However, the average score for the national marker with the highest score is 0.7 point higher than that for the marker at the local level. In contrast, the second highest national marker has approximately the same average as that at the local level, which is significantly less attractive than the highly attractive place at the regional level ($p < 0.001$). Note that this test presumes that the ratings for the places marked at the different spatial levels can be meaningfully compared, which is an issue we will return to in the discussion.

Spatial representativeness: discounting

Visual inspection of the national markers by region of origin revealed a link between the hotspots and the region where the participants live (Langers et al., 2013). We attempted to quantify this discounting effect by calculating the density of markers for several distance-from-home zones per region. Note that this is a more simple density calculation (the number of markers divided by the area within the zone) than the one used to create a raster density map, so the figures cannot be compared. Subsequently, we calculated the factor by which the density-per-distance zone differed from the overall density of markers originating from that region for the Netherlands as a whole, with values above 1 indicating a value higher than this overall density. Previously, we referred to this statistic as the HotSpotIndex (HSI) (Sijtsma et al., 2013). Indeed, zones close to home tended to have higher HSI scores. However, the pattern of density by distance was not a monotonically declining one. A possible reason for this behavior is that some nationally well-known places often receive a marker, regardless of the distance at which they are located. As a partial check, a second analysis was performed, in which the markers located in any of the four major hotspots were not included. This exclusion involved 48% of all national markers, with an exceptionally high 55% of the markers placed by participants originating from Over-Betuwe. Table 4 indicates that without these markers, the pattern of density by distance is a perfectly monotonically declining pattern for all regions of origin, with Twente and Over-Betuwe exhibiting stronger spatial discounting than Groene Hart and Groningen.

Qualities associated with the hotspots

Qualities associated with the marked places by spatial level

At the national level, more qualities (highest: $M = 3.8$; second highest: $M = 3.4$) were mentioned per marker than at the regional ($M = 2.4$) and local level ($M = 2.5$). The four qualities that were mentioned most often are the same for all three levels: green, quiet, natural and presence of water (see Table 5).

Earlier, we reported that the markers at the national level were significantly more often said to be indicative of a larger area than those at the local level. This area factor may be one of the reasons that more qualities are mentioned at the national level. The number of qualities mentioned for the markers indicating a larger area is indeed higher than the number for those indicating an exact spot. For the highest marker at the national level, the average number of qualities is $M = 3.9$ for an area versus $M = 3.1$ for an exact spot. For the second highest marker at this level, the numbers are $M = 3.5$ for an area and $M = 3.0$ for a spot (both $p < 0.001$). However, the average number of qualities mentioned for an exact spot at the national level is still higher than the overall averages for the markers at the regional and the local level. If a place possesses a larger number of positively valued qualities, it may also be considered more attractive. The correlation between the number of qualities and the attractiveness score at the national level are indeed positive, but not very strongly: the national highest is $r = 0.18$, and the national second highest is $r = 0.25$ (both $p < 0.001$). The number of qualities mentioned largely seems to be an individual response characteristic: the correlation between the number of values mentioned for the national highest marker and the national second highest marker is $r = 0.72$.

Qualities associated with the empirically defined hotspots

The most universal qualities are: natural, quiet and open; they rank among the top six qualities for all four major hotspots, with natural and quiet scoring higher than open (see Table 6). As might be expected, presence of water is the dominant quality mentioned

Table 4
Scores on HotSpotIndex (HSI) for distance-from-home zones by region of origin, with only markers placed outside the four major national hotspots included.

	<25 km	25–50	50–100	100–150	150–200	>200 km
Groningen	3.3	2.5	1.1	1.0	0.3	0.2
Twente	6.7	1.6	1.1	0.6	0.3	0.3
Over-Betuwe[a]	6.8	1.1	0.7	0.6	0.5	–
Amsterdam[a]	5.8	1.6	0.8	0.5	0.4	–
Groene Hart	2.1	1.9	0.9	0.7	0.6	0.0
De Kempen	4.3	1.9	0.8	0.6	0.6	0.3

Note: HSI-scores > 1 indicate higher densities than that for the Netherlands as a whole.
[a] Because of their central location, Over-Betuwe and Amsterdam do not have (Dutch) zones located more than 200 km away.

Table 5
Percentage of all respondents that mentions a quality in relation to a marker (more than one quality per marker possible).

Quality	Local	Regional	National highest	National second highest
Green	59.1	39.8	44.1	44.3
Quiet	36.3	30.3	43.7	40.3
Natural	30.5	29.2	44.7	41.2
Presence of water	26.6	24.6	40.9	35.1
Open	19.4	20.3	34.3	30.0
Recreation	18.9	20.4	36.3	34.5
Silence	11.9	16.0	27.7	22.6
Variation	10.4	14.5	24.3	22.1
Non-urban	10.3	15.5	28.8	26.2
Personal	9.0	8.1	20.9	16.7
Historical	8.0	6.6	12.1	11.4
Ecological	7.1	8.2	14.5	10.9
Cohesion	4.2	4.6	7.5	6.5
Economical	0.5	0.3	1.3	1.5

Table 6
Six qualities most often mentioned per hotspot.

Quality rank	North sea coast ($n = 1327$)	Wadden Islands ($n = 614$)	Southern Limburg ($n = 373$)	Veluwe ($n = 707$)
1	Water (70%)	Water (56%)	Green (53%)	Green (72%)
2	Recreation (49%)	Quiet (53%)	Variety (50%)	Natural (63%)
3	Natural (33%)	Natural (52%)	Natural (48%)	Quiet (58%)
4	Quiet (29%)	Recreation (45%)	Quiet (39%)	Silence (40%)
5	Open (29%)	Green (44%)	Recreation (33%)	Open (39%)
6	Personal (18%)	Open (43%)	Open (30%)	Variety (33%)

for the North Sea coast and the Wadden Islands. However, it does not appear in the top six qualities for Veluwe and Southern Limburg, where green is the highest scoring quality. Green is not in the top six qualities of the North Sea coast and 'only' fifth for the Wadden Islands. Recreation is also included in most of the top six qualities of the areas in the study, although Veluwe is an exception. Regarding the water-based hotspots, recreation scores are especially high. Furthermore, variety is included in the top six qualities of the two hotspots that are dominated by green, but it is not frequently mentioned in connection with the two hotspots dominated by presence of water. So, despite considerable overlap in the assigned qualities, the four hotspots also exhibit some differences in the dominant qualities, most notably presence of water versus green.

Objective characteristics of the hotspots

Marker densities and the different types of environments: tourist areas

Thus far, hotspots have been characterized based on the qualities assigned to them by the participants. We will now explore to what extent the marker densities are related to more objective characteristics of the environment, making use of predefined typologies. Because the four major hotspots are all located in well-known tourist areas, we will use the tourist area classification of Statistics Netherlands as a starting point. This tourist area map divides the entire Netherlands into seventeen areas (see Fig. 4). To avoid confusion with the empirically defined hotspots, the tourist areas are denoted by their Dutch names.

We calculated the HSI score per tourist area, using the markers originating from all regions. The markers outside the boundaries of any (land-based) tourist area were ignored in these calculations. The results indicate that 'Waddeneilanden' has the highest density followed by 'Noordzeebadplaatsen' (see Table 7). The third highest density is in the four largest cities of the Netherlands, closely followed by 'Zuid-Limburg'. Fifth in rank is 'Veluwe en Veluwezoom'. There is only one other destination area with an HSI-score clearly above 1.0: 'Utrechtse Heuvelrug en 't Gooi'. All other tourist areas score at or below the overall density. The density of markers was compared to the density of domestic holiday nights spent per region in 2010 (CBS, 2011). The correlation between these two densities for the seventeen tourist areas was $r = 0.96$.

Other relevant characteristics besides the type of tourist area

How tight is the fit between the hotspots and, in this case, the tourist areas? If the markers are not distributed evenly, there are likely to be (additional) relevant characteristics that differentiate the hotspots within the predefined area from the remainder of that area. To assess the level of evenness, we used a somewhat different density map than the one used for empirically defining hotspots. Whereas the raster size is the same (250 m), the map to determine the level of evenness used a radius of 1 km. This smaller radius was chosen to minimize the influence of markers located outside the tourist area, which was sometimes quite small (e.g., polygon for one city). The mean of these local densities, their standard deviation and the coefficient of variation (standard deviation divided by mean) were calculated for each tourist area.

Table 7 shows that the coefficient of variation ranges from 1.29 for 'Waddeneilanden' to 4.14 for 'Overig Nederland'. Thus, relative to the size of the mean, the evenness in density is considerably higher in the former area than in the latter. 'Noordzeebadplaatsen' has the third lowest coefficient. The four largest cities, on the other hand, have the second highest coefficient, indicating a relatively uneven distribution of markers. 'Veluwe en Veluwezoom' also has a relatively high coefficient of variation. These results lead to the question of which special qualities or characteristics the hotspots within these tourist areas possess compared to the remainder of the area. The frequently mentioned qualities in relation to the empirically defined hotspots offer some clues with regard to the tourist area in which they are located. For example, for the North Sea coast, presence of water was an important quality. At some places the accompanying tourist area may be defined too widely, resulting in larger distances from the water. 'Natural' was also an important quality for this hotspot. The parts of the coast with dikes rather than dunes are likely to be considered less natural. As for the importance of recreation as a quality, the presence of beaches may also be highly relevant.

The characteristics frequently mentioned for the hotspots are also (locally) present in other tourist areas. Because natural is an important quality associated with many of the markers, we calculated the density of markers in areas that are characterized as forest or natural in the land use database of Statistics Netherlands (BBG 2008). We used the same local density calculation we used for the tourist areas. The average density for forest and natural is 0.46, compared to an average of 0.11 for the other types of land use and of 0.14 for all types of water. The coefficient of variation is 2.6 for the natural and forest areas, 4.7 for land areas other than natural or forest and 5.6 for water. Thus, the presence of forest or natural definitely increases the likelihood of a place receiving a marker, although not all natural and forest areas have an equally high density.

Discussion

Does the HSM generate an accurate map of the hotspots at a national level?

Natural areas in the Netherlands that are known for their attractiveness and landscape qualities exhibited high marker densities. As such, the face validity of the data generated by the HSM is high. This result suggests that the Google Maps literacy of the Dutch population is sufficient for widespread use of such techniques in studies of the social values of landscapes. However, note that the present sample was drawn from a commercial Internet panel and that it is not representative of the Dutch population in terms of socio-demographic characteristics. Given the purpose of our study, we do not consider this to be problematic. As for the participants, the focus of the study was on the importance of the *spatial* representativeness of the sample or the possible lack thereof. Our analysis demonstrated that the region of residence of participants influenced which places were marked as highly attractive at the national level. To a large extent, the density of markers placed by participants living in a certain region exhibited a clear decay with distance, only disturbed by a few nationally well-known hotspots. Some types of places may be highly valued but, simultaneously, may not be very unique. It stands to reason that people are more likely to know, use and appreciate (and therefore mark) closer

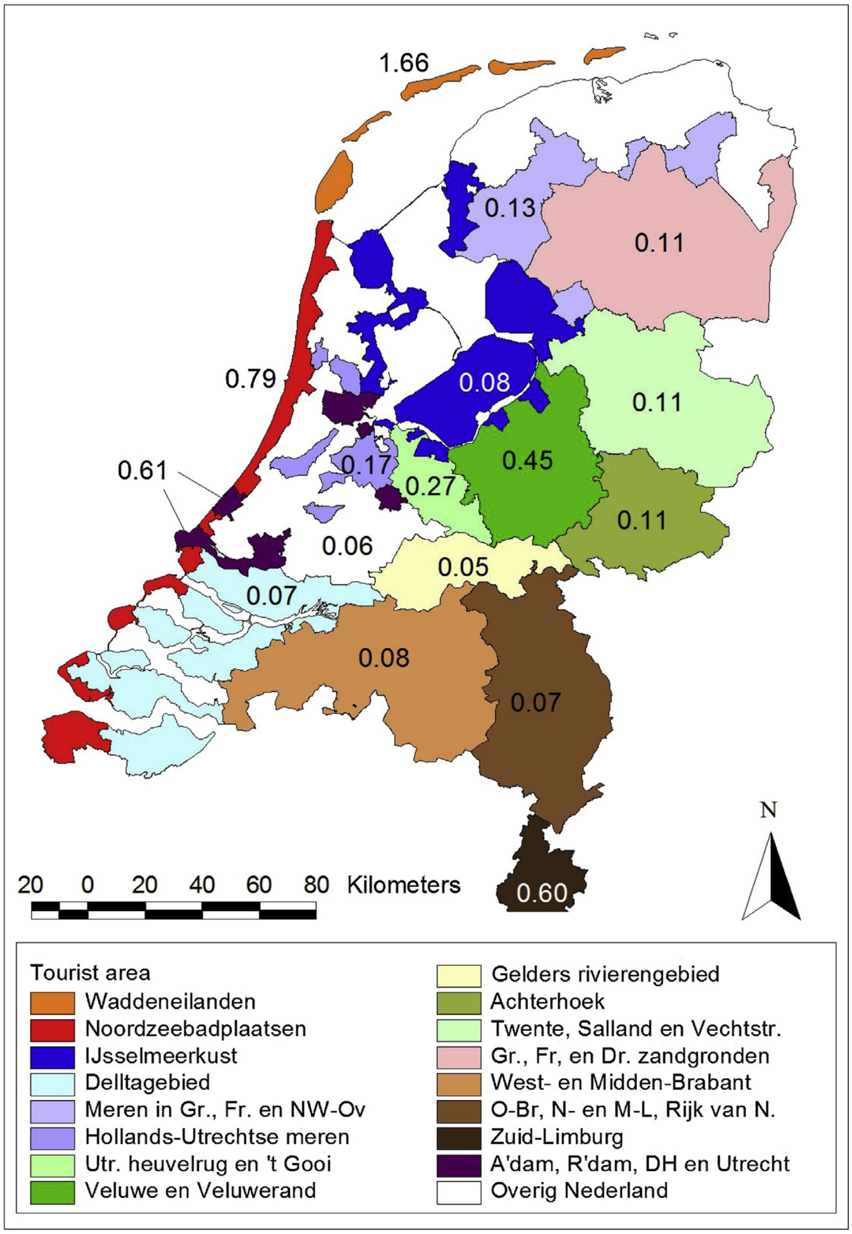

Fig. 4. Tourist areas with overall density of markers per km^2 within the area.

exemplars of such places. However, whatever the reason, the conclusion is that for a representative map of the natural places that are highly attractive to the population at a national level, the sample should not only be representative in a demographic and socio-economic sense but also in a spatial sense.

Why did people consider the natural places they marked as attractive?

The qualities or values people mention in connection to the places they mark are quite similar for all spatial levels. In addition to the qualities that are more or less already implied in the definition of natural places (green, presence of water and natural), quiet is mentioned very often as an attractive quality. This result is consistent with the results of other studies conducted in the Netherlands (De Vries et al., 2007; Lankhorst, De Vries, & Buijs, 2011). To a large extent, the four major national hotspots are ascribed similar qualities as well. There are also, however, differences. For the North Sea coast, presence of water is the top quality, and green is not in the top six qualities, whereas for Veluwe and Southern Limburg, green is the top quality and presence of water is not in the top six. Note that whereas natural is one of the qualities most often mentioned, ecological features (the presence of special animals or plants) are not mentioned very often. This difference leads to the question of what Dutch citizens perceive as (highly) natural (see also Fischer & Van der Wal, 2007; Junker & Buchecker, 2008).

Which (combinations of) characteristics predict a high attractiveness?

The present study only offers a first attempt to identify which characteristics of an area are predictive of its attractiveness. We decided to start with tourist areas. Although they are

Table 7
Overall density and average local density of markers within tourist areas.

Tourist area	Overall density (per km^2)	HSI-score	Average of local densities	Standard deviation densities	Coefficient of variation
Waddeneilanden	1.66	9.8	1.54	1.98	1.29
Noordzeebadplaatsen	0.79	4.7	0.67	1.31	1.94
IJsselmeerkust	0.08	0.4	0.07	0.21	3.07
Deltagebied	0.07	0.4	0.07	0.23	3.54
Meren in Gr., Fr.en NW-Ov	0.13	0.8	0.13	0.35	2.72
Hollands-Utrechtse meren	0.17	1.0	0.17	0.38	2.24
Utr. heuvelrug en ’t Gooi	0.27	1.6	0.27	0.46	1.71
Veluwe en Veluwerand	0.45	2.6	0.44	1.35	3.04
Gelders rivierengebied	0.05	0.3	0.05	0.14	2.72
Achterhoek	0.11	0.6	0.11	0.23	2.11
Twente, Salland en Vechtstr.	0.11	0.7	0.11	0.35	3.10
Gr., Fr. en Dr. zandgronden	0.11	0.6	0.11	0.31	2.92
West- en Midden-Brabant	0.08	0.4	0.08	0.28	3.72
O—Br., N- en M-L., Rijk van N.	0.07	0.4	0.07	0.22	3.14
Zuid-Limburg	0.60	3.5	0.59	1.22	2.06
A’dam, R’dam, DH en Utrecht	0.61	3.6	0.64	2.46	3.81
Overig Nederland	0.06	0.3	0.05	0.23	4.14
The Netherlands	0.17	1.0			

Note: overall density is based on all markers within the area, whereas local density is based on a 250 × 250 m raster with a 1-km radius.

administrative units, to some extent each tourist area is assumed to be homogeneous and different from the other areas in terms of the landscape and the nature-based recreation opportunities it offers (or cultural activities, in the case of the four largest cities). The marker density differed considerably per tourist area. Moreover, the marker density was highly correlated with the density of overnight holiday stays in these same areas. So the (unspecified) attractiveness of a region at the national level coincided strongly with its popularity as a holiday destination among the Dutch. The stated preferences generated by the HSM-tool converged with the preferences revealed by holiday behavior. Both methods inform each other (Sijtsma & Brouwer, 2011). For example, besides landscape characteristics the presence of holiday accommodations (hotels, holiday resorts and campgrounds) is likely to contribute to whether a location receives markers. This presence need not be evenly spread within the tourist area and potentially could be used to better predict hotspots within a tourist area. The direction of causality of the relationship between the scenic beauty of the landscape (attractiveness in a more narrow sense) and the presence of holiday accommodations remains open to discussion. This is not the case for the presence of natural and forest: we consider the observed high marker density in natural and forest areas to be a direct result of people’s preference for these types of land use over other types. As for the selection of natural places at the national level because they constitute attractive holiday destinations, this may not be true in all cases. We already mentioned the spatial discounting for all places except for the four identified major hotspots. In our opinion, distance is unlikely to be a very important factor for domestic holiday destinations because in the Netherlands, the maximum distances are relatively short within a holiday time frame. This result suggests that some of the marked places at the national level are attractive for other reasons, perhaps as destinations for day trips. It was somewhat surprising that the tourist area consisting of the four largest cities (municipalities) of the Netherlands had a high density of markers, given that the markers had to be placed in natural areas. Of course, cities have green areas as well, and some urban parks are quite popular (although they are unlikely to constitute holiday destinations in and of themselves).

Strengths and limitations of the HSM and future research

Compared to traditional questionnaires, the HSM is flexible in its use and allows for a high level of spatial detail. For example, the maps upon which the respondents can place the markers are automatically centered on the place they live. Through this technique, studies may be conducted on a sample of all inhabitants of a country, and the responses may be obtained on different spatial scales. However, despite the high level of spatial detail suggested by the marker, the area that the respondent has in mind is not clearly defined. Moreover, there may be systematic differences in the area implied by the spatial level of the choice set. What one considers a place or an area may be partly a matter of viewing scale. As a consequence, the markers at the national level may generally be meant to implicate larger areas than those at the local level. Moreover, if a marker at the national level signifies an attractive holiday destination, a wider area is likely to be involved. Furthermore, visual inspection suggests that in some cases, the label of a larger area shown in Google Maps may have functioned as an anchor for marker placement, e.g., the name of a national park. This tendency also implies that at least sometimes, much larger areas are implicated. It would be useful to have better knowledge regarding what area the respondent has in mind. Such knowledge would improve the usefulness of the data as input for CBAs: what precisely is the area with which the benefits (and costs) are associated?

One of the strengths of the HSM is that with the HSI, it offers a measurement at a cardinal level for the attractiveness value of a natural area: the number of people who find it highly attractive. However, for the current study, this measurement should be interpreted with some caution, precisely because the HSM only offers information on places that people find highly attractive. Places that only a small percentage of the participants find highly attractive may have a higher marker density than places that are considered just a little less than highly attractive by a large majority of the participants, and these areas may receive no markers at all. Knowing which proportion of the population finds a place highly attractive therefore is not necessarily the same as knowing how attractive a place is considered to be by the population as a whole. This issue can be partially resolved by having people place (and rate) more markers per spatial level. If the social value of a natural place is ultimately defined as the value one derives from visiting or using this place, the lack of markers for slightly less attractive places may matter less, as long as one is willing to assume that people predominantly choose to visit (only) their most attractive place in the available choice set (Sijtsma et al., 2013). Nevertheless, the HSM can already be used to identify areas with a high value to many people; thus, the planners of spatial interventions may wish to proceed with extra caution, so as not to disrupt existing social values.

Another issue that needs to be resolved with regard to the application of the data in CBAs and EIAs is whether and how the information on values gathered for the different spatial levels may be integrated in an overall measure for a place. At the moment, the spatial scales are not mutually exclusive. In addition, although the reasons for finding a place attractive may differ between spatial levels (an issue we will return to in a moment), they may also overlap. Thus, in principle, an individual may mark the same place at all three spatial levels for the same reasons. (Of course, such a place then needs to be located in the local zone.) Should such a place be counted thrice? Another question is whether a marker at one level should have the same weight as a marker at another level. It could be argued that because the higher level offers more places to choose from, a marker at this higher level is more 'valuable'. The fact that the second most attractive place at the national level on average receives a lower rating than the places marked at the regional level (while, in general, places marked at the different spatial levels do not coincide) suggests that participants are indeed more critical at the national level. As mentioned before, the reasons for placing a marker may differ between spatial levels. Whereas at the national level, one might select a place because it is an attractive holiday destination, at the local level, one is unlikely to do so. As a result, a perfect place at the national level may not be a perfect place at the local level, even if it happens to (also) be included in the latter choice set. Note that the above also implies that the relevant physical characteristics for the attractiveness of a place may be different for different spatial levels.

Finally, the HSM is a tool to gather information on the attractiveness of existing places. For CBAs and EIAs, it is also necessary to be able to predict how possible future situations would be valued. Such a prediction requires other methods, such as modeling the social value based on the physical or objective characteristics of the landscape (De Vries et al., 2007). However, model development, calibration and validation benefit from sound empirical data on the variable that one tries to model. Thus, we consider the HSM, although still under development, a promising new tool to assess the attractiveness of natural landscapes. We believe the HSM can contribute to the further development of a well-established method for determining the social valuation of landscapes.

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