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Biodiversity and wind energy in Kenya: Revealing landscape and wind turbine perceptions in the world's wildlife capital

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ABSTRACT

People vary in their perceptions of wind turbines. Perceptions have been well-documented in European and North American studies and have been attributed to constructs like place attachment. *Genius loci*, or "spirit of a place," is an ancient Roman idea that has new relevance in the study of landscape perceptions, including perceptions of wind turbines. As wind energy development expands to developing countries, new studies of public perceptions in unique cultural landscapes are required. We surveyed visitors to Nairobi National Park about their perceptions of the park landscape and the six-turbine Ngong Hills wind farm. Two complementary theories were used to analyze perceptions: place attachment and *genius loci*. The Ngong Hills Wind Farm had a slightly positive effect on the visitors who saw them. Additional turbine development would have no effect on their visitor experience but additional urban growth would have a very negative effect. Responses show that place attachment and *genius loci* explain aspects of visitor perceptions of the Nairobi National Park landscape. The human aspects of the landscape, including wind turbines and the Nairobi skyline, interact with the natural elements and the visitors' own experiences to create a distinct *genius loci* and evokes feelings of place attachment.

1. Introduction

Nairobi, Kenya calls itself "The World's Wildlife Capital" because it claims to be the only capital city that includes a national park dedicated to wildlife preservation. Visitors to Nairobi National Park can see, for example, lions and giraffes juxtaposed against the city skyline. The Kenya Wildlife Service uses this unique contrast as a marketing tool for the park. It is unclear, however, if park visitors see the human-dominated landscape as an intrusion on the park or as an example of sustainable development on a landscape scale.

Wildlife is not Kenya's only natural resource. African countries have significant wind resources most of which are untapped. Researchers estimated that Kenya's technical wind power potential for areas with a capacity factor of 20% or greater is 647 TWh/year. This vastly exceeds its total final electricity consumption of 5.7 TWh/year in 2012. Kenya's wind power potential is ranked 13th out of 48 African countries [24]. Wind power can also be cost-effective in Kenya. Nordman [28] found that wind-generated electricity can be less expensive than grid-based electricity in the best wind resource areas of Kenya's tea-growing regions. All of this suggests that wind power is poised for growth across Africa and especially in Kenya. How these wind energy deployments will be accepted by residents and visitors is unclear. This manuscript is but a small step in understanding the public acceptance of energy infrastructure across a large and diverse continent.

Kenya's first utility scale wind farm sits atop the Ngong Hills west of Nairobi National Park. The wind turbines are approximately 15 km from the park boundary and are visible from within the park (Fig. 1). Previous public perception surveys have indicated that, in some circumstances, utility scale wind turbines can affect recreation experiences. Jacquet and Stedman [14], for example, found that wind turbines had a weakly negative effect on recreational experiences in Pennsylvania, USA. It is unknown if the Ngong Hills Wind Farm affects the experiences of visitors to Nairobi National Park.

The Ngong Hills area is one of the few significant wind resource areas near Nairobi and there is potential for further development there. It is therefore important to understand how the current and potentially increased levels of wind energy development in the region might affect park visitors. Almost all public perception studies of wind energy have been done in developed countries, mainly Europe and North America. Lombard and Ferreira [20] studied per-

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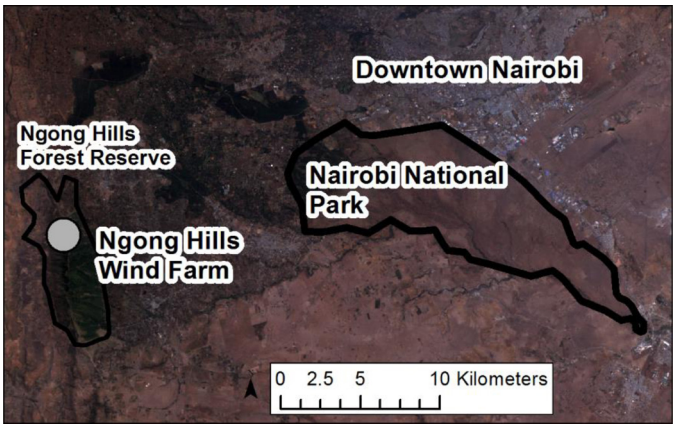

Fig. 1. Study site at Nairobi National Park, Nairobi city center, and the Ngong Hills wind farm.

ceptions of proposed wind farms in South Africa. Wind energy is relatively new to Sub-Saharan Africa and this study would be the first in the region to assess public attitudes toward a constructed and operating wind farm.

The landscape changes around Nairobi National Park present challenges and opportunities for sustainability. This article builds on the idea of a sustainable landscape to investigate the effect of human-made elements of the landscape surrounding Nairobi National Park, namely the Nairobi skyline and the Ngong Hills Wind Farm, on the experience of park visitors.

This article seeks to fill several gaps in the literature. Molnarova et al. [26] suggest that further research should investigate the impact of wind turbines on natural and human-dominated, and especially high-quality, landscapes. Also worthy of research is the character of the landscape in the context of historical development. Sovacool [32] reviewed the contributions of social science to energy research. Among the 75 research questions, he included several relevant to this study, including:

- "How do people's historical behavior and attitudes toward energy influence their use of it today?"
- "Which energy technologies and systems help reduce poverty and meet development goals. . .?"
- "How do the energy security needs of developing countries differ from those of developed countries?"
- "Does a certain energy system harm the environment, degrade the social structure of local communities, or damage traditional culture?"

This paper adds to the literature on the public perceptions of energy and human-dominated landscapes by (1) contrasting perceptions of wind turbines with urban development; (2) describing how energy and urban development contribute toward sustainable development; and (3) contrasting two perspectives on human interactions with the environment.

Two theoretical lenses are used in the research: place attachment and *genius loci* ("spirit of a place"). While not mutually exclusive, the use to two approaches broadens the discourse and allows for additional insights into the public perceptions of human-dominated landscapes. Place attachment refers to how individuals form an identity based on a "sense of place" which, in some cases, can be disrupted by landscape changes including renewable energy projects. Researchers, primarily in the West, have used place attachment to study perceptions of wind turbines and other structures. *Genius loci*, on the other hand, has received less attention and lends a novel element to this study. The results suggest that both place attachment and *genius loci* help explain perceptions of the human-dominated elements of the landscape around Nairobi National Park and both may be useful in other situations. While this manuscript focuses on Kenya, and Nairobi National Park in particular, it is a first step in building a body of knowledge about the public acceptance of energy infrastructure in Africa.

2. Theoretical basis

2.1. Place attachment

The history of place attachment's theoretical development was thoroughly reviewed by Lewicka [19]. Place attachment as a distinct concept emerged within environmental psychology literature during the early 1980s and gained greater attention with the publication of Altman and Low's [1] volume *Place Attachment*. Lewicka [19] found that 60% of all articles in the *Journal of Environmental Psychology* in 2001–2010 featured some aspect of place attachment, up from about 25% in the previous decade.

Researchers have variously described place attachment as a one-dimensional concept alongside place dependence and place identity; as a multi-dimensional construct comprising up to five interrelated elements; or as a component of more general concepts [12]. The research seems to be converging on describing place attachment as "a multidimensional concept with person, psychological process, and place dimensions" [30,p. 1] otherwise known as the PPP framework. The personal dimension involves connections to a place: evocation of memories, milestones, or experiences. This personal dimension can occur at the individual or group level. The psychological process is the mechanism through which the individual or group relates to the place including affect, cognition, and behavior. The locus of attachment – the place dimension – is both social and physical. People, in the words of Scannell and Gifford [30,p. 4], "are attached to places that facilitate social relationships and group identity." The places the inspire attachment range from built environments to rural regions to wilderness areas.

Seamon [31], working from a phenomenological perspective, identified and described six processes that contribute to the structure and dynamics of a place as it is experienced by residents and visitors. These processes may support or erode a person's place attachment.

1. Place interaction: the typical actions, behaviors, and events occurring in a place.
2. Place identity: the process by which people recognize a place as a meaningful part of their worlds.
3. Place release: the pleasure of surprising and welcome encounters.
4. Place realization: the recognition of a distinct character or ambiance evoked by a place.
5. Place creation: the intentional improvement of a place through human activity.
6. Place intensification: the ability of physical and designed environments to affect human actions and experiences.

Though much of the early literature on place attachment focused on permanent residences, interest in attachment to recreation spaces has grown significantly. Studies have shown that, consistent with the theoretical foundations of place attachment, permanent residents have a stronger sense of place attachment than tourists and seasonal residents (e.g. Ref. [16]). There is evidence, however, that length of residence is associated with the social aspect of the place dimension of place attachment, but not with the physical or natural aspect [30]. That is, permanent residents may have strong social ties to a place than visitors leading to an overall higher degree of place attachment. Temporary residents and visitors may exhibit

strong feelings of place attachment based primarily on the physical or natural aspects of the place. Similarly, Stedman [33] found that seasonal residents and tourists form place attachments based on recreational activities and environmental qualities while permanent residents derive attachment from social networks.

2.2. Genius loci

Genius loci ("spirit of a place") is a place-based concept dating back to Roman times. According to Roman lore, a guardian spirit, or *genius*, determined the character of each independent being and place [27]. Conzen [4,pp. 56–57], quoted in Jivén and Larkham [15]) defined *genius loci* as a region's "culture- and history-conditioned character which commonly reflects not only the work and aspirations of the society at present in occupancy but also that of its precursors in the area." *Genius loci* is an integrated totality comprising man-made structures in a meaningful relationship with a natural place [27]. In this sense, *genius loci* embodies Seamon's [31] phenomenologically-based processes of place attachment, specifically place realization, place creation, and place intensification. Seamon's dynamic processes align with the ideas of Norberg-Schulz [27] in that a changing landscape is inevitable, but change does not necessarily mean that the *genius loci* is diminished. For example, urban development may visibly change the landscape, but such a change may or may not be consistent with the region's *genius loci*. Seamon's six-point process, therefore, provides an important link between the ideas of place attachment and *genius loci.*

2.3. Applications in renewable energy

Place attachment has been widely applied to understand the perceptions of, and in some cases opposition to, wind energy development. Patrick Devine-Wright has written extensively on place attachment (for example, [23] and its applications to energy landscapes. A strong critic of the "Not In My Backyard" (NIMBY) approach, Devine-Wright advocated for a more nuanced approach explaining place-protective action through place attachment [6,7]. Landscapes are dynamic and place attachment can evolve as the landscapes change. Changes that enhance the landscape are more likely to be accepted than those that are disruptive [8]. Hall et al. [11] found that strong feelings of place attachment, along with trust, distributional justice, and procedural justice, conflicted with wind farm development in Australia.

Maarten Wolsink has also made significant contributions on the public perceptions of renewable energy facilities (e.g., Refs. [37–39]). Wolsink [39] noted that public attitudes toward wind power are general positive, whereas attitudes toward particular wind farms is often negative. In his words, "It's the landscape, stupid!" [39,p. 2695]. Landscapes that elicit low levels of place attachment, such as industrial areas and military facilities, were shown to be more compatible with wind energy development. The cumulative effect of additional wind turbine development is also relevant to this study. Ladenburg et al. [18] found that, under certain conditions, additional wind turbine development can lead to a crowding effect with more negative perceptions among those who see turbines during the daily routine.

Lombard and Ferreira [20] assessed attitudes toward potential wind farm sites in South Africa—perhaps the first such assessment in Sub-Saharan Africa. They used place attachment as a theoretical lens to evaluate how a proposed wind farm might affect the natural landscape and tourism. The methods included a quantitative survey, semi-structured interviews, and group discussions. Area residents reported a strong sense of place attachment and regarded the physical landscape as very special. Somewhat surprisingly, about three-quarters of those who said the physical landscape is special were supportive of wind turbines in the region. Lombard and Ferreira interpret this finding to mean that these residents believe wind turbines might actually enhance the landscape.

In contrast to place attachment, *genius loci* has most often been applied in architecture, geography, and urban landscapes, but has rarely been applied to renewable energy. Bell [2], writing about biomass energy forest cultivation, described the energy forest landscape "in terms of its shape and scale, the degree of diversity contained in it, its inherent unity and its '*genius loci*'. . ." Landscape architect Migliori et al. [25] encouraged her colleagues to invoke a city's *genius loci* and incorporate energy, such as water, wind, and kinetic energy, into their designs. Others applied *genius loci* to develop public engagement tools for offshore wind energy development in Michigan, USA [29]. No previous studies have used *genius loci* to describe and explain the perceptions of wind turbines, nor have studies attempted to measure *genius loci* through a quantitative survey instrument.

Genius loci and place attachment may be useful in addressing some of the key questions Sovacool [32] posed regarding energy research and social science. *Genius loci* in particular may help elucidate a region's "culture- and history-conditioned character" [4,pp. 56–57] and how that affects its relationship to energy infrastructure and other aspects of the built environment. Because it includes aspirations for the future, *genius loci* can help researchers and communities understand how a 21st century energy system can be integrated into a sustainable landscape.

2.4. Visual impact of wind turbines

During the last 15 years, researchers have applied quantitative measures of visual impact to the issue of wind turbines. Bishop [3], for example, modeled different aspects of turbine visibility (detection, uninformed and informed recognition, and impact) at various distances. The simulated turbine was 50 m tall, about the same height as those in the Ngong Hills Wind Farm. Estimates of turbine visibility drop sharply between six and twelve kilometers under most conditions. Under the conditions most favorable to visibility (55% contrast and clean air), the probability of detection at 20 km was 50%. Under favorable, but more typical, conditions, about ten percent of viewers would detect and recognize a turbine at 20 km. An assessment of a wind farm in Crete, similar in size and context to the Ngong Hills site, used the "Spanish Method" (Hurtado et al. [13]; reviewed and revised in Manchado et al. [22]) to evaluate the visual impact. The five-turbine wind farm was found a medium visual impact on the neighboring villages which were less than 2 km away [35].

Visibility, however, is not the only consideration. Landscape quality can influence how the turbine is perceived. Lothian [21] found that wind turbines have a negative effect on landscape quality on high-quality (coastal, mountain) landscapes but a positive effect on low-quality (agricultural) landscapes, even at distances as great as 11 km. Similarly, researchers in the Czech Republic found that viewers had lower preferences for simulated views of wind turbines in attractive and average landscapes than in less attractive landscapes [26].

These and other studies suggest that the Ngong Hills Wind Farm will be visible to at least some Nairobi National Park visitors and may have a modest, but measurable, effect on visitor experiences. By comparing and contrasting place attachment and *genius loci*, the study offers a richer picture of how wind turbines and urban development – and human dominated landscapes more generally – affect the quality of the landscape and our place in it. It also brings *genius loci* – a modern interpretation of an ancient concept – squarely into the discussion of public perceptions of energy landscapes.

2.5. Measuring place attachment and genius loci

Hernandez et al. [12] reviewed the theoretical and methodological approaches used in place attachment research. They noted that researchers have tended to develop new metrics for measuring place attachment with each new paper. Quantitative surveys based on Likert-type items and scales are common although qualitative and mixed-methods approaches area also used. Hernandez et al. [12] found that the statistical approaches fall into three categories: (1) those that report global scores of the survey instruments; (2) those that describe relationships between place attachment and other place based-concepts; and (3) those that compare the degree of place attachment among different groups. They also note that much of the literature to this point has been descriptive but, as the field matures, is tackling higher order analytical questions and building theory. In order to progress, the field needs to converge on an accepted set of scales that measure a well-defined concept of place attachment. The work described herein falls into the second category: describing the relationship between place attachment and *genius loci*.

Lewicka [19] offered three directions for future studies of place attachment: (1) to study place attachment within a broader social context including community empowerment; (2) to emphasize the physical nature of places and how that influences attachment; and (3) to describe processes through which people form meaningful connections to places. Following Lewicka's suggestions, this manuscript attempts to expand the study of place attachment by connecting place attachment to *genius loci* and, in doing so, understand how people create meaningful relationships with the physical and cultural nature of particular places.

3. Methods

3.1. Study area: Nairobi National Park and Ngong Hills

According to Steinhart [34], Nairobi National Park was created by the British colonial government in 1946 in response to changing values regarding game preservation. During the 1930s, concerns about soil conservation and smuggling of ivory and other trophies prompted the government's Game Department to begin to shift its priorities from hunting licensing and game control toward preservation. Mervyn Cowie, a white Kenyan-born settler, championed the idea of a national park like the United States' Yellowstone. World War II, however, delayed the establishment of Nairobi National Park until 1946. Nairobi National Park now occupies land that was formerly the Nairobi Commonage south of the capital [34]. Today the 117 km^2 park is managed by the Kenya Wildlife Service and more than 100,000 people visit the park each year [17].

Nairobi National Park is home to four of Africa's "big five" animals: Cape buffalo (*Syncerus caffer*), African lion (*Panthera leo*), African leopard (*Panthera pardus*), and black/white rhinoceros (*Diceros bicornis*/*Ceratotherium simum*) [17]. It lacks African elephants (*Loxodonta africana*), though the David Sheldrick Wildlife Trust and its orphan-elephant rehabilitation center is adjacent to the park. The park's unfenced southern border allows for the migration of wildebeest (*Connochaetes taurinus*), zebra (*Equus quagga*), and other mammals into the Athi-Kapiti plains. The park is primarily a savanna grassland with a dry climate [5].

The Ngong Hills to the west of Nairobi mark the eastern edge of the Rift Valley. The wind farm site at the Ngong Hills Forest Reserve is at about 2200 m above sea level. The hills rise some 500 m above the plains of the park. At the time of the survey in 2013, the Kenya Electricity Generation Company (KenGen) operated six turbines at the site with a total generating capacity of 5.1 MW. In 2014 KenGen completed construction of 16 additional utility scale turbines [10]. The turbines are about 15 km from the closest border of the national park. Based on the visual impact estimates of Bishop [3], about ten percent of viewers would be expected to detect and recognize the turbines from within the park.

3.2. Survey instrument

A visitor survey was used to address two key research questions:

1. Does the visual impact of the man-made landscape elements, including the Nairobi city skyline and the Ngong Hills wind farm, affect, positively or negatively, the experiences of visitors to Nairobi National Park?
2. In what ways are visitors affected and by what mechanism (place attachment and/or *genius loci*)?

Six hypotheses were derived from the two research questions:

- $H1_0$: Nairobi National Park and the surrounding landscape is similar in landscape character (*genius loci*) to other that of other Kenyan parks and landscapes.
- $H2_0$: The Nairobi skyline has no effect on the landscape character (*genius loci*) of Nairobi National Park and the surrounding landscape.
- $H3_0$: The wind farm has no effect on the landscape character (*genius loci*) of Nairobi National Park and the surrounding landscape.
- $H4_0$: Visitors have a sense of place attachment toward Nairobi NP and the surrounding area that is neither weak nor strong.
- $H5_0$: The Nairobi skyline has no effect on place attachment.
- $H6_0$: The wind farm has no effect on place attachment.

The population from which the sample was drawn is the Nairobi National Park visitors, which receives about 100,000 visits annually. A 5% error would require 383 responses. 422 surveys were returned across five convenience-sampling dates that included weekends and weekdays in late May and early June 2013, including Madaraka Day (a holiday commemorating Kenya's independence). The surveys were distributed to all vehicles entering the park's main gate and collected as they left. Traffic into and out of the park is carefully controlled so it was relatively easy to distribute the surveys to the visitors as they waited to enter. The response rate was 64.7% (652 attempts). Common reasons for non-response included "were too excited looking at the animals and forgot;" "weak English language skills;" and "didn't have time." One survey was given to each private vehicle. In addition, surveys were distributed to visitors taking the Kenya Wildlife Service's Sunday afternoon bus tours. Only visitors over 18 years of age were surveyed. Visitors were told that the survey focused on the skyline and Ngong Hill Wind Farm and they were instructed to look for these features during their park visit. Though this instruction may result in more people seeing the wind farm than otherwise would have, it is not any different from showing someone a picture of a hypothetical wind farm—a common research technique.

The survey instrument asked about demographic information (age, gender, residence), level of environmental concern, overall park visit satisfaction, status as a first-time or return visitor, mode of transportation (Kenya Wildlife Service bus, private vehicle, or other), whether the respondent saw the Nairobi skyline or the Ngong Hills wind farm, and whether the respondent had previously seen a wind turbine in person. The quantitative questions used a seven-point Likert-type scale to elicit responses about landscape character (*genius loci*) and place attachment (Table 1). Comment boxes at the end of the landscape character and place attachment section enabled visitors to further explain their responses.

Table 1
Likert-type and open-ended survey questions.

General and demographic questions
Q1. What is your age?
Q2. What is your gender?
Q3. Where is your home?
Q4. How concerned are you about environmental problems in Kenya? (Likert item)
Q5. How satisfied are you with today's park visit? (Likert item)
Q6. What was the most important reason for your level of satisfaction? (open ended)
Q7. Had you visited Nairobi National Park before today? (yes, no)
Q8. How did you tour the park today (KWS bus, private car, other)
Q11. Did you see the buildings and skyline of Nairobi during your park visit?
Q15. Had you seen a wind turbine (windmill) in person before day?
Q16. The Ngong Hills Wind Farm generates electricity for the Nairobi area. Did you see the turbines of the Ngong Hills Wind Farm during your visit to Nairobi National Park today?
Questions about landscape character (*genius loci*) (Hypotheses 1, 2, and 3)
Q9. Relative to other parks and landscapes in Kenya, to what degree do the natural and man-made parts of the landscape in and around Nairobi National Park blend together to make a meaningful whole?
Q10. To what degree does the landscape of Nairobi National Park and the surrounding area reflect the potential for sustainable development in Kenya?
Q12. What kind of effect did seeing the city skyline have on your park visit?[a]
Q13. Landscape character is the way the natural and man-made parts of the landscape blend together to make a meaningful whole. In your opinion, what kind of effect does the view of the skyline have on the landscape character of Nairobi National Park and the surrounding areas?[a]
Q14. What kind of effect do you think **additional** residential, business, and manufacturing development outside the park would have on the landscape character of Nairobi National Park and the surrounding area?[a]
Q17. What kind of effect did seeing the wind turbines have on your park visit today?[a]
Q18. Landscape character is the way the natural and man-made parts of the landscape blend together to make a meaningful whole. In your opinion, what kind of effect does the view of the Ngong Hills Wind Farm have on the landscape character of Nairobi National Park and the surrounding areas?[a]
Q19. What kind of effect do you think **ten (10) additional** wind turbines in the Ngong Hills would have on the landscape character of Nairobi National Park and the surrounding area?[a]
Questions about place attachment (Hypotheses 4, 5, and 6)
Q20. If you had the opportunity, would you visit Nairobi National Park again?
Q21. When you are away from Nairobi National Park, will you (or do you) have pleasant memories and feelings about the park and surrounding landscape?
Q22. How intense is your sense of personal connection to Nairobi National Park and the surrounding area?
Q23. What kind of effect does the view of the Nairobi city skyline have on your sense of personal connection to Nairobi National Park and the surrounding area?[a]
Q24. What kind of effect does the view of the Ngong Hills Wind Farm have on your sense of personal connection to Nairobi National Park and the surrounding area?[a]

[a] Answered only if visitor reported seeing the skyline or wind turbines.

The survey was piloted and revised based on feedback from visitors and colleagues. One of the authors (J. Mutinda) is a Kenyan citizen and reviewed the questions as culturally appropriate and clear to those for whom English is a foreign language. The survey was conducted with the permission and assistance of the Kenya Wildlife Service.

The questions about place attachment relate to the person-process-place framework of place attachment [30]. The question about having pleasant memories of the park relates to the personal dimension and is derived from the "place-referent continuity" aspect of place identify [36,30]. The question about visiting the park again, if given the opportunity, relates to the psychological process aspect of the process dimension. The psychological process dimension of place attachment includes affect, cognition, and behavior. Scannell and Gifford [30] suggest that the proximity-maintaining behaviors, including efforts to return to a particular place, is a measurable aspect of place attachment. The physical features of a place may influence place attachment through what Stedman [33] calls the meaning-mediated model. People, in this case visitors, associate meanings to a place's physical features and become attached to those meanings. The question about the intensity of personal connection to the park related to the place dimension. Questions about the specific landscape attributes, namely the Nairobi skyline and wind farm, related to the physical aspects of place based on the meaning-mediated model. The questions are based on well-established concepts of place attachment though they do not replicated precisely the wording of previous studies. This is a common practice but also inhibits theoretical progress within the field, as noted earlier. The authors acknowledge the limitations of this method.

3.3. Data analysis

The response distributions from the Likert-type items were analyzed using the chi-square goodness of fit test. All questions in the groups tested for different aspects of the same phenomenon and featured the same Likert responses. Each null hypothesis assumed an equal distribution across responses.

4. Results

There was no difference in the distribution of responses across the five sampling dates for any of the key variables (chi-square, $p > 0.10$) therefore allowing the aggregation of the responses.

4.1. Demographic results

Results of the demographic and general questions are summarized in Table 2. Survey respondents had a mean age of 36.7 years. Men composed just over half of the respondents (57%). About two-thirds of respondents were Kenya residents and a slight majority (55%) were return visitors. Most toured the park by private vehicle (79%) and the rest used the KWS bus. Visitors, in general, reported being *concerned* about environmental issues in Kenya (Q4) and were *satisfied* with their park visit (Q5) (Table 3). Visitors' level of concern was significantly positively correlated with one of the measures of place attachment (Q22 personal connection to NNP,

Table 2
Summary statistics for demographic responses.

Variable	*n*	Statistic
Age	406	Mean = 36.7
Gender	413	56.7% male, 43.3% female
Home location	420	63.4% in Kenya, 36.6% outside
Return visitors	419	55% return visitors, 45% first time
Vehicle type	422	78.7% private vehicle, 21.3% public bus

Kendall's tau = 1.33, $p < 0.05$) but with none of the measures of *genius loci*.

The Ngong Hills Wind Farm is 15 km away from the park and, though it is clearly visible from within the park, its visual impact is relatively small. More than half of the respondents (63%) had seen a wind turbine before (Q15). Only 29% of survey respondents reported seeing the Ngong Hills Wind Farm on that day's visit (Q16). The large majority of park visitors did not see the turbines even when prompted to look for them. Some respondents informally reported (verbally or notes on the response sheet) that they did not notice the turbines because they were looking at the animals. That is, the appeal of the park is a close-up experience with wildlife rather than broad, scenic vistas. The turbines are up on the hill about 15 km away and are not looming over the park. On the other hand, almost all respondents (92%) reported seeing the Nairobi city skyline.

The demographic profile of park visitors who reported seeing the turbines were not significantly different from those who did see them in terms of age, gender, or visitor satisfaction. The two areas in which the groups differed were in reported concern for environmental issues and residency. Those who did and did not see the turbine both had a median response of 6 (*concerned*) but those who saw the turbine had a higher mean response (5.75) compared to those who did not (5.37). Their distributions were significantly different ($\chi^2 = 17.32$, $p = 0.01$). Among those who saw the turbines, 81% reported Kenya residency compared to 56% of those who did not see them. The difference was statistically significant ($p < 0.01$).

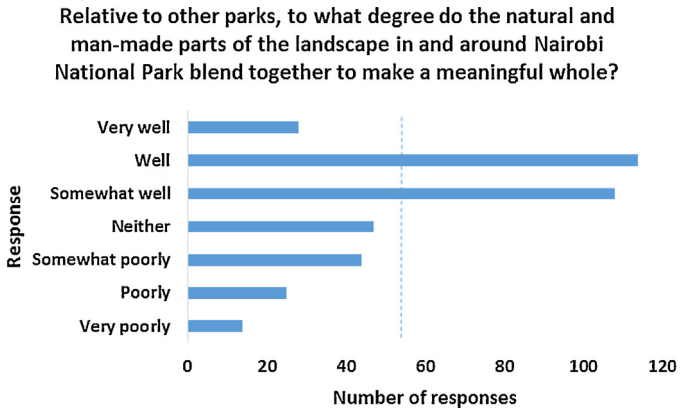

Fig. 2. Response frequencies for Q9. The distribution was significantly different from the expected distribution ($\chi^2 = 180.2$, $p < 0.05$, $n = 380$) with a median of 5 (somewhat well). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

In general, those who saw the turbines were relatively similar to those who did not with the exception of Kenya residency.

4.2. *Hypotheses 1–3: landscape character (*genius loci*)*

$H1_0$. Nairobi National Park and the surrounding landscape is similar in landscape character (*genius loci*) to other that of other Kenyan parks and landscapes.

Our definition of landscape character (*genius loci*) included two parts: how the landscape elements blend together into a meaningful whole and how it reflects the potential for sustainable development. Survey respondents indicated that natural and man-made parts of the landscape in and around NNP blend together into a meaningful whole *somewhat well* (Table 3, Fig. 2, Q9, median = 5, mode = 6, $\chi^2 = 180.2$, $p < 0.05$, $n = 380$). Similarly, visitors stated that

Table 3
Chi square tests for key variables.

Question	*n*	Median	χ^2
General visitor questions			
Q4. How concerned are you about environmental problems in Kenya?	416	6 (Concerned)	347.1*
Q5. How satisfied are you with today's visit?	362	6 (Satisfied)	316.6*
Q11. See the Nairobi skyline?	409	92.4% yes	
Q15. See a wind turbine before?	391	62.8% yes	
Q16. Did you see the Ngong Hills Wind Farm today?	383	29.0% yes	
H1: NNP's landscape character			
Q9. Meaningful Whole	380	5 (somewhat well)	180.2*
Q10. Sustainable Development	381	5 (somewhat strongly)	100.2*
H2: Skyline effect on landscape character			
Q12. Skyline effect on visit	387	4 (no effect)	66.0*
Q13. Skyline character	377	4 (no effect)	92.6*
Q14. Skyline additional	379	2 (negative effect)	308.2*
H3: Wind farm effect on landscape character			
Q17. Turbine effect on visit	108	5 (slightly positive effect)	42.4*
Q18.Turbine character	110	4.5 (no/slightly positive effect)	21.0*
Q19. Turbine additional	111	4 (no effect)	10.4
H4: Visitors' sense of place attachment			
Q20. Visit again	396	6 (yes)	387.1*
Q21. Pleasant memories	395	6 (yes)	344.6*
Q22. Personal connection	383	5 (somewhat strong)	199.0*
H5: Skyline effect on place attachment			
Q23. Skyline connection	359	4 (no effect)	46.9*
H6: Wind farm effect on place attachment			
Q24. Turbine connection	103	4 (no effect)	30.7*

* $p < 0.05$.

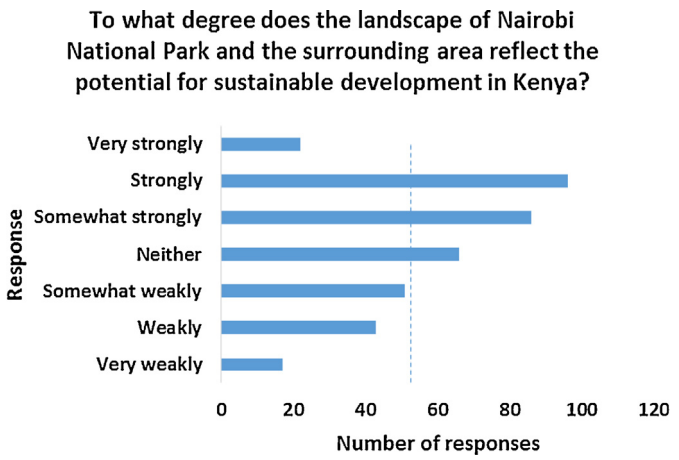

Fig. 3. Response frequencies for Q10. The distribution was significantly different from the expected distribution ($\chi^2 = 100.2$, $p < 0.05$, $n = 381$) with a median of 5 (somewhat strongly). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

the landscape in and around NNP reflects the potential for sustainable development in Kenya *somewhat strongly* (Table 3, Fig. 3, Q10, median = 5, mode = 6, $\chi^2 = 100.2$, $p < 0.05$, $n = 381$). Responses to both questions were significantly different from the expected distribution ($p < 0.05$) and both distributions were unimodal with clear peaks around the median response.

Taken together the responses to the two questions suggest that Nairobi National Park does have a unique "spirit of a place" that positively integrates the various landscape elements and reflects the potential for Kenya's sustainable development. The null hypothesis can be rejected.

$H2_0$. The Nairobi skyline has no effect on the landscape character (*genius loci*) of Nairobi National Park and the surrounding landscape.

Responses to questions about the Nairobi city skyline's effect on the landscape character were only included if the responded answered affirmatively to seeing the skyline during the park visit. The skyline in general had *no effect* on visitors' experience in the park (Table 3, Fig. 4, Q12, median = 4, mode = 6, $\chi^2 = 66.0$, $p < 0.05$, $n = 387$). The response distribution with bimodal with peaks at *positive* (6) and *negative* (2) which canceled each other. Visitors also noted that the Nairobi city skyline had *no effect* on the landscape character (*genius loci*) of NNP and the surrounding area (Table 3, Fig. 5, Q13, median = 4, mode = 6, $\chi^2 = 92.6$, $p < 0.05$, $n = 377$). This

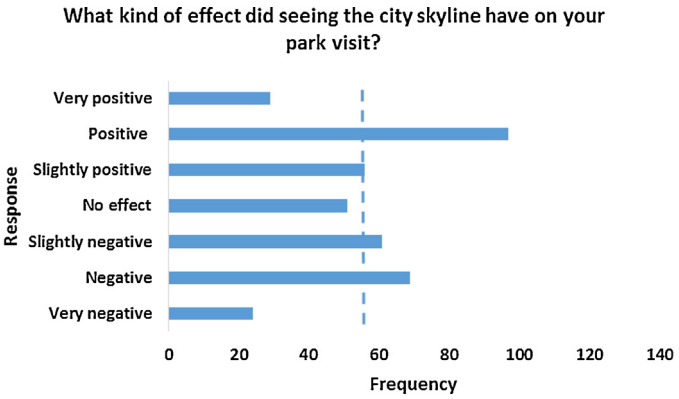

Fig. 4. Response frequencies for Q12. The distribution was significantly different from the expected distribution ($\chi^2 = 66.0$, $p < 0.05$, $n = 387$) with a median of 4 (no effect). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

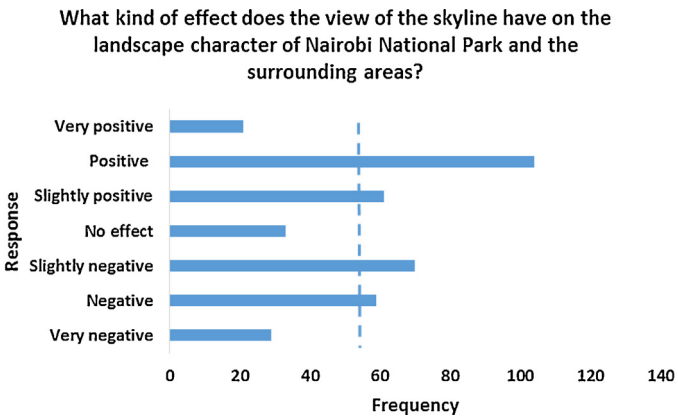

Fig. 5. Response frequencies for Q13. The distribution was significantly different from the expected distribution ($\chi^2 = 92.6$, $p < 0.05$, $n = 377$) with a median of 4 (no effect). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

also had a weakly bimodal distribution with a clear peak at *positive* (6) and a smaller peak at *slightly negative* (3). Visitors did, however, state that additional development would have *a negative effect* on the area's landscape character (*genius loci*) (Table 3, Fig. 6, Q14, median = 2, mode = 2, $\chi^2 = 308.2$, $p < 0.05$, $n = 379$). The response distribution was clearly unimodal with a peak at the median. Several visitors commented that additional residential development at the edge of the park was more intrusive than additional skyscraper development further from the park.

Responses to the first two questions suggest that the Nairobi city skyline, in its present form, does not consistently affect the landscape character either positively or negatively. Additional construction, however, would negatively affect the landscape character. Some comments distinguished between the skyscrapers of Nairobi's central business district, which are more acceptable, and the residential condominium developments that are sprouting up close to the park (less acceptable).

The results suggest that the present configuration of the Nairobi city skyline has no effect on the landscape character (*genius loci*) of the park and the null hypothesis cannot be rejected.

$H3_0$. The wind farm has no effect on the landscape character (*genius loci*) of Nairobi National Park and the surrounding landscape.

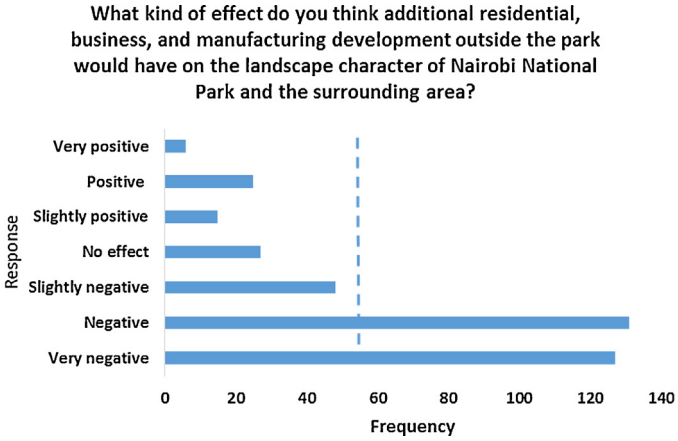

Fig. 6. Response frequencies for Q14. The distribution was significantly different from the expected distribution ($\chi^2 = 308.2$, $p < 0.05$, $n = 379$) with a median of 2 (negative). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

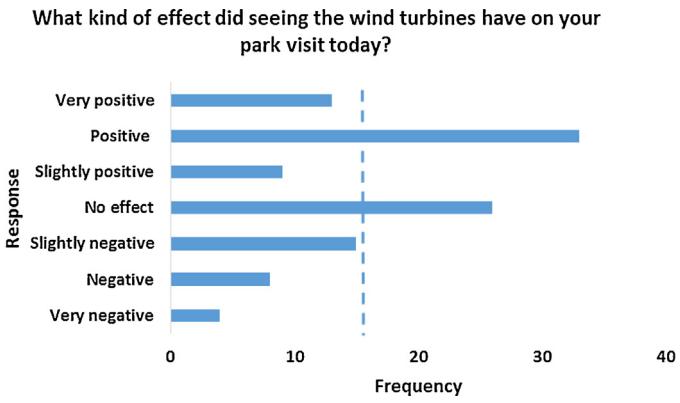

Fig. 7. Response frequencies for Q17. The distribution was significantly different from the expected distribution ($\chi^2 = 42.8$, $p < 0.05$, n = 108) with a median of 5 (slightly positive). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

Responses to questions about the wind farm's effect on the landscape character were only included if the responded answered affirmatively to seeing the wind turbines during the park visit. For the minority of visitors that saw the wind farm, they reported it having a *slightly positive effect* on their park experience (Table 3, Fig. 7, Q17, median = 5, mode = 6, $\chi^2 = 42.4$, $p < 0.05$, $n = 108$). The turbines had a *very slightly positive effect* on the landscape character in and around NNP (Table 3, Fig. 8, Q18, median = 4.5, mode = 6, $\chi^2 = 21.0$, $p < 0.05$, $n = 110$). Responses to both of these questions had bimodal distributions with peaks at the *positive* and *no effect* responses.

The response to whether additional turbines would have an effect on the landscape character of the park and surrounding area was inconclusive. The distribution of responses was not significantly different from the expected distribution (Q19, median = 4, mode = 22, $\chi^2 = 10.4$, $p > 0.05$, $n = 111$).

Taken together, the responses indicate that the wind farm has a small positive effect on the park's *genius loci*. For those visitors who see the wind farm, the turbines may be symbolic of the "cultural- and history-conditioned character" [4,pp. 56–57] of the region and its aspirations for sustainable development. The null hypothesis can be rejected.

The wind turbines, to the extent that they are noticed, are viewed more positively than the Nairobi city skyline. Wind turbines seem to enhance the area's *genius loci*, whereas the skyline has no effect. The difference is especially evident with regard to the prospect of additional development. The residential development

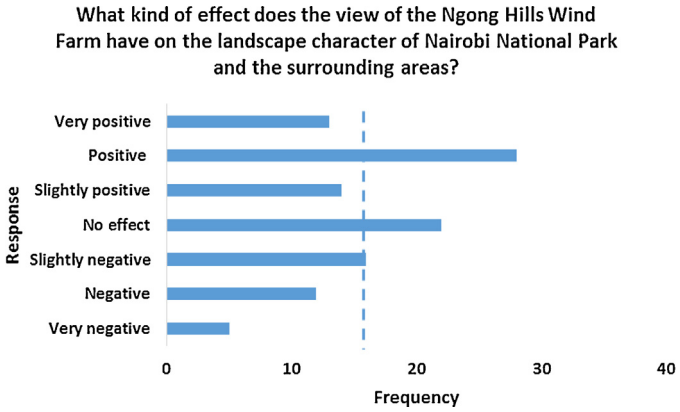

Fig. 8. Response frequencies for Q18. The distribution was significantly different from the expected distribution ($\chi^2 = 21.0$, $p < 0.05$, n = 110) with a median of 4.5 (no effect/slightly positive). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

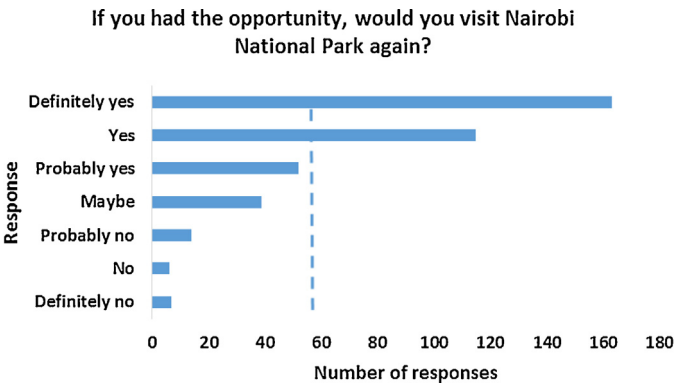

Fig. 9. Response frequencies for Q20. The distribution was significantly different from the expected distribution ($\chi^2 = 387.1$, $p < 0.05$, n = 396) with a median of 6 (yes). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

is occurring right outside the park whereas the wind farm is 15 km away.

4.3. Hypotheses 4–6: place attachment

$H4_0$. Visitors have a sense of place attachment toward Nairobi NP and the surrounding area that is neither weak nor strong.

Our definition of place attachment included three aspects: whether a visitor would come again, whether the place evokes pleasant memories, and the strength of a person's connection to the place. Three questions addressed the different dimensions of place attachment. Visitors said that if given the opportunity, most *would visit* NNP again (Table 3, Fig. 9, Q20, median = 6, mode = 7, $\chi^2 = 387.1$, $p < 0.05$, $n = 396$). Visitors, in general, *will have pleasant memories* of NNP (Table 3, Fig. 10, Q21, median = 6, mode = 6, $\chi^2 = 344.6$, $p < 0.05$, $n = 395$) and have a *somewhat strong personal connection* to NNP (Table 3, Fig. 11, Q22, median = 5, mode = 6, $\chi^2 = 199.0$, $p < 0.05$, $n = 383$). The response distributions of all three questions were unimodal with peaks around the median.

Taken together the responses indicate that park visitors have a relatively strong sense of place attachment to Nairobi National Park. The null hypothesis can be rejected.

$H5_0$. The Nairobi skyline has no effect on place attachment.

Question 23 asked visitors how the Nairobi city skyline affected their sense of personal connection to NNP. Visitors generally responded that the skyline had *no effect* on their personal connection to the park (Table 3, Fig. 12, Q23, median = 4, $\chi^2 = 46.9$,

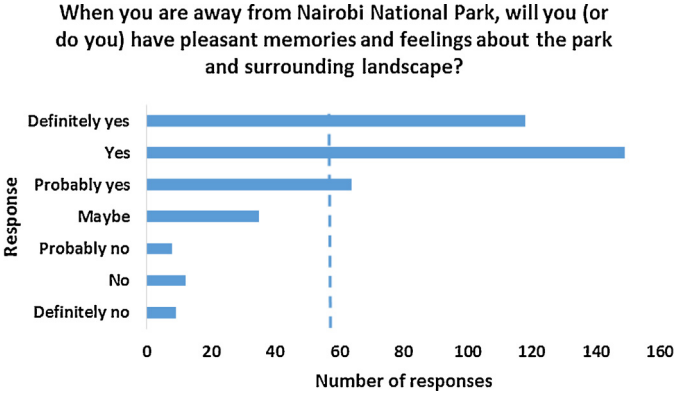

Fig. 10. Response frequencies for Q21. The distribution was significantly different from the expected distribution ($\chi^2 = 344.6$, $p < 0.05$, n = 395) with a median of 6 (yes). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

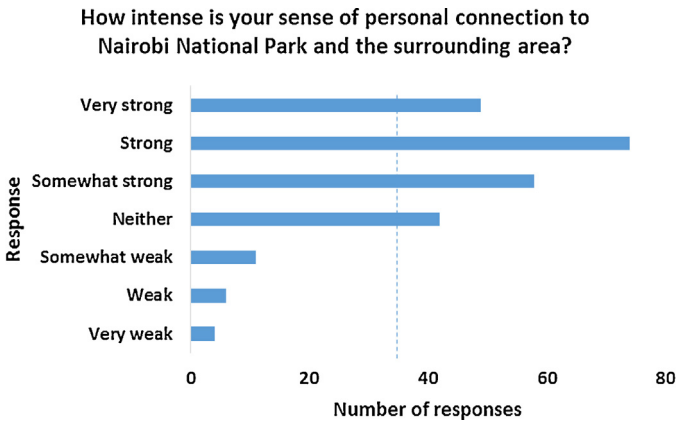

Fig. 11. Response frequencies for Q22. The distribution was significantly different from the expected distribution ($\chi^2 = 199.0$, $p < 0.05$, $n = 383$) with a median of 5 (somewhat strong). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

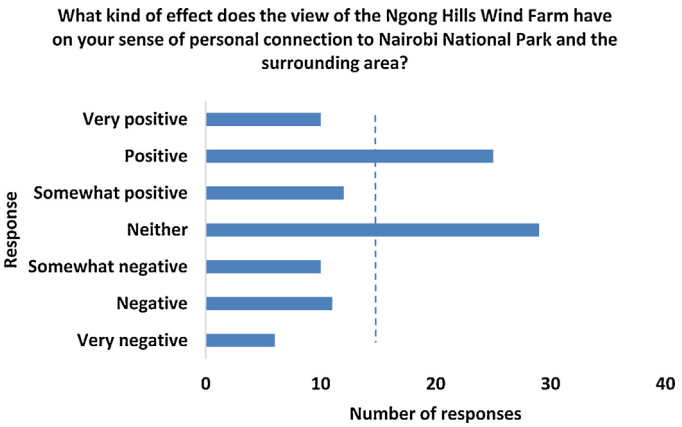

Fig. 13. Response frequencies for Q24. The distribution was significantly different from the expected distribution ($\chi^2 = 30.7$, $p < 0.05$, $n = 103$) with a median of 4 (no effect). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

$p < 0.05$, $n = 359$). The distribution was significantly different from the expected distribution. Though the median response was *neither positive nor negative* (4), the responses showed two peaks at *positive* and *somewhat negative*. The null hypothesis cannot be rejected.

$H6_0$. The wind farm has no effect on place attachment.

Question 24 asked visitors how the Ngong Hills Wind Farm affected their sense of personal connection to NNP. Like the skyline, the wind farm had *no effect* on their personal connection to the park (Table 3, Fig. 13, Q24, median = 4, $\chi^2 = 30.7$, $p < 0.05$, $n = 103$). The responses showed a bimodal distribution with peaks *positive* and *neither positive nor negative*. The null hypothesis cannot be rejected.

5. Discussion

Wind turbines and urban development can affect landscape quality, which in turn can influence place attachment and the region's *genius loci*. The survey data indicate that Nairobi National Park is an important ecological and social landscape with a rich *genius loci*—the human and natural elements blend together into a meaningful whole and the landscape reflects the aspirations for sustainable development. The Nairobi skyline in general had no effect on the region's *genius loci* (Table 3, Q12 and Q13) but the Ngong Hills Wind Farm had a very slight positive effect (Table 3, Q17 and Q18). This is somewhat surprising given the literature on the visual impact of turbines. The turbines' distance from the park (15 km) suggests its influence would be modest [3] and its location near a high quality landscape (Nairobi National Park) suggests it would have a negative impact, as was the case in Australia [21]. Instead, the turbines, at least to those who detected them, seem to inspire positive feelings.

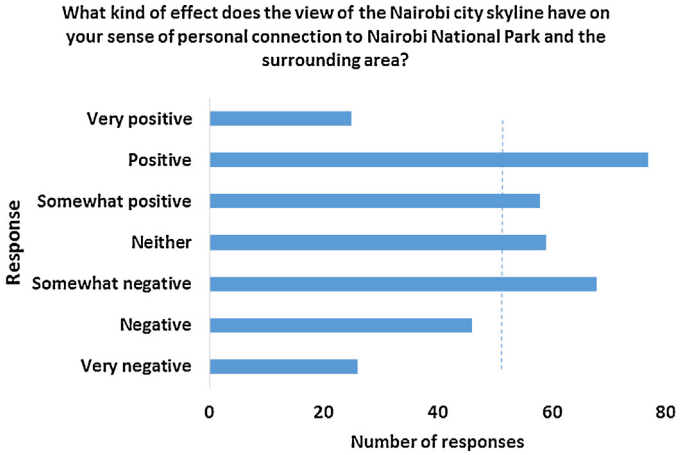

Fig. 12. Response frequencies for Q23. The distribution was significantly different from the expected distribution ($\chi^2 = 46.9$, $p < 0.05$, $n = 359$) with a median of 4 (no effect). The dashed line indicates the expected χ^2 distribution under the null hypothesis.

We hypothesized that turbines and skyline would also affect place attachment. Nairobi National Park does elicit feelings of attachment in its visitors. The skyline and the turbines, however, have no consistent effect on park visitors' sense of place attachment (Table 3, Q23 and Q24). This is again surprising, given the literature linking people's perceptions of wind turbines with place attachment, especially negative perceptions (e.g. [6,8,11]. This finding, however, is consistent with the work of Lombard and Ferreira [20] in South Africa. They found residents of the Western Cape exhibited strong place attachment but also had positive attitudes toward wind turbines in their own regions. In terms of the person-process-place (PPP) concept of place attachment, the results suggest that the personal (e.g. pleasant memories) and psychological process (e.g. behavior—visiting again) dimensions had a greater influence than did certain aspects of the physical place (turbines and Nairobi skyline). Interpreting this through the concept of meaning-mediated model [33], it suggests that park visitors do not attach meaning to the turbines and skyline when thinking about Nairobi National Park. The open ended responses about visitor satisfaction offers some idea of what could be influencing place attachment, if not the skyline and turbines. Consistent with the region's identification as "The World's Wildlife Capital," visitors to Nairobi National Park are most interested in viewing wildlife. While some respondents noted a desire for scenic views and natural landscapes, most visitors came to see the park's large mammals and variety of birds. A large number, mostly Kenyan residents, also noted they came for picnicking and socializing with family and friends. As Scannell and Gifford [30,p. 4] noted, people are "attached to places that facilitate social relationships and group identity." If these anecdotal comments are accurate, then it would explain why neither the turbines nor the skyline influenced place attachment to Nairobi National Park.

Several of the questions yielded bimodal response patterns that were statistically significant (Table, 3, Q13, Q17, Q18, Q23, and Q24). In most of these cases, the bimodal responses were separated by only one unit on the Likert-type item. In these cases, there is not a high degree of polarization. The two questions about the wind turbines effect on the region's *genius loci* (Q17 and Q18) both had peaks at positive (6) and no effect (4) with positive being the

most common response (Figs. 7 and 8). For the questions about the skyline's and turbine's effects on place attachment (Q23 and Q24), the median response of *no effect* masks two diverging opinions. Though visitors responded positive (6) or neither (4) to what kind of effect the turbines have on their personal connection to the park, the responses suggest that the turbines do not cause negative feelings (Q24, Fig. 13, Table 3). Responses to Q13 about the skyline's effect on landscape character had peaks at positive (6) and slightly negative (3) with positive being the most common response (Fig. 5). This question had the most polarized response and suggests that park visitors' attitudes toward the skyline are more complex than attitudes toward the Ngong Hills Wind Farm. Further research is needed to determine the composition of these groups and the drivers behind their attitudes. Additional analyses will be conducted to determine whether the bimodal response can be attributed to, for example, Kenyan residents vs. foreign visitors; first vs. return visitors; visitors' strength of environmental concern; and visitors' overall satisfaction with their park visit.

Both place attachment and *genius loci* help us understand the attitudes and motivations of park visitors. It is clear that certain landscape elements, such as the wind turbines and Nairobi skyline, influenced the region's *genius loci*. They had no effect, however, on place attachment. This suggests that *genius loci* describes something about the park visitors' relationship with the landscape that was missed by place attachment, or at least how place attachment was measured in this study. This leads to new questions based on the three conceptions of place attachment [12]. Is *genius loci* a separate concept, unrelated to place attachment? Is *genius loci* a component of place attachment along the lines of place identity or person-process-place model? Is *genius loci* a higher order concept which includes place attachment as well as other constructs? This paper marks a first step in bringing *genius loci* into the conversation of place attachment at a descriptive level. Future research should, as Hernandez et al. [12] suggest, focus on theory-building by investigating how these two concepts are (or are not) integrated.

The results offer a few answers to four of Sovacool's [32] 75 questions on social science and energy research mentioned in the introduction. *Genius loci* provides a lens through which energy landscapes' "culture- and history-conditioned character" [4,pp. 56–57] can be described and evaluated. It expands the vocabulary with which we describe people's relationships with energy landscapes. It is clear that the Ngong Hills Wind Farm is contributing to a modernizing electricity grid in Kenya without compromising the visual quality of Nairobi National Park. In that sense, the study shows that the wind farm is directly contributing to Kenya's sustainable development. The survey results confirm that the Ngong Hills Wind Farm is seen as a symbol of sustainable development. The positive attitudes toward the wind farm, especially from Kenya residents, suggests that the context of energy development matters. In a country like Kenya in which the majority of people have little or no access to electricity in their homes, a wind farm may be a sign of progress. This study also suggests that wind turbines do not necessarily harm the environment or social structures of communities. In the case of the Ngong Hills Wind Farm, it actually enhances the region's *genius loci*.

While the study breaks ground in its pairing of place attachment and *genius loci* and in the assessment of landscape, especially wind turbine, perceptions in Africa, it does have several limitations. First, the study was conducted as a natural experiment under existing conditions. The distance to the wind farm was farther than is found in most experimental simulations and its visual impact is relatively modest. In the survey's pilot phase, respondents were not instructed to look for the turbines or skyline. As a result, very few respondents reported seeing the turbines at all. By instructing park visitors to look for the turbines during their game drive, it is possible that we biased some respondents toward detection. However, in experimental simulations, the participants are also asked to view the wind turbines in photo montages. If the turbines were closer and more obvious, directing the visitors to watch for them would have been unnecessary. Given the existing conditions and the value of real-world observations, we opted to instruct the visitors to look for them.

The second limitation lies with the descriptive, as opposed to explanatory, nature of the survey and analysis. The study of wind turbine perceptions is relatively new and descriptive studies are common (e.g. Ref. [9]). No study has even described the perceptions of wind energy landscapes in Sub-Saharan Africa, much less explained the reasoning behind it. By analyzing the perceptions of turbines and urban development through both place attachment and *genius loci*, this study expands the breadth of theoretical lenses with which to describe, and ultimately explain, attitudes toward human-dominated landscapes. The descriptive results herein set a benchmark against which future studies of African landscapes may be measured.

African nations are beginning an energy transition to modern electrical systems from biomass fuels. The next decade will be a fruitful time for natural experiments of deployed energy infrastructure and simulation-based experiments. Concepts like place attachment and place protective actions have be useful in explaining the perceptions of energy landscapes among European and North American residents. The results of this study offer a possibility that – in contrast to Europe and North America – aspirations for sustainable development may influence positive perceptions of turbines and energy landscapes in Kenya and beyond.

6. Conclusions

Nairobi National Park is a treasured resource for residents and international tourists alike. The research shows that visitors do not evaluate all man-made elements in the landscape in the same way. The turbines of the Ngong Hills Wind Farm had a slightly positive effect on the visitors who saw them, whereas the Nairobi city skyline had no effect. Respondents indicated that additional turbine development would have no effect on their visitor experience but additional urban growth would have a very negative effect.

The responses show that both place attachment and *genius loci* explain aspects of visitor perceptions of the Nairobi National Park landscape. These approaches complement one another rather than being mutually exclusive. The park's landscape character, its *genius loci*, helps expand the phenomenological perspective of place attachment described by Seamon [31]. Specifically, *genius loci* – the spirit of a place – fits with Seamons' concepts of place release, place realization, and place creation. The human aspects of the landscape, including wind turbines and the Nairobi skyline, interact with the natural elements and the visitors' own experiences to create a distinct *genius loci* that in turn evokes feelings of place attachment.

This research offers one of the first of what is sure to be many studies of public perceptions of wind turbines and other renewable energy facilities in Africa. More studies are needed to understand how new renewable energy facilities are perceived in regions where energy access is limited, as compared to perceptions in industrialized countries where access is high. In highlighting the linkage between place attachment and *genius loci*, the study opens up a new avenue for research in public perceptions of renewable energy landscapes in countries at all stages of development.

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