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Frequency and rates of outdoor activities, and perceptions of places to perform these activities by Native Americans and Caucasians interviewed in Tennessee

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Abstract

Activity patterns and perceptions play a key role in human health risk, management, and planning. A survey of 233 people attending a Native American festival in Cookeville Tennessee were interviewed to determine the types, percent participation, and outdoor activities rates, and their perceptions of the importance of characteristics of sites. The indicate that: 1) a high percentage of respondents used outdoor environments, 2) they used them for consumptive (hunting, fishing), non-consumptive (hiking, walking, bird-watching), and religious/sacred activities, 3) a higher percentage of respondents engaged in non-consumptive than consumptive activities, 4) praying or meditating, communing with nature, and bird-watching had the highest uses rates 5) the environmental characteristics rated the highest were lack of radionuclides that presented a health risk, no visible smog, clean air, and unpolluted water, 6) presence of people, buildings and roads were rated the lowest and 7) Native Americans had higher participation rates, participated more frequently, and evaluated environmental characteristics higher than did Caucasians. This information can be used by managers to create and maintain outdoor habitats that fit the needs of local people. Planning and management require information on public policy, human needs and requirements, and human perceptions and evaluations of environmental characteristics.

Keywords

evaluations; activity patterns; Native Americans; environmental characteristics; nuclear facilities

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Introduction

Increasing energy prices, competition among energy sources, and global warming have led many energy companies, governments, and the public to reconsider nuclear energy use. Recent surveys indicate increasing support for nuclear power in the United States (Bisconti 2005, 2007, Greenberg 2009a, Nuclear News 2009), but there is also concern about spent nuclear fuel, accidents, and other issues with nuclear power (MIT 2003, Ansolabehere 2007). Concerns about risk might be strongest for people living near nuclear facilities (Greenberg 2009b), and risk might be related to how often people engage in outdoor activities in regions around such facilities.

Considerable research indicates that people are worried about the risks from nuclear and chemical facilities (Slovic 1983, 1987, Flynn et al. 1994, Rosa 2001). Research by Greenberg and colleagues (Greenberg et al. 2007, Greenberg 2009) reported that people living near six Department of Energy (DOE) facilities were most worried about threats to drinking water, transportation accidents, and worker exposure. Similarly, studies have examined what natural resources people worry about (e.g. hunting or fishing opportunities, Burger et al. 2000), and how often then engage in recreational activities (Burger 2004). Yet, there have been no studies that examined the relationship between how many people use natural ecosystems, what resources they use, how often they use resources, and whether their use reflects the environmental characteristics they value. Understanding how people use natural areas aids managers in their decisions about land management, remediation, and long-term stewardship. Actual participation is a form of valuation, since it requires time, effort and money to engage in outdoor activities.

The objective of this research was to determine the frequency and rates of participation in outdoor activities, and the perceptions of Native Americans and Caucasians about the importance of environmental characteristics for the places they engage in outdoor activities. Respondents were interviewed at Cookeville, Tennessee, near the Oak Ridge Reservation a major DOE site. People were asked to evaluate a number of different attributes for the places they engage in consumptive/non-consumptive, and for religious/sacred activities, including goods (e.g. fish, game, herbs), services (e.g. clean air), and eco-cultural attributes (e.g. noise-free, no visible smog, Burger *et al.* 2008). This research is unique because it combines all three: participation rates, use rates, and evaluation of characteristics of places people engage in outdoor activities.

The main research questions examined were:

What percentage of people engage in different outdoor activities, and what is the frequency of engagement?

How important are different environmental characteristics to the places that Native Americans and Caucasians engage in outdoor activities, including consumptive, non-consumptive, and religious/sacred ones?

Are there ethnic differences?

Both activity patterns and perceptions of environmental characteristics are important for environmental planners that deal with local and regional planning around current DOE facilities and nuclear power plants. The DOE has waste, laboratory, and management facilities in 137 sites in 34 states, most of which have economic and environmental effects on the local region (Frisch *et al* 1998, Greenberg *et al* 2002, Greenberg 2009). The local economy has sometimes suffered from the stigma associated with DOE sites, or from withdrawal of federal funds (Greenberg 2009). The United States has 104 nuclear power plants in 35 states. The Nuclear Regulatory Commission has received several applications for new nuclear reactor sites, and is in the process of licensing them (NRC 2004, 2006, 2009).

Background: Activity Patterns and Evaluations

Public planners, ecologists, and risk assessors are aware that in democratic societies, perceptions of people regarding management and conservation of natural habitats are important components of the decision-making process concerning management of those systems. One component of management is public support of the services that ecosystems provide. Two factors might affect evaluation of ecosystems: frequency of use, and ethnic/cultural traditions, particularly for Native Americans that have a holistic view of nature (Harper et al. 2008). That is, nature provides not only goods and services, but cultural, spiritual, and religious experiences. There might be a functional relationship between benefit perceptions and frequency of use, and between benefit perceptions and ethnic cultures, which may be causally related (Frewer et al. 1998; Siegrist et al. 2000). That is, people who hunt and fish a lot may well value clean water and healthy forests highly, while those who hike may value good trails or scenic vistas highly (Burger et al. 2008).

Ecosystem health, human health, and economic and societal health all depend upon ecosystem processes, and influence human values and perceptions, which in turn affect how stakeholders become involved in decisions regarding regional planning, management, regulations, and public policy. For example, humans depend upon ecosystems to provide for their needs (food, fiber, clean air and drinking water, recreational and religious opportunities), which in turn determines their well-being in terms of health and economics. Stakeholders will participate in decisions when it directly affects their well-being. The many connections between ecological and human health, as well as human values and perceptions, all influence regional planning, management, and policy decisions. Such decisions then affect human and ecological health.

Ecosystems provide a number of benefits, including goods and services, and eco-cultural attributes. Goods and services are the benefits that ecosystems provide to people, including food (e.g. fish), water, fiber, medicines, herbs, clean air and water, and coastal protection from storms, among others (deGroot et al. 2002, Leitao and Ahern 2002, Burger 2008, Burger *et al.* 2004). Eco-cultural attributes refer to ecological factors that affect human health and well-being in addition to goods and services, including exposure to toxic chemicals, and perceived degradation of cultural and religious activities that depend upon intact ecosystems (Burger *et al.* 2008).

Although subsistence people and Native Americans derive the same goods and services from natural resources as do others, they also derive additional values from intact ecosystems that may be less obvious within other cultures. Human activities and artifacts (e.g. sacred grounds, archeological sites) can be considered as much a part of nature as organism and populations (Davidson 2000, Folke 2006).

Methods

The overall design was to interview attendees at a Pow Wow (= Indian festival) at Cookeville, Tennessee, located a little over a 100 km from the Oak Ridge Reservation (Fig. 1). This event was selected because both Native Americans and Caucasians would be present, and using this venue allowed for an examination of activity patterns and perceptions among people in the vicinity of a major DOE site. The event attracted a general public and not just respondents interested in natural resources, and the event went for several days providing the opportunity to interview 233 people of both ethnicities.

Structured interviews employing a questionnaire were used to assess resource uses, perceptions about the features of ecosystems that were important to them, and resource activity rates. Consumptive activities are those that remove (consume) resources from the environment (e.g. fish, wildlife, plants, herbs), and non-consumptive are all other outdoor activities that do not involve removing resources. The questionnaire was one used in several other studies (Burger 2003, 2012; Burger and Gochfeld 2010, Burger et al. 2012). All interviewers were trained, and had participated in other surveys using the same exact questionnaire (Burger 2012).

People were interviewed while they watched or waited in lines for activities to begin, and few people declined to be interviewed. Interviewers introduced themselves as from Rutgers University, and explained the purpose of the survey was to understand “how people perceive natural resources, how people use and value the environments they prefer”. A person was selected for the interview, and after completion, the interviewer moved at least 3 m away to select the next interviewee. Interviewers moved along a waiting line, or moved through the crowd. While this represents a convenience sample, there is no reason to assume a bias in our selection process. An interview typically required 20–30 min, depending upon how many questions respondents asked.

The questionnaire was divided into sections that included rating the importance of environmental features by 3 classes of places they : 1) hunted, fished, gathered herbs or berries (consumptive), 2) hiked, walked, camped, bird-watched (non-consumptive), or 3) engaged in religious/sacred activities. Frequency and relative importance of various activities was also recorded. Demographic information included age, gender, education, family income, and self-identified ethnicity. The interviewers alternated the order in which they asked the three classes of questions. Respondents were asked whether they participated, how often they participated, and to rate the importance of different environmental features of the habitats where they liked to conduct these activities (on a Likert scale of 1 [unimportant] to 5 [very important]). The full list of environmental characteristics can be found in Table 2. Although many other characteristics could have been included, the list was

refined to reduce the total interview time (Burger and Gochfeld 2012). For example, people might distinguish between gathering herbs and berries for medicine, for religious purposes, for dyes, or for weaving, or for food; these were all combined into one category. For non-consumptive activities, photography was usually part of either hiking or walking. No professional photographers were interviewed.

Kruskal-Wallis non-parametric one way analysis of variance χ^2 tests were used to distinguish differences among Caucasians and Native Americans, and men and women (SAS, 1995). $P < 0.05$ was accepted as significant. Means and standard errors are provided in the text and figures. Although we interviewed 233 people, all but 13 identified themselves as Native Americans or Caucasians; in this paper we compare only these two groups.

Results

Demographic differences

There were few ethnic differences, although Native Americans ($n = 92$) had significantly lower incomes than did Caucasians ($n = 128$; Table 1). Income increased significantly with education, with college graduates making an average of four times more than those with less than a high school education (mean of \$ 23,900 $\pm$ 3,100 vs \$ 101 $\pm$ 2,500; X^2 of 16.9, $P < 0.002$). There were no significant differences in mean age or percent female as a function of education, so the differences in income were not due to age or gender.

Activity patterns

A higher percentage of Native Americans engaged in consumptive and religious/sacred activities than did Caucasians, although they had similar rates of non-consumptive activities (Fig. 2). Overall, some activities had higher participation rates than others (Fig. 2). Over 60 % of the respondents fished, while less than 20 % engaged in hunting. A higher percentage of people engaged in gathering herbs and berries (27 %) than engaged in hunting. A higher percentage of Native Americans engaged in fishing, vision quests (seeking peace or a life/religious goal), and visiting sacred grounds than did Caucasians, and more Caucasians engaged in church activities compared to Native Americans. When participation in the three classes is examined (regardless of the specific activity), most people engaged in all three classes (Fig. 3).

Overall, respondents who participated in specific activities had the highest rates of participation (days/month) for praying and meditating, communing with nature and bird watching, and the lowest rates for fishing, crabbing or hunting, collecting herbs and berries, vision quests, and picnicking (Fig. 4). People engaged in higher rates of non-consumptive activities than consumptive activities. Native Americans participated for more days per month than did Caucasians for praying and meditating, communing with nature, bird-watching, and fishing, crabbing or hunting.

Evaluations of environmental characteristics

There were significant differences in the evaluations of environmental characteristics between consumptive/non-consumptive and for religious/sacred activities (Fig. 5). For

places where people prefer to conduct consumptive/non-consumptive activities, the highest rated were lack of radionuclides that present a health risk, unpolluted water, no visible smog, and clean air, and lack of people, no buildings, few roads, and distance from home were rated the lowest. For places where people prefer to engage in religious/sacred activities the relative ratings were the same (Fig. 5).

There were significant ethnic differences in how Native Americans and Caucasians rated the importance of environmental characteristics for 12 of the 20 characteristics where people preferred to engage in consumptive/non-consumptive activities (Table 2). Although the ratings for individual characteristics were not very different (but significant), the overall pattern was consistent. Native Americans rated the importance higher than Caucasians for all those with significant differences.

For the places where people prefer to engage in religious/sacred activities there were also significant ethnic differences (Table 3). In all cases, Native Americans gave higher ratings than did Caucasians for all characteristics, except distance from home. These ethnic differences in evaluations were greater for places where people preferred to engage in religious/sacred activities than for consumptive/non-consumptive activities.

Discussion

Understanding how people use sites, and how they evaluate the qualities of those sites is critical to environmental management and planning. Each of these aspects will be discussed below, followed by the implications for managers and planners.

The discussion relates to the respondents interviewed at the festival, and not to the general population in the region. However, the data provide a view of those interviewed, and show consistent differences in activity patterns, and importance of environmental characteristics, between Native Americans and Caucasians. They provide information for further regional studies, and for planners and managers to consider in making land use decisions. Other methodological issues concern the sampling method (convenience), the questionnaire asked only about certain activities and environmental characteristics, and the survey was conducted at one time period.

Activity patterns

The data from interviews of respondents indicate three things: 1) there were differences in overall percent participation in different types of activities, 2) there were ethnic differences in the percent participation in different activities, and 3) there were ethnic differences in the frequency of participation. It is not surprising that there were differences in overall participation rates, and in frequency of participation, because some activities are seasonal (e.g. picking berries or gathering herbs), depend upon breeding seasons (e.g. hunting or fishing for migratory species), or require either short or long periods of time. For example, bird-watching can be done in little time, whereas a vision quest, hunting, or going to a sacred ground may require days or weeks. Activities such as praying and meditating, and communing with nature, can be done almost daily (and were by some of the respondents interviewed), but collecting herbs and berries is seasonal and cannot be done every day.

The percentage of people who participated, however, could vary because a person only had to do something once a year to be included as a participant. Thus, the percentage of people who participate in a given activity (refer to Fig. 2) provides an upper bound for the people who use a given environment, or be exposed in that environment (e.g. to chemicals, radionuclides). That nearly 90 % of the respondents interviewed engage in non-consumptive activities in nature suggests the importance of including such environments in neighborhoods, or within commuting distances, and of considering these activities in risk evaluations and assessments.

Our expectation was that more Native Americans would engage in fishing and hunting (and perhaps other consumptive activities) than Caucasians because of the importance of hunting and fishing in their culture, and the availability and accessibility of fishing sites (Harper et al. 2008). Game, fish and other food, fiber and herbs obtained from nature play an important role in their everyday lives and in exposure scenarios (Harris and Harper 1998, Harper et al., 2008). For example, salmon plays an important role in the culture of the northwestern tribes (Lande and Pinkham, 1999, Nez Perce, 2003). However, interest-group theory (Floyd et al. 1994) predicts that Caucasians and Native Americans living in the same geographical area, where local ecosystems provide abundant and aesthetically pleasing opportunities for hunting, fishing and other outdoor activities, would have similar activity preferences and evaluations.

The data from the respondents interviewed indicated that more Native Americans engaged in consumptive activities (as well as religious/sacred activities), than did Caucasians (refer to Fig. 3). However, there were no differences with respect to non-consumptive activities. Further, when individual activities are examined, there were significant ethnic differences only for fishing, vision quests, and religious/sacred activities (Native Americans had higher rates, Fig. 2). Vision quest, sacred activities, or other ceremonies are all activities that are performed in nature by Native Americans, and they all rely on intact, undisturbed ecosystems. That is, they require intact ecosystems for maximum benefit (Burger et al. 2008). Nature-based recreation has been an important part of American society (Shrestha et al. 2007), but use of natural habitats for religious/sacred activities has been part of Native Americans life for centuries (Harper et al. 2008, Burger et al. 2008), as well as for subsistence and more rural societies (Toth and Brown 1997).

The overall participation rates reported in this paper can be compared to those of others living around DOE sites (studies conducted in the late 1990s, using the same methodology). Then the percent of people engaged in hunting varied from 30 % for the Savannah River Site (SRS) in South Carolina to 41 % for Los Alamos National Laboratory (LANL) in New Mexico (compared to 20 % for Tennessee in this study); for fishing it varied from 55 % for LANL to 74 % for Brookhaven National Laboratory (BNL) on Long Island, New York (compared to 63 % for Tennessee); for hiking it varied from 35 % at SRS to 71 % at LANL (compared to 55 % for Tennessee); for camping it varied from 38 % at SRS to 75 % at Idaho National Laboratory (compared to 52 % for Tennessee); for bird-watching it varied from 29 % (LANL) to 49 % (BNL)(compared to 45 % for Tennessee)(data from Burger 2004). No data are available for cultural/religious activities. Thus, the data from the present study

indicate that respondents engaged in less hunting, but similar percent participation for other activities. Rates of activities were also similar (Burger 1999, 2004).

Evaluations of importance of environmental characteristics

Understanding perceptions of environmental characteristics to natural or man-made habitats is important for ecosystem management, for public policy, and for planners, among others. There are several methods of valuing ecological resources, including use of a likert scale to rate a number of options (Martinez-Espineira, 2006), travel cost analyses (Shrestha et al. 2002), willingness to pay (Nielsen et al. 2007), and contingency valuation (Mitchell and Carson, 1989; Diamond and Hausman, 1994, Coztanza et al. et al., 1997; Chambers and Whitehead, 2003), Efroymson et al., 2008). Others have used a ranking of evaluations to design a value index, which might include different aspects, such as stakeholder evaluations (non-monetary) and monetary (import/export demand, Suneetha and Chandrakanth 2006). Knowing how stakeholders evaluate the goods, services, and eco-cultural attributes that ecosystems provide is essential to inform policy, planning, and management. We used a likert scale because it allows comparisons among environmental characteristics as a function of ethnicity, and because they were activities that are normally not paid for directly (particularly cultural/spiritual/religious).

In this study we used actual participation rates and frequency of activity, along with a Likert scale evaluations to examine respondent's valuation of activities and environmental characteristics. There were differences in evaluations of environmental characteristics, including, 1) characteristics were not rated equally in importance for consumptive/non-consumptive activities compared to spiritual/cultural, 2) human-related characteristics were rated the lowest for both consumptive and non-consumptive activities, 3) the same environmental characteristics (lack of radionuclides providing a health risk, unpolluted water, no visible smog, clean air) were rated highest for both categories of activities, although the order differed, and 4) Native Americans rated environmental characteristics higher than Caucasians (refer to Fig.5). These attributes of natural ecosystems have not been examined in other populations.

It is notable, but not surprising, that the highest rated characteristics related directly to human health (health risk from radionuclides, unpolluted water, clean air). However, eco-cultural or aesthetic characteristics (no smog in the air, and appears unspoiled) were also rated very high. Consumptive goods (e.g. abundant fish, crabs and herbs) were rated relatively low, and human-related characteristics (lack of people, buildings and roads) were rated very low in importance for places people liked to engage in outdoor activities. To some extent, this suggests that natural habitats within suburban and urban areas can be highly regarded despite the presence of human structures as long as "human health" and "natural" aspects or characteristics are retained.

Given the importance of an outdoor lifestyle for Native Americans (Harper et al. 2008), it is not surprising that Native Americans rated nearly all environmental characteristics more highly than did others. The differences were greater for religious/sacred activities, which were likely due to the Native American use of the outdoors for these activities, and the

importance of having healthy, intact, and “unspoiled” environments for these traditional activities.

Implications for Managers and Planners

Ecosystem management, whether the systems are natural or man-make (e.g. parks), requires a full range of scientists, planners and public policy makers (Fig. 6). Professionals use various assessment tools to aid in their decision-making for ecosystems. In turn, the public is interested in the well-being of humans, and their environment, which also requires assessment of ecosystem structure and function, human use of those environments, and understanding of perceptions and other human needs (Fig. 6). All of these aspects are both relevant and important for environmental managers and planners.

For managers and planners to be effective, information on all aspects shown in figure 6 is essential, including activity patterns and perceptions. While the data for this paper was not generated by a random sample of the whole population in Tennessee, or in the vicinity of Oak Ridge, the sample still provides insights into activity patterns and perceptions. While activity frequencies may be higher than for people living in more urban/suburban areas, the data represent one important segment of the populations that uses outdoor habitats, could be exposed if there is a risk from chemicals, and has interests in the health and well-being of the outdoor habitats they use. Further, the activity rates were generally within the range of those reported for four other sites (with nearby DOE facilities) from the late 1990s (Burger 2004).

The data from this paper indicate that: 1) a high percentage of the respondents interviewed use outdoor environments, 2) they use them for consumptive (i.e. hunting, fishing), non-consumptive (i.e. hiking, walking), and religious/sacred activities, 3) a higher percentage of people engage in non-consumptive than consumptive activities, 4) praying or meditating, communing with nature, and bird-watching have the highest rates of use, 5) the environmental characteristics rated the highest are lack of radionuclides that present a health risk, no visible smog, clean air, and unpolluted water, 6) presence of human structures are rated the lowest, and 7) Native Americans generally have a higher percentage of participation, higher rates of participation, and evaluate environmental characteristics higher than do Caucasians. This information can be used by planners and managers to create and maintain outdoor habitats that fit the needs and desires of people residing in these areas.

The relatively high rate of participation in natural habitats is suggestive of the need for planners and managers to develop, protect, and manage these habitats in a full range of communities. While having no visible smog in the air, clean water and air, and scenic horizons may be difficult to create in some urban or suburban ecosystems, these data provide information for public policy makers and managers to use in developing policies, in designing neighborhoods, and in landscape architecture. The high participation and rates of engagement for praying and meditating, communing with nature, and bird-watching all suggest the need for solitary places where the environment appears pristine, unspoiled, and quiet. The lower frequencies of consumptive activities, such as fishing, crabbing, and hunting, suggests that the respondents interviewed are less at risk from ingestion than they are from other routes of exposure when engaging in outdoor activities.

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Figure 1.
Map showing the location of the sampling (Cookeville, Tennessee), and Oak Ridge Reservation, the closest Department of Energy site.

Figure 2. Percentage of Native Americans and Caucasians who said they engaged in any consumptive, non-consumptive, and religious/sacred activities. Star indicates a significant difference.

Figure 3.

Percent of Native Americans and Caucasians who said they engaged in specific types of consumptive, non-consumptive, and religious/sacred activities. Star indicates a significant difference.

Figure 4. Frequency of specific activities by Native Americans and Caucasians interviewed at Cookeville, Tennessee.

Figure 5.

Mean ratings of the importance of specific environmental characteristics for consumptive and non-consumptive (open circles) and for religious/sacred activities for the respondents interviewed at Cookeville, Tennessee.

Figure 6. Schematic of the importance of different types of information for ecosystem management, including activity patterns and perceptions.

Table 1

Demographics of study population in Cookeville, Tennessee (2009). Given are means $\pm$ standard error and range for age and income (N=233).

	Overall ^a n = 233	Caucasian n=128	Native American n=92	X ²
Age	47.3 $\pm$ 0.9	47.0 $\pm$ 1.2	48.5 $\pm$ 1.5	1.0 (NS)
Gender (% Women)	58%	56%	40%	0.05 (NS)
Education				
Less than high school	11%	13%	9%	2.7 (NS)
High school graduate	43%	43%	44%	
Some college	19%	16%	23%	
College graduate	23%	23%	23%	
Graduate level education	3%	4%	2%	
Income (thousands of dollars)	39.2 $\pm$ 2.3	42.7 $\pm$ 3.3	35.4 $\pm$ 3.7	4.9 (0.03)
% household income below mean (\$39,200)	65%	58%	74%	

^a 13 people were not Caucasian or Native American. Other ethnicities include (Hispanic, Mexican, Asian, African American, and South American). These were only included in the overall analysis.

Table 2

Ratings about the importance of environmental factors impacting natural areas used for consumptive and non-consumptive activities. Rating scale: 1= least important and 5= most important. Given are means $\pm$ standard error and Kruskal-Wallis X^2 (p).

	Caucasian (n=128)	Native American (n=92)	X^2
For your favorite spot how important is:			
Lack of radionuclides that present a health risk	4.8 $\pm$ 0.05	4.9 $\pm$ 0.05	6.5 (0.01)
Unpolluted water	4.7 $\pm$ 0.06	4.8 $\pm$ 0.06	5.3 (0.02)
No visible smog in air	4.8 $\pm$ 0.04	4.7 $\pm$ 0.07	1.8 (NS)
Clean air	4.6 $\pm$ 0.06	4.8 $\pm$ 0.05	2.7 (NS)
Appears unspoiled	4.5 $\pm$ 0.08	4.7 $\pm$ 0.07	4.1 (0.04)
Scenic horizon (unspoiled)	4.6 $\pm$ 0.07	4.6 $\pm$ 0.07	0.2 (NS)
Unpolluted groundwater	4.4 $\pm$ 0.10	4.7 $\pm$ 0.06	3.2 (NS)
Unpolluted soil	4.4 $\pm$ 0.09	4.7 $\pm$ 0.07	6.8 (0.009)
Butterflies/flowers	4.3 $\pm$ 0.10	4.5 $\pm$ 0.10	3.4 (NS)
Complexity of nature (food chains)	4.0 $\pm$ 0.10	4.6 $\pm$ 0.07	13.1 (0.0003)
Diversity of plants	4.1 $\pm$ 0.10	4.6 $\pm$ 0.09	13.6 (0.0002)
Lack of any radionuclides in soil or groundwater	4.0 $\pm$ 0.14	4.4 $\pm$ 0.11	2.3 (NS)
Natural tidal flow or river flow	4.0 $\pm$ 0.11	4.5 $\pm$ 0.10	10.4 (0.001)
Noise-free	3.9 $\pm$ 0.10	4.3 $\pm$ 0.09	7.0 (0.008)
Abundant fish/crabs/herbs	3.8 $\pm$ 0.13	4.4 $\pm$ 0.11	15.3 (<0.0001)
High number of different kinds of fish	4.0 $\pm$ 0.11	4.2 $\pm$ 0.14	4.7 (0.03)
Lack of people	3.6 $\pm$ 0.11	3.9 $\pm$ 0.14	4.7 (0.03)
No buildings around	3.6 $\pm$ 0.11	3.8 $\pm$ 0.12	1.1 (NS)
Few or no roads on site	3.5 $\pm$ 0.11	4.0 $\pm$ 0.12	9.2 (0.003)
Distance from home	3.0 $\pm$ 0.13	3.0 $\pm$ 0.14	0.09 (NS)
X^2	396 (<0.0001)	317 (<0.0001)	

Table 3

Ratings about the importance of environmental factors impacting natural areas used for religious/cultural purposes. Rating scale: 1= least important and 5= most important. Given are means $\pm$ standard error and Kruskal-Wallis X^2 (p).

	Caucasian (n=128)	Native American (n=92)	X^2
For your favorite spot how important is:			
No visible smog in air	4.14 $\pm$ 0.17	4.82 $\pm$ 0.08	11.2 (0.0008)
Lack of radionuclides that present a health risk	4.10 $\pm$ 0.18	4.79 $\pm$ 0.10	11.5 (0.0007)
Clean air	4.01 $\pm$ 0.19	4.88 $\pm$ 0.06	16.6 (0.0001)
Unpolluted water	3.99 $\pm$ 0.20	4.85 $\pm$ 0.08	11.6 (0.0007)
Lack of any radionuclides in soil or groundwater	3.78 $\pm$ 0.24	4.75 $\pm$ 0.11	11.3 (0.0008)
Unpolluted soil	3.72 $\pm$ 0.21	4.82 $\pm$ 0.08	20.5 (<0.0001)
Appears unspoiled	3.75 $\pm$ 0.20	4.70 $\pm$ 0.09	14.2 (0.0002)
Unpolluted groundwater	3.81 $\pm$ 0.20	4.61 $\pm$ 0.12	10.2 (0.001)
Scenic horizon (unspoiled)	3.53 $\pm$ 0.20	4.48 $\pm$ 0.13	13.0 (0.0003)
Butterflies/flowers	3.37 $\pm$ 0.20	4.51 $\pm$ 0.12	18.7 (<0.0001)
Noise-free	3.39 $\pm$ 0.20	4.54 $\pm$ 0.10	18.0 (<0.0001)
Diversity of plants	3.16 $\pm$ 0.21	4.60 $\pm$ 0.12	26.8 (<0.0001)
Complexity of nature (food chains)	3.27 $\pm$ 0.20	4.33 $\pm$ 0.15	14.7 (0.0001)
Natural tidal flow or river flow	3.13 $\pm$ 0.21	4.39 $\pm$ 0.15	20.9 (<0.0001)
Few or no roads on site	3.20 $\pm$ 0.19	4.19 $\pm$ 0.14	14.9 (0.0001)
High number of different kinds of fish	3.15 $\pm$ 0.20	4.27 $\pm$ 0.16	16.5 (<0.0001)
Abundant fish/crabs/herbs	3.03 $\pm$ 0.21	4.29 $\pm$ 0.16	19.5 (<0.0001)
Lack of people	2.67 $\pm$ 0.20	4.16 $\pm$ 0.16	27.5 (<0.0001)
No buildings around	2.97 $\pm$ 0.18	3.91 $\pm$ 0.16	14.6 (0.0001)
Distance from home	3.35 $\pm$ 0.18	3.51 $\pm$ 0.18	0.5 (NS)
X^2	91.8 (<0.0001)	154 (<0.0001)	