

American Indians, Hunting and Fishing Rates, Risk, and the Idaho National Engineering and Environmental Laboratory

Joanna Burger

Department of Ecology, Evolution, and Natural Resources; Cell Biology and NeuroScience; and Environmental and Occupational Health Sciences Institute, Rutgers University, Piscataway, New Jersey 08854-8082

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Hunting, fishing, and recreational rates of 276 American Indians attending a festival at Fort Hall, near the Idaho National Engineering and Environmental Laboratory (INEEL), were examined. Nearly half of the sample lived on the Fort Hall Reservation, and half were American Indians from elsewhere in the western United States. An additional 44 White people attending the festival were also interviewed. The hypothesis that there are differences in hunting, fishing, and recreational rates as a function of tribal affiliation, educational level, gender, and age was examined. Information on hunting and fishing rates are central for understanding potential exposure scenarios for American Indians if the Department of Energy's INEEL lands are ever opened to public access, and the data are important because of the existence of tribal treaties that govern the legal and cultural rights of the Shoshone-Bannock regarding INEEL lands. Variations in hunting, fishing, and photography rates were explained by tribal affiliation (except fishing), gender, age, and schooling. Hunting rates were significantly higher for Indians (both those living on Fort Hall and others) than Whites. Men engaged in significantly higher rates of outdoor activities than women (except for photography). Potential and current hunting and fishing on and adjacent to INEEL was more similar among the local Whites and Fort Hall Indians than between these two groups and other American Indians. © 1999 Academic Press

INTRODUCTION

Human values guide both the protection of ecosystem integrity and future land use and the interface of public health and ecosystem health (Grumbine, 1994; Burger *et al.*, 1997). Ecosystem and public health management should integrate planning, research, and public involvement into the decision-

making process (Slocombe, 1993), and this is only possible with knowledge about public behavior and attitudes. Knowledge about behavior patterns and perceptions is particularly critical when agencies are expanding or changing their management directions (Jacobson and Marynowski, 1997), and when there are differences in attitudes and behavior among different groups of people. There is considerable interest and debate about cleaning up hazardous and toxic waste sites in the United States, and these include lands owned by the Department of Energy and the Department of Defense, as well as other hazardous waste sites. It is becoming increasingly clear that knowledge about future land uses can, and should, inform and influence the degree of cleanup (NRC, 1994). Where lands may be cleaned up for traditional, cultural, or recreational outdoor activities it is essential to know the amount of time that different groups of people may choose to use the land, both for public policy planning and for understanding potential exposure.

In this article I examine the hunting, fishing, and recreational behavior of American Indians who attended a Shoshone-Bannock Festival at Fort Hall in southeastern Idaho, near the Idaho National Engineering and Environmental Laboratory (INEEL). I use the term American Indian throughout because the people I interviewed at the festival expressed a preference for this term rather than Native American. Nearly half of the sample included Shoshone-Bannock living on the Fort Hall reservation, half were Indians from elsewhere in the United States west of the Mississippi, and a small sample identified themselves as White.

The closest border of the Shoshone-Bannock reservation is about 37 km from the closest edge of INEEL, and the Shoshone-Bannock claim tribal rights to the land. I examine the hypothesis that there are differences in hunting and fishing rates,

and beliefs about the safety of fish and deer obtained from INEEL which are attributable to tribal affiliation, educational level, gender, and age. Information on the perceptions and attitudes of the Shoshone-Bannock are particularly important because of tribal treaties that affect cultural rights and land use of INEEL (DOE, 1992). With the ending of the Cold War, the Department of Energy (DOE) has devoted considerable attention to future land use on its sites (DOE, 1996), as well as to remediating huge quantities of chemical and radioactive wastes (DOE, 1995). The costs, potential public safety risks, and ecological risks are enormous (Grumbly, 1996), and it is critical to involve stakeholders at every level of decision-making concerning cleanup at the Department of Energy sites (NRC, 1993, 1995). Obtaining knowledge of the differences between Native American and others on behaviors and values is a necessary step to forging agreements among diverse groups of people (Grumbly, 1994; Commission on Risk Assessment, 1996) about clean up levels, land use, and resource management.

In its recent future use report, DOE used 14 days as a reasonable maximum number of exposure days for recreationists who might use DOE sites in the future (DOE, 1996). A previous study at the Savannah River Site showed that many hunters would use the site for over 14 days (Burger *et al.*, 1997). It seems unlikely to me that this estimate is reasonable for Native Americans, even for their recreational activities (camping, hiking), quite apart from hunting and fishing that are an integral part of their culture.

Researchers have examined differences in environmental attitudes as a function of gender and race (Carney, 1971; Bullard and Wright, 1986; Pillisuk and Acredolo, 1988; Steger and Witte, 1989; Slovic *et al.*, 1989, 1995; DeJoy, 1992; Gutteling and Wiegman, 1993; Spigner *et al.*, 1993; Stern *et al.*, 1993), but most of these studies have dealt with White and Black. American Indians generally have not been included, even though environmentalists often believe that American Indians traditionally lived in harmony with nature (Callicott, 1989; Huffman, 1992; Cornell, 1994). There is a recent trend to examine the ecological views of the American Indians from their point of view (Zinn, 1995; Grinde and Zinn, 1995), and to develop exposure scenarios that take into account their cultural practices (Harris and Harper, 1998) and holistic perspectives (Stoffle and Evans, 1990). This article partly addresses the potential exposure of American Indians who might use the lands of INEEL for hunting, fishing, and recreational activities and examines

some of the differences between those living on the Fort Hall Reservation and other American Indians. This study is part of a larger effort by the Consortium for Risk Evaluation with Stakeholder Participation to understand exposure and risk on Department of Energy lands.

SUBJECTS AND METHODS

INEEL was established in 1949 on 2308 km² of land on the Upper Snake River Plain. Only 6% of INEEL lands contain roads and industrial facilities, and the rest is undisturbed, pristine sagebrush-steppe biome (DOE, 1995; Mitchell *et al.*, 1997). In 1975, it was one of several DOE sites that was established as a National Environmental Research Park for the purposes of studying the effects of nuclear production activities and contaminants on organisms, populations, and communities. Desert, foothills, and agricultural lands surround INEEL. In general, INEEL lands are off-limits to hunting, although some hunting of elk and antelope is allowed on land within a kilometer of the INEEL boundaries that are adjacent to private lands, and then only during a controlled hunting season, in possession of a hunting permit (from a lottery, Idaho, 1997). This combination of requirements makes it difficult for American Indians to hunt legally on INEEL lands.

Three hundred and twenty-one attendees at the 34th Annual Shoshone-Bannock Indian Festival on the Fort Hall Reservation, Idaho, were interviewed August 7-10 1997 (Fig. 1). The Fort Hall Reservation has a land area of 2200 km², and a population of 2932; the overall population of the Shoshone-Bannock Tribe is 4118 (Burger *et al.*, in press). Information on hunting and fishing rates of the Shoshone-Bannock are important because of DOE agreements obligating it to "avoid endangering the Tribes' environment" (DOE, 1992).

The 1997 Shoshone-Bannock Festival was attended by about 8000 people and contained events such as dancing, sports, rodeos, and other competitions. Although 40% of the people interviewed were Indians living on the Fort Hall reservation (who mostly identified themselves as Shoshone, Bannock, or Shoshone-Bannock), the sample also included 46% American Indians from other areas (hereafter referred to as Other American Indians) and 14% White Americans. Differences in the variables are examined by Fort Hall Indians, and other American Indians from neighboring states: Utah, Nevada, Montana, and Washington, as well as from Arizona, New Mexico, and other western states. A few

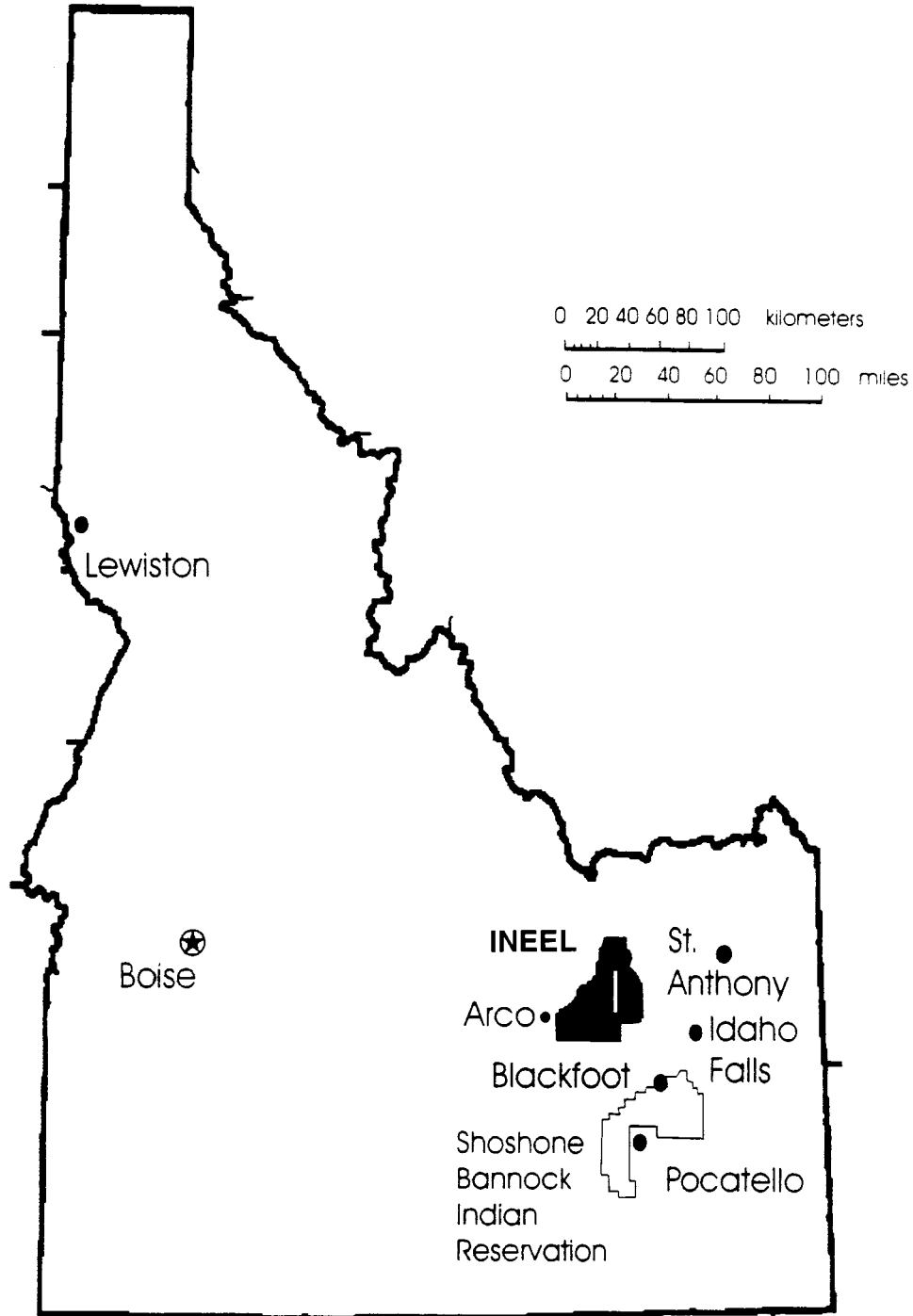


FIG. 1. Map of Idaho showing the location of INEEL and the Shoshone-Bannock Reservation at Fort Hall.

attendees came from as far away as Florida. The people who identified themselves as White all lived locally. Only 6% had ever worked at INEEL.

Subjects were approached while they waited for events to begin, were eating, or were standing about relatively unoccupied. Since many people were

camping at the site, they were available for interviewing (Frey and Oishi, 1995; Alreck and Settle, 1995). The sample was not randomly selected, but there is no reason to believe it was not representative of those attending the festival. When approached with an explanation of what the interviewers

were doing (and why), most people agreed to be interviewed. Only eight people refused to be interviewed, and four of these said that no one would listen to their views anyway. Exceptions were people who were engaged in conversations, or were intent on watching events. A few older people did not want to express their opinion.

The questionnaire was divided into sections dealing with demography (age, sex, occupation, tribal affiliation or ethnicity, where they lived, education), recreational activities, attitudes on how land at INEEL should be used in the future, whether federal funds should be spent on selected environmental problems, and concerns specific to INEEL. Future land use and environmental concerns will be discussed elsewhere (Burger *et al.*, in press). Subjects were not asked about their income because on previous surveys it was clear that people were reluctant to answer this question; education (highest level they reached in school) and present employment were used as a partial surrogate, although clearly income information would have been very valuable.

The questionnaire was basically the same one that was used at four events in South Carolina near the Savannah River Site (Burger *et al.*, 1997), and at four other events in Idaho, and the interviewers were the same. In other places where we used this survey instrument, the interview usually required about 15 min to complete; at the Shoshone - Bannock Festival the interview often required 30 min because of the Indians' interest and deliberation in answering questions, and their willingness to volunteer information.

Recreational questions dealt with days spent in different activities, how many cameras, guns and fishing rods they possessed, whether they ever hunted or fished on INEEL, whether they would engage in any future recreation on INEEL, whether they would pay to do so, and whether they believed that the game and fish from INEEL were safe to eat. Subjects were also asked which game species they currently ate.

The data were analyzed by dividing the sample into Shoshone-Bannock (and others) living on the Fort Hall Reservation, all other American Indians, and Whites. I was particularly interested in the hunting and fishing rates of the Shoshone-Bannock living at Fort Hall because the tribe has treaty rights to INEEL lands, and thus they have a clear stake in both the ecological resources on the INEEL site and any future land use decisions concerning INEEL.

Wilcoxon χ^2 tests and ANOVA were used to determine whether there were differences among vari-

ables as a function of tribal affiliation, and Duncan Multiple Range Test to determine difference between them (SAS, 1988). In the text and figures "Fort Hall Indians" refers to those living on the Fort Hall reservation, and "Other Indians" refers to all other American Indians interviewed. These same procedures were used to examine whether there were gender and age differences among the American Indians living at Fort Hall.

RESULTS

Demographics

There were significant ethnic differences (Table 1) in the mean age of those interviewed, as well as in advancement in school and self-evaluation of their health. American Indians living at Fort Hall ranked their health significantly lower than the other two groups. The relative percentage of unemployed was much higher among the Fort Hall Indians than among the other groups (Table 1). Partly this reflects the relative well-being of the Other American Indians who could afford to travel to a weekend festival several states away, compared to the local Fort Hall Indians who are already on site. There were no gender differences in age, advancement in school, or health self-evaluation.

Ethnic and Tribal Characterization of Hunting and Fishing and other Recreation

Ethnicity (tribal residence or White), gender, and schooling explained much of the variation in number of days devoted to hunting and photography (Table 2). For days devoted to fishing, variation was explained by gender, age, and schooling. There were no significant models for either camping or hiking.

Indians engaged in significantly more days of hunting per year, and significantly less photography than Whites, but there were no ethnic differences in fishing, hiking, and camping rates (Table 3). Not all people engaged in all recreational activities (Table 4). These data are important because they indicate the percentage of American Indians who would be exposed to contaminants in game or fish because of hunting and fishing behavior.

As might be expected, for all Indians hunting was significantly correlated with fishing ($r = 0.52$, $P < 0.0001$), hiking ($r = 0.30$, $P < 0.0001$), and camping ($r = 0.18$, $P < 0.01$). Hiking and camping were also significantly correlated ($r = 0.48$, $P < 0.00001$), as were hiking and fishing ($r = 0.39$, $P < 0.0001$). Age was not significantly correlated with any activities for all American Indians, but age was positively

TABLE 1
Demographics^a

	Ft. Hall American Indians	Other American Indians	White ^b	Wilcoxon χ^2 (<i>P</i>)
Number of Respondents	129	147	44	
Age	39.7 ± 1.5 (B)	36.6 ± 1.2 (B)	45.4 ± 2.3 (A)	10.7 (0.005)
Sex				
% male	53	50	57	
% female	47	50	43	
Advancement in school (years)	11.4 ± 0.3 (C)	12.6 ± 0.2 (B)	14.7 ± 0.5 (A)	35.6 (0.0001)
Residence (%)				
ShoBan (Ft. Hall) ^c	95	0	0	
Other S. E. Idaho ShoBan	0	10	0	
Western or Other S. E. Idaho	0	5	88	
Adjacent states (WA, MT, WY, UT)	0	29	7	
Further away	0	56	5	
Job Status (%)				
Unemployed/no job	21	5	0	
Retired	2	3	3	
Housewife/grandmother	8	7	3	
Health	3.7 ± 0.1 (B)	4.2 ± 0.1 (A)	4.2 ± 0.1 (A)	17.8 (0.0001)

^a Given are means ± standard error. NS, not significant. Like letters are not significantly different when all three groups are considered (Duncan multiple range test).

^b Includes white and 5 Hispanics.

^c Includes Shoshone, Bannock, or Shoshone-Bannock.

correlated with hunting ($r = 0.13$, $P < 0.05$) and negatively correlated with camping ($r = -0.19$, $P < 0.005$) for Fort Hall Indians.

The mean number of days people engaged in hunting, fishing, and recreational activities is the usual method of presenting such information (i.e., Table 3). However, for risk scenarios and for future use planning, it is essential to know the distribution of these activities among the populations (Fig. 2).

Although for both Fort Hall Indians and Other American Indians many people hunted, fished, or hiked 30 days or less per year, a significant proportion did so for more than 30 days a year. For example, 28% of Fort Hall Indians and 17% of other American Indians hunted more than 30 days a year. Moreover, 17% of Fort Hall Indians and 7% of other American Indians hunted on 100 or more days a year (Fig. 2). Similarly, 11% of Fort Hall Indians and

TABLE 2
Importance of Ethnicity, Gender, Age, and Schooling on Rates of Recreational Activities for People Interviewed at a Shoshone-Bannock Festival^a

	Hunting	Fishing	Hiking	Camping	Photography
Model					
<i>F</i>	1.52	2.46	0.86	0.74	1.43
<i>df</i>	8,201	8,199	8,185	8,186	8,184
<i>r</i>	0.38	0.50	0.27	0.24	0.45
<i>P</i>	0.01	0.0001	NS	NS	0.02
Factors (<i>F</i> , <i>P</i>)					
Ethnicity	6.65 (0.002)	NS	NS	NS	5.89 (0.003)
Gender	5.53 (0.02)	7.11 (0.008)	NS	NS	3.98 (0.05)
Age	NS	1.85 (0.0009)	NS	NS	NS
Schooling	1.67 (0.04)	4.37 (0.0001)	NS	NS	1.50 (0.09)
Ethnicity × schooling	—	—	—	—	1.67 (0.05)

^a Given are General Linear Models. NS, not significant.

TABLE 3
Recreational Activities of People Attending the Shoshone–Bannock Festival^a

	Ft. Hall American Indians	Other American Indians	White ^b	χ^2 (<i>P</i>)
Number of Respondents	129	147	44	
Recreational Activities (days/yr) ^c				
Hunt	43.1 ± 6.3 (A)	31.9 ± 6.7 (A)	3.4 ± 0.9 (B)	21.5 (0.0001)
Fish	30.7 ± 4.9 (A)	31.0 ± 5.8 (A)	24.6 ± 11.6 (A)	NS
Hike	39.6 ± 7.3 (A)	31.8 ± 7.6 (A)	32.4 ± 11.3 (A)	NS
Camp	19.8 ± 3.9 (A)	15.4 ± 2.1 (A)	11.4 ± 3.6 (A)	NS
Photograph	18.6 ± 4.2 (B)	15.8 ± 3.4 (B)	41.6 ± 10.5 (A)	11.0 (0.004)
Number Owned ^c				
Guns	1.5 ± 0.2 (A)	2.4 ± 0.4 (A)	2.3 ± 0.6 (A)	NS
Fishing Rods	2.2 ± 0.3 (A)	3.3 ± 0.4 (A)	3.4 ± 0.8 (A)	NS
Binoculars	0.9 ± 0.1 (B)	1.0 ± 0.1 (B)	1.5 ± 0.2 (A)	7.8 (0.02)
Cameras	1.3 ± 0.2 (B)	1.1 ± 0.1 (B)	5.2 ± 3.4 (A)	15.9 (0.0004)
INEEL ^d				
% Would recreate there	20.9 (B)	8.9 (C)	25.6 (A)	62.0 (0.001)
% Would pay to recreate there	4.7 (B)	2.1 (B)	17.5 (A)	69.0 (0.001)
% Would pay to camp there	5.4 (B)	3.4 (B)	12.5 (A)	64.5 (0.001)
% Work or worked on site	6.2 (B)	4.1 (B)	14.6 (A)	6.0 (0.05)
% Hunted on site	11.1 (A)	0 (B)	2.4 (B)	18.6 (0.001)
% Hunted adjacent to site	19.8 (B)	2.8 (C)	26.2 (A)	25.1 (0.001)
% Fished on site	3.2 (A)	0 (A)	2.4 (A)	NS
% Fished adjacent to site	11.9 (B)	2.1 (C)	26.2 (A)	24.0 (0.001)
% Say game on site is safe to eat	27.8 (B)	12.6 (C)	54.8 (A)	48.3 (0.001)
% Say fish on site is safe to eat	22.4 (B)	11.9 (B)	45.9 (A)	41.2 (0.01)

^a Given are means ± standard error. Like letters are not significantly different when all three groups are considered (Duncan multiple range test). NS, not significant.

^b includes white and 5 Hispanics.

^c Kruskal–Wallis χ^2 .

^d Goodness-of-fit χ^2 .

6% of other American Indians fished more than 100 days a year.

Hunting was the most common recreational activity for Fort Hall Indians, and they hunted and ate a number of different game species (Table 5). Deer was more commonly eaten, followed by elk and self-caught fish. A higher percentage of the Fort Hall Indians ate most species of game than did other American Indians. Hunting, fishing, and recre-

ational activity rates were relatively consistent among the American Indians, but Whites engaged in significantly fewer days of hunting. However, Whites were more willing to recreate on the INEEL site to pay to recreate there, and a higher percentage had worked on site than Indians (Table 3). Significantly more Fort Hall Indians had hunted on INEEL than Whites, but more Whites had hunted or fished adjacent to the site than the other groups.

TABLE 4
Percentage of Respondents That Said They Do Engage in the Following Recreational Activities

	Ft. Hall American Indians	Other American Indians	White ^a	Pearson Goodness-of-fit χ^2 (<i>P</i>)
Number of respondents	129	147	44	
Hunting	68	57	39	12.1 (0.002)
Fishing	68	64	63	NS
Hiking	60	53	70	NS
Camping	60	61	84	8.7 (0.01)
Photography	44	44	66	7.0 (0.03)

^a Includes white and 5 Hispanics.

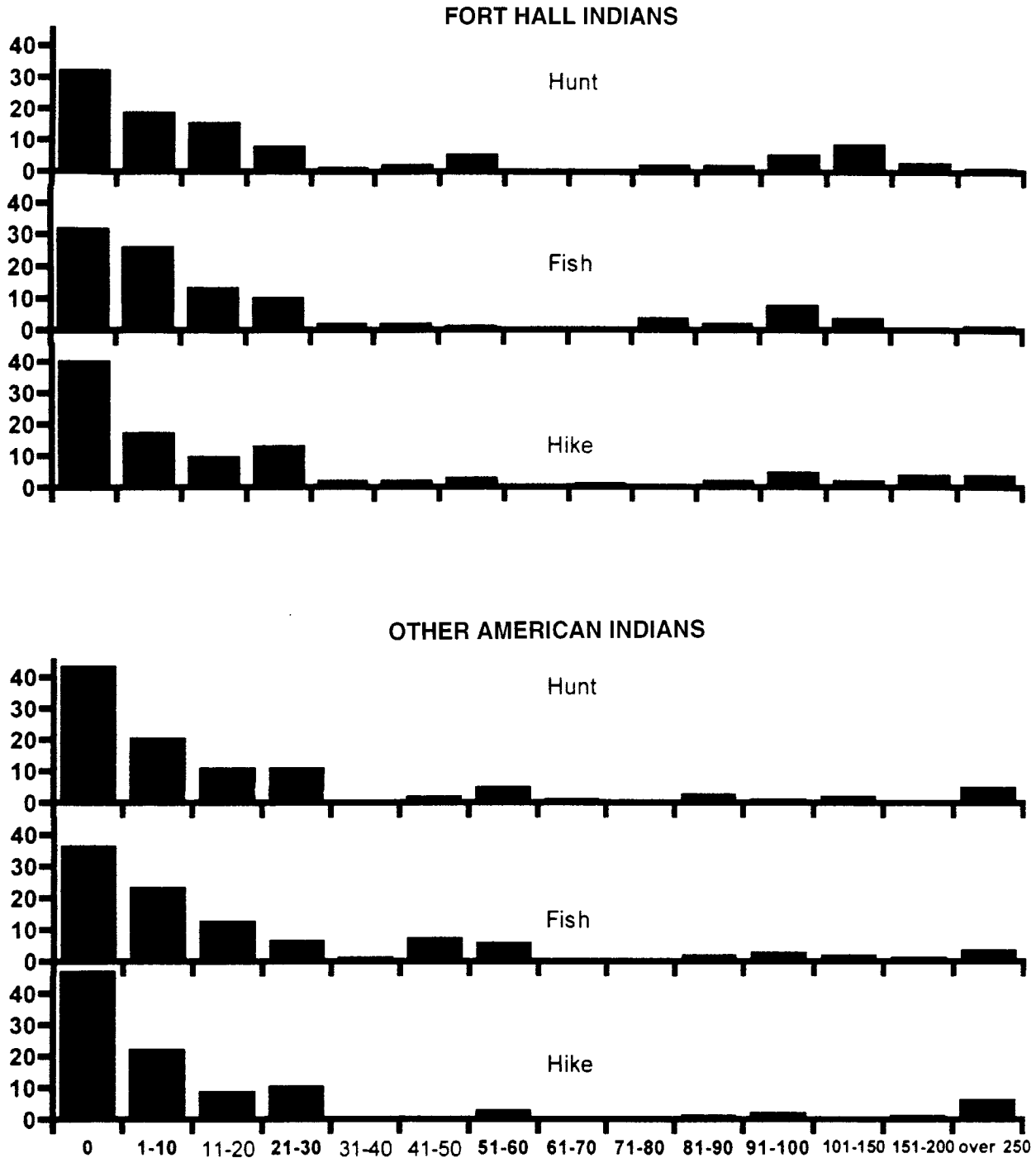


FIG. 2. Distribution of days spent hunting, fishing, and campling by Fort Hall Indians and other American Indians. Shown are percentages.

Significantly more Whites thought the fish and game from INEEL were safe to eat; Fort Hall American Indians were intermediate, and fewer other American Indians thought the fish and game were safe to eat (Table 3). Among Fort Hall Indians,

a higher percentage of those who believed the game on INEEL was safe reported that they hunted there (Fig. 3). Thus, there was a clear relationship between belief in the safety of the game and hunting on INEEL land for American Indians.

TABLE 5
Percentage of Respondents That Say They Eat the Following^a

	Ft. Hall American Indians	Other American Indians	White ^b	Pearson Goodness-of-fit χ^2 (P)
Number of respondents	129	147	44	
Deer	94.6	86.4	74.4	13.2 (0.001)
Elk	89.9	78.2	67.4	12.7 (0.002)
Pronghorn	48.8	39.5	32.6	NS
Moose	57.4	36.1	39.5	13.2 (0.001)
Waterfowl	48.8	36.1	55.8	7.4 (0.02)
Grouse	49.6	36.7	60.5	9.3 (0.009)
Rabbit	75.2	50.3	34.9	28.7 (0.001)
Squirrel	38.0	17.7	14.0	18.4 (0.001)
Dove	8.5	12.2	20.9	NS
Pheasant	64.3	48.3	62.8	7.9 (0.02)
Self-caught fish	79.1	70.7	69.8	NS

^aNS, not significant.

^bIncludes white and 5 Hispanics.

Gender Characterization of Hunting, Fishing, and Recreation of American Indians

There were significant gender differences in rates of participation in recreational activities for American Indians (both Fort Hall and other Indians, Table 6). Men engaged in more hunting, fishing, hiking, and camping, while women engaged in significantly

more photography. A significantly lower percentage of Indians women engaged in hunting, fishing, hiking, and camping than men (Table 7). Men owned significantly more guns, fishing rods, and binoculars than women (Table 6).

Men were significantly more willing to recreate on INEEL land, and to pay to do so, than were women; significantly more men had hunted and fished on

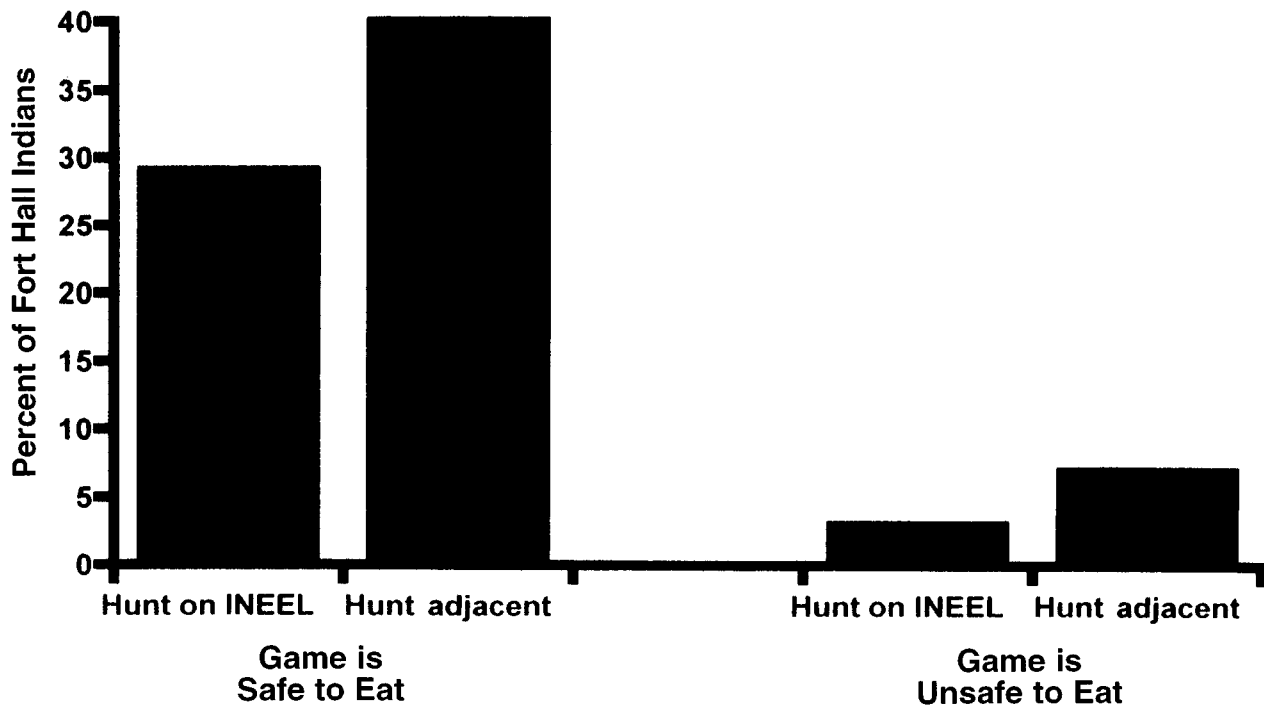


FIG. 3. Relationship of belief in the safety of the game, and hunting on or adjacent to the site.

TABLE 6
Recreational Activities of American Indians Attending the Shoshone–Bannock Festival^a

	Male	Female	$\chi^2(P)$
Number of respondents	138	132	
Recreational activities (days/yr) ^b			
Hunt	47.2 ± 6.7	25.1 ± 5.9	29.0 (0.0001)
Fish	36.9 ± 5.6	22.9 ± 5.3	15.9 (0.0001)
Hike	47.7 ± 8.1	23.4 ± 6.8	15.9 (0.0001)
Camp	20.2 ± 3.1	14.8 ± 3.2	7.3 (0.007)
Photograph	11.6 ± 2.8	22.3 ± 4.5	3.9 (0.05)
Number owned ^b			
Guns	2.4 ± 0.2	1.6 ± 0.4	31.5 (0.0001)
Fishing Rods	3.1 ± 0.3	2.4 ± 0.4	13.1 (0.0003)
Binoculars	1.1 ± 0.1	0.8 ± 0.1	11.9 (0.0006)
Cameras	1.2 ± 0.2	1.2 ± 0.1	NS
INEEL ^c			
% Would recreate there	18.8	9.8	6.1 (0.05)
% Would pay to recreate there	5.8	0.8	7.9 (0.02)
% Would pay to camp there	6.5	2.3	5.3 (0.07)
% Work or worked on site	6.6	3.8	NS
% Hunted on site	7.5	3.1	NS
% Hunted adjacent to site	15.8	6.2	6.2 (0.01)
% Fished on site	1.5	1.5	NS
% Fished adjacent to site	9.8	3.8	3.6 (0.06)
% Say game on site is safe to eat	24.8	15.4	NS
% Say fish on site is safe to eat	21.2	13.1	NS

^a Given are means ± standard error. NS, not significant.

^b Kruskal–Wallis χ^2 .

^c Pearson goodness-of-fit χ^2 .

INEEL land than had women (Table 6). There were no gender differences in whether they felt the fish and game from INEEL were safe to eat.

There were gender differences in the percentage of American Indians that eat different species of game (Table 8). In general, a significantly higher percentage of men eat a diverse range of game species than do women; there was no difference for waterfowl, rabbit, and self-caught fish.

TABLE 7
Percent of Respondents That Say They Do Engage in the Following (American Indians Only)

	Male	Female	Pearson goodness-of-fit $\chi^2(P)$
Number of respondents	138	132	
Hunting	79	45	31.1 (0.001)
Fishing	76	54	13.1 (0.001)
Hiking	66	47	8.4 (0.004)
Camping	66	55	3.1 (0.08)
Photography	38	52	4.8 (0.03)

DISCUSSION

Methodological Considerations

The American Indians interviewed were more deliberate in their replies and volunteered more

TABLE 8
Percentage of Respondents That Say They Eat the Following (American Indians Only)^a

	Male	Female	Pearson goodness-of-fit $\chi^2(P)$
Number of respondents	138	132	
Deer	93.5	87.1	3.1 (0.08)
Elk	90.6	78.0	8.1 (0.004)
Antelope	55.8	32.6	14.7 (0.001)
Moose	55.8	37.9	8.7 (0.003)
Waterfowl	46.4	37.9	NS
Grouse	49.3	36.4	4.6 (0.03)
Rabbit	65.2	59.8	NS
Squirrel	35.5	19.7	8.4 (0.004)
Dove	11.6	9.8	NS
Pheasant	62.3	50.0	4.2 (0.04)
Self-caught fish	75.4	75.8	NS

^a NS, not significant.

information than did others interviewed using the same survey instrument (Burger *et al.*, 1997; Burger *et al.*, in press). They asked more questions about why the information was important, how the information would be used, and exactly what was meant by some of the questions. Another difference between this event and others where similar interviews were conducted was in the distance people had traveled to attend; although 40% lived on the Fort Hall reservation, other people had driven from as far away as Florida. Thus, whereas the Shoshone-Bannock population shared a common homeland (and presumably a common set of problems), other American Indians did not.

It was difficult to determine total potential use of a site such as INEEL. For example, people were asked about several different outdoor activities (hunting, fishing, camping, hiking) separately, and people told us how many days they engaged in each of these activities. However, it is possible that people engage in more than one activity on the same day (i.e., fish and hunt on the same days, or hike and hunt on the same days). At the extreme, however, people may do these on different days, and their potential exposure could be computed by adding up the days they engage in different activities.

Differences between Shoshone-Bannock at Fort Hall and Other American Indians

Many risk communication scientists have noted that people's attitudes and judgments about environmental hazards are influenced by their experiences and values (Lowrance, 1976; Slovic *et al.*, 1979; Slovic, 1987; Barke and Jenkins-Smith, 1993). Perceptions are correlated with factors such as age, gender, and ethnicity, as well as trust and optimism (Taylor, 1989; Stern *et al.*, 1993; Flynn *et al.*, 1994; Arp and Kenny, 1996). Conflicts over ecological systems and land use occur, however both within groups of American Indians and among Indians and others (Smaby, 1975). In this article, I show differences in hunting and recreational rates, and attitudes about game on INEEL land as a function of tribal residence and of gender.

Fort Hall Indians and other Indians were similar with respect to hunting, fishing, hiking, camping, and photography rates, as well as in the number of binoculars and cameras owned. However, Fort Hall Indians were more similar to Whites (than to other Indians) with respect to their views on whether they would recreate on INEEL land, would pay to recreate there, and had hunted or fished on site. It appears that Fort Hall Indians were more similar to

other Indians in their recreational rates, but were more similar to local Whites than to other Indians with respect to whether they would use INEEL, or had used INEEL land. This suggests that although hunting rates differ ethnically within the local population around INEEL, their perceptions of future recreational use (or current use) of the site are similar. Further the high hunting rates of some Shoshone-Bannock might be a function of both cultural values and subsistence.

One other aspect of hunting deserves comment: 11.1% of the Fort Hall Indians and 2.4% of Whites reported that they had hunted on INEEL land. Further, some of the people who said they hunted adjacent to the site reported "sometimes going a bit onto the INEEL lands," but answered no to hunting on INEEL, suggesting that the percentage hunting on INEEL lands is higher than 11%. This hunting rate is remarkable given that there is very little legal hunting on site. INEEL lands are generally off-limits to hunting, although some hunting of elk and antelope is allowed on lands within a kilometer of the INEEL boundaries that are adjacent to private property, but then only during a controlled hunting season, in possession of a hunting permit (from a random draw, Idaho, 1997). Thus it is difficult for American Indians to legally hunt on INEEL lands. Many people first said they hunted on site, and then said, "I am not sure it is legal to hunt there, so maybe I just hunted on the corner" or similar statements. There is clearly interest in hunting on site, particularly for deer and antelope. Further, some Shoshone-Bannock living on Fort Hall mentioned that it would be nice to reestablish a buffalo herd on site. They have already established a small herd on the Fort Hall reservation, a source of pride for the tribe.

Recently several authors have made the point that cultural aspects of land use are critically important, and not just the subsistence or recreational value of hunting (Stoffle and Evans, 1990; Tano *et al.*, 1996; Toth and Brown, 1997; Harris and Harper, 1998). For many ethnic groups, fishing, and presumably hunting, meets a wide range of social needs that are far more important than the subsistence value of the fish or game themselves (Toth and Brown, 1997). This is particularly true for American Indians, such as the Shoshone-Bannock, whose views about culture and behaviors derive partially from the buffalo hunt (Murphy and Murphy, 1960).

There were abundant subsistence resources in the eastern Snake River Plains in pre-Euro settlement days (Reed *et al.*, 1987). These resources on the traditional tribal lands of the Shoshone-Bannock

included buffalo, antelope, deer, moose, elk, and bighorn sheep, and many of these migrated through the plains. Early Shoshone-Bannock culture was nomadic, and they traveled from the Fort Hall region north and east for buffalo (Steward, 1938). Until the mid-1800s there were buffalo near Fort Hall (Schoolcraft, 1861), and Fort Hall served as the traditional winter location for buffalo (Anderson *et al.*, 1996). As buffalo diminished, other game animals were added to the hunt over time. Today Shoshone-Bannock hunt other game, such as elk, deer, and antelope.

Comparison with Other Hunting and Fishing Rates

Outdoor activities, such as hunting, fishing, and other recreation, may be a viable future land use for some DOE sites (DOE, 1996; Lowrie and Greenberg, 1997; Burger *et al.*, 1997). Thus, in addition to comparisons between the Fort Hall Indians and other American Indians, it is useful to compare the hunting and fishing rates of Indians with other people living in the same region, and with people living in other regions of the country (Table 9).

The American Indians examined in this study have average hunting and fishing rates that are similar to those of the population interviewed at a South Carolina Sportsmen festival. However, the Indians surveyed at the Shoshone-Bannock Festival were a general population, and not a specific group of sportsmen. The equivalent comparison is between the general population in South Carolina and the general population at the Festival. In this comparison, the Fort Hall Indians (mean of 43 days/year) are hunting significantly more often than the South

Carolínians (mean of 3 days/year). These data confirm the importance of hunting and fishing in the daily lives of the American Indians and corroborate the exposure scenarios of Harris and Harper (1998).

Further, the people interviewed at the sportsmen festival in South Carolina were predominantly men; hunting and fishing rates for women in this region were far lower (Burger, 1997). In comparison, the hunting and fishing rates of American Indian men and women were much closer; men hunted an average of 47 days, and women hunted an average of 25 days. Also, 93% of the women in South Carolina did not hunt at all (Burger, 1997), while only 55% of the Indian women interviewed for this study said they did not hunt (this study).

Exposure Scenarios

In its Future Use report, DOE used 14 days as a reasonable maximum days of exposure for recreationists who might use DOE sites (DOE, 1996). The DOE did not consider a Native American or subsistence scenario. There are three other problems with this assumption: (1) people who engage in recreational activities may do so for more than 14 days a year; (2) people who engage in hunting and fishing may do so as part of a subsistence or cultural lifestyle, and might engage in far more than 14 days a year; (3) visitors on INEEL lands may engage in cultural activities other than recreation (i.e., gathering medicines). These assumptions appear not to be valid even for white or black Americans living near DOE lands (Burger *et al.*, 1997; Burger, 1997). American Indians, for whom the land assumes a sacred and religious meaning (Tano *et al.*, 1996), clearly fall way outside the 14-day assumption (DOE, 1996).

In the present article I have dealt only with hunting, fishing, and recreational rates of Shoshone-Bannock and other American Indians. Nonetheless, it is clear that both groups would be exposed far more than the 14-day assumption of the DOE (DOE, 1996). These data strongly suggest that site-specific data need to be acquired for each DOE site before exposure scenarios are developed, particularly when they may be used to establish clean-up levels (Lowrie and Greenberg, 1997). Even without examining the broad aspects of American Indian culture (Stoffle and Evans, 1990), it is clear that potential exposure of the Shoshone-Bannock to any contaminants on INEEL land would be higher than the assumptions.

Recently, Harris and Harper (1998) provided an excellent, encompassing exposure scenario and risk

TABLE 9
Hunting and Fishing Rates (Number of Days per Year)
for Selected Populations

Population	Hunting	Fishing	Source
Idaho			
Shoshone-Bannock	43 ± 6	31 ± 5	This study
Other Indians	32 ± 7	31 ± 6	This study
Whites	3 ± 1	25 ± 12	This study
South Carolina			
Sportsmen	43 ± 4	49 ± 4	Burger <i>et al.</i> , 1997
General population	3 ± 1	11 ± 3	Burger, 1997
Hunters and fishermen only ^a			
All U.S.	17	14	U.S. Fish & Wildlife Service, 1991
Idaho	11	9	
South Carolina	17	14	

model for tribal peoples. They included a variety of activities, such as hunting; fishing; gathering plants for food, medicine, and ceremonies; and sweat-house exposures. They noted that the health of the tribe is intimately connected to the health of the environment. Tribal exposure is much more than subsistence hunting and fishing, plus a few ceremonies. Their article strongly suggests that a more holistic approach is necessary to provide data about future land uses on the Department of Energy sites.

CONCLUSIONS

The data gathered in this paper present a potential exposure scenario for Fort Hall Shoshone-Bannock, as well as other American Indians. However, there are many other aspects of exposure that were not considered (see Harris and Harper, 1998), including food and medicinal uses of plants. A next step might be to interview women in depth about their total diet, and what percentage comes from self-collected foods (both plants and animals). Further, time they might spend on the site for religious or for other tribal affairs should be examined.

This study will assist land use planners and others in meeting the overall goals for Department of Energy lands through enhanced communication and information with tribal nations and different stakeholder groups. Hunting and fishing rates are key for developing potential exposure scenarios for American Indians and others who may use these lands if they are opened. This is particularly important because of the large number of government facilities where future land uses are now being debated. By understanding how different communities view ecological resources it is possible to begin conflict resolution that involves groups not otherwise included in the decision-making process through the usual institutional mechanisms. These concerns are especially important, given the existence of tribal agreements with the Shoshone-Bannock with regard to land use and land stewardship, which make the perceptions of the Shoshone-Bannock preeminent in the region. I suggest that increased knowledge of American Indian attitudes and values (more particularly, of the Shoshone-Bannock) will lead to a more satisfactory and equitable outcome of future land use decisions for INEEL, balancing the needs and interests of disparate groups.

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