Marking Places in the Southern Black Hills: A Preliminary Analysis

Ralph J. Hartley
Anne M. Wolley Vawser

Midwest Archeological Center
National Park Service
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Introduction

Anthropological archaeologists have long recognized that the nature of the archeological record at a "site", defined spatially and by artifact assemblage, is sometimes the result of hundreds of years of intermittent and diverse activities by unrelated individuals or kin groups. Many "sites" with observable remains of prehistoric or historic Native American activities are places amenable to contemporary use by individuals in an era of sophisticated mobility. These means of moving about the landscape often result in increased use of a place by any number of individuals but with less time occupying the place per individual. The result being that a place may be visited by a great number of individuals for a short period of time per person. The siting of a "campground" on public land, for example, is often topographically situated such that humans may have intermittently occupied this place for centuries, with the resultant material remains of past activities. One consequence of this siting is conflict between the preservation of the remains of these historic activities and that of continued use of the place, where "use" may involve the potential alteration or destruction of these remains.

Cultural resource management, as developed and practiced in the realm of archaeological sites on public lands, is primarily oriented toward preservation via protection of the remains of past human activities – where emphasis is placed on the antiquity of these activities. The goal of "historic" preservation, as sanctioned and codified socio-economically in western society, is conducted by way of "protecting" these remains from human induced and sometimes, non-human, damage – what Loubser (2001:83) has called "freeze-frame methodology". Understanding how and why places of social value change, however, is of increasing interest to social scientists and of utility to those assigned responsibility for their preservation.

Behavior deemed inappropriate at places assigned by society as having some kind of public value is, for the most part, rooted in the socio-economics of an area and the psychological makeup of the individual(s) (see Pitt and Zube 1987:1031-1032). Meskell (2002) goes so far as to emphasize that the western construction of "heritage" strongly influences concepts of conservation and destruction, such that the "notion of cultural good is often synonymous with economic success." Places where prehistoric petroglyphs and pictographs (rock art) are known are sometimes vulnerable to "vandalism" – the intentional alteration or destruction of rock art or "graffiti" – added markings at the site, sometimes superimposed over the rock art. Oftentimes the motivation for graffiti and vandalism are perceived as related by those responsible for "protecting" a place, but yet may be manifestations of different goals (e.g. Cottrell and Padgett 1997; Whitley 2001:27; cf. Loubser 2001:106).

Archeological sites in the Black Hills National Forest are places where both the effects of vandalism and graffiti can be observed. Surrounded by the high plains, the heavily forested Black Hills is characterized by highly dissected ridges, valleys, and deep canyons. Erosion has carved numerous rockshelters in this topography, although the remains of prehistoric and historic Native American activities are found throughout the large valleys, on the tablelands, and near waterways. Sites with prehistoric Native American petroglyphs and pictographs are the subject of several studies (e.g. Sundstrom 1990; 1993). While this study involves places where rock art exists, the content, age and group affiliation of these remains are not variables of interest to these analyses.

The purpose of this study is to (1) assess what situational factors are associated with a prehistorically occupied site that make it amenable to contemporary marking or the target of firearm discharge; and (2) to ascertain how the morphology and technique used in recent markings varies with these settings. This study is therefore not focused on interpreting use of prehistoric sites in the recent past but rather to initiate an effort to categorize variation in observations about contemporary activities and to derive testable predictions about future behavior at these places. Also, results of

this study permit questions to be posed that, although more broad in scope, lend themselves to potential empirical research.

Background

Information presented in both the visual and auditory modes is vital to all primates for communication. Symbolic communication furthermore is an energetically expensive adaptation limited to species such as primates that are highly intelligent, have a long period of immaturity, and are heavily dependent on socially transmitted technologies (Parker 1987:22; Liska 1994:235). Humans, however, depend primarily on the visual mode for discriminating information. This physiological wiring does not discount the advantages of multimodal signals (e.g. sound, smell) that humans rely upon, but the visual-spatial environment is one where abstract conceptualization is most prevalent (see Kaplan and Kaplan 1982:191-194; Rowe 1999).

The marking of a place suggests that the "signaler", regardless of species, relies on the presence of a potential "receiver(s)" of the information embedded in the marking, in effect advertising the past or current presence of the "signaler". If the receiver's knowledge is changed in some way as a result of the content of the "message" then information is conveyed. To mark a place visually is in essence to create a visual anomaly or, as Dissanayke (1995:108) argues with reference to humans, the embellishment of a place to make it "special". It may be that places are marked in such a way as to increase their novelty or memorability through contrast with methods such as coloration (Guilford and Dawkins 1991:7-8; Coe 1992; Heath and Bryant 1992:107; Zubrow 1994; Mithen 1996). The human marking of place is, not unlike the behavior of other species, oriented toward communicating information. How we assign intent and motivation to these markings varies with regard to the social and economic fabric of a society.

The study of "graffiti" (borrowed from the Italian word referring to scratching inscriptions and drawings and used to describe both the behavior underlying the act of marking as well as its content), has been focused primarily in urban environments (Ley and Cybriwsky 1974; Abel and Buckley 1977; Brown 1978; Kaplan 1981; Blake 1981; Cintron 1991; Gross and Gross 1993; Ferrell 1993; Peteet 1996; Alonso 1998). Studies of graffiti in rural environments are rare. Exceptions are studies of carvings on trees, especially aspen in the intermountain west. These carvings range from representational figures, to initials, dates and names (DeKorne 1970; Dominguez et al. 1992, Dominguez and Danielson 2000).

Sources of "graffiti" are diverse. The symbolic abilities of small children, for example, are believed to be the products of their developing cognitive structure and as they grow older ultimately of their social interaction needs (Parker 1987:14). Graffiti produced by children at sites with aboriginal or prehistoric rock art is well documented among the Sandawe of Tanzania (Ten Raa 1971:44). In the Wardaman country of Australia where small children were observed in 1988 carving simple grooves and non-representational geometric shapes in the rock with flakes picked up at the site and a 12-year old girl carving a "star" from two triangles (Flood, David and Frost 1992:35). The study of graffiti as a medium of visual communication and symbolization in Puerto Rico suggests that the morphology of the markings made by pre-teen children is oriented primarily toward self-identity and interpersonal relationships (Lucca and Pacheco 1986).

Researchers who study prehistoric and aboriginal rock art sometimes acknowledge that recent graffiti is laden with information about the social environment in which it was produced and is therefore worthy of study (e.g. Morwood and Keiser-Glass 1991; Clegg 1998; Loubser 2001). We consider recently produced graffiti at places where prehistoric rock art or other material remains exist to be a medium of symbolic communication worthy of study enhanced by its variable placement on the landscape. The assumption taken here is that graffiti is a means of transferring

social information and in some environments a means of communication within and between social classes (Rolston 1987; Sluka 1992; Lasley 1995:166; cf. King 1994:107).

Why prehistoric rock art is intentionally damaged is a question of behavior that is somewhat more problematic. Vandalism, as defined by Goldstein (1996:27), is "an intentional act of destruction or defacement of property not one's own". In a rural setting vandalistic behavior is believed to usually take place in a group and as a "status-seeking enterprise" – a means by which to strive for prestige within a peer-setting (Donnermeyer and Phillips 1984:159-160). Males are more apt to behave as vandals than females, regardless of setting. This motivation is best explained by the "Equity-Control Theory" of vandalistic behavior where an individual perceives a lack of fairness in the social environment. The goal of vandalism is then to restore equity and achieve a perception of control (Goldstein 1996:43-45).

In some cases the act of imposing markings over existing markings, deleting or confusing the original image (often called superimposition), may be an attempt to destroy or mask information embedded in the underlying image. The underlying motivation for this behavior may be rooted in competition between groups or individuals.[1] Morphology of the images, in some cases, serve as a marker of ascribed identity, reinforcing the perception and mechanics of social borders (Ross 1975). In other cases enhancement or embellishment of the original image or text is the goal of the "artist" as a means to maintain "cultural tradition". The utility of a place with rock art to maintain social cohesiveness and corporate identity can serve political and economic goals in a social environment where competition is manifested at a multitude of scales (Culwick 1931:36; Bowdler 1988; Vinnicombe 1992; Ward 1992; Walsh 1992; Ouzman 1995). The marking and re-marking of places, irrespective of the time period, is behavior that can be examined most profitably in the realm of socio-economic competition.

Methodology

A total of 41 sites with prehistoric or historic Native American rock art as a component were examined for this study. Each site was relocated during the summer of 2000 and 2001. All but four sites were selected by personnel from the Black Hills National Forest for assessment of their preservation status. All sites examined for this study are located in Custer and Fall River counties of South Dakota. Many of these locations had not been fully recorded for the State and three previously unknown sites were encountered during the process of relocating other sites.

Variables chosen for the analyses used in this study were selected from criteria stipulated by the U.S. Forest Service for assessment of "condition" of the sites, all of which are oriented to preservation of remains of prehistoric or historic Native American activity. "Condition" is considered that which is relative to information initially documented about the site sometime (in most cases years) previous to our visit and an assessment of potential threat to the current status of the site. The twenty variables defined for this study concern association with or product of rock art and graffiti; physical evidence of contemporary activities at a site; evidence of firearm discharge at a site; and setting of the site, including both topographical and human alteration of the landscape. These variables are presented below; capitalized words in parentheses are variable names used in the tables.

<u>Rock Art and Graffiti</u>:

--- Symbols of identity (IDSYMBOL) are represented in graffiti that identifies an individual, kin-group, or otherwise ascribed grouping. Examples include initials, names, and ranch brands (Figure 1).

---Words, either singly or in a string, and calendar dates are considered together as a variable (TEXTDATE). No words inscribed in languages other than English were observed.
--- Figures, either inscribed or painted, that could be recognized and identified by any member of the field crew as representative of anything, including an iconic semblance, other than as a symbol of identity were categorized (REPRESEN) (Figure 2).
--- Non-representational figures (NONREPRE) constitute any inscribed or painted figure for which field crew observers had no referent with which to make an association. The lack of recognized depiction in this study does not, however, suggest that there lacks potential for others to perceive some representation.
---The use of white chalk (CHALK) to enhance the outline of petroglyphs is widespread across the intermountain west. Chalking was documented for this category when observed to be in contact with prehistoric or Native American rock art (Figure 3).
--- Use of paint, ink, crayon, or charcoal (PAINT) to produce graffiti on or near rock art was included as one variable (Figure 4).
--- The light abrasion of sandstone with a sharp object (SCRATCH) to form graffiti anywhere at a site was documented.
--- The deep carving of sandstone with an object much harder than the sandstone (INCISING) to produce any kind graffiti.

Physical Evidence:
--- The remains of fire hearths (FIRE), presumed to have been used during brief visits to the sites, were documented.
--- Miscellaneous debris of contemporary or recent historic age was documented (TRASH). Examples include cans, plastic, foil, paper, cigarette butts, etc.

Firearm Impact:
--- Indentation and spalling of sandstone due to firearm discharge (GUNSHOT) (Figure 5).
--- Impact of firearm discharge at or near petroglyphs or pictographs of anthropomorphic morphology (ANTHRO).
--- Impact of firearm discharge at or near petroglyphs or pictographs of zoomorphic morphology (ZOOMORPH) (Figure 5).
--- Impact of firearm discharge at or near petroglyphs or pictographs of a representational form (REPGUN).
--- Impact of firearm discharge at or near a petroglyph or pictograph of a non-representational form (NONREPGN).

Setting:
--- A locality where there exists the physical remains of some kind of resource extraction activity, e.g. mining, timber cutting (EXTRACT).
--- A locality where a small stock dam or pond or its remnants is visible for the watering of stock (STKDAM).
--- A locality at or near the head of a canyon (HEADCNYN), usually steep-walled or with very steep slopes from which water drains to a lower elevation.
--- A locality near a river, stream, or creek (WATER), both active and intermittent,
--- A locality at the edge of flat or gently undulating tableland (RIM).
--- A site's proximity to a road or trail was categorized as less than 100 meters (RDTR100), 100-200 meters (RDTR200), or greater than 200 meters (RDTRMAX).

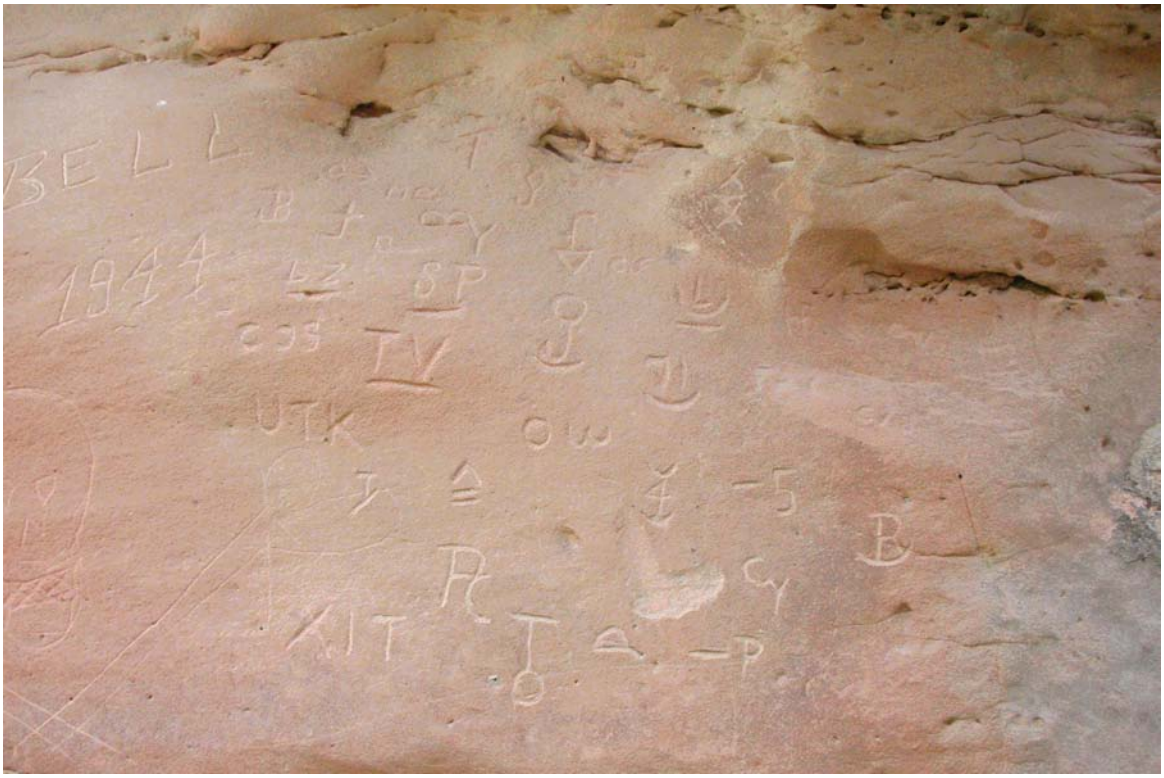

Figure 1. Example of symbols of identity (IDSYMBOL) such as ranch brands, and dates (TEXTDATE) such as “1944”. (Site 39FA690)


Figure 2. Example of a representational figure (REPRESEN) (the human figure in a boat on the right side of the panel). (Site 39FA90)

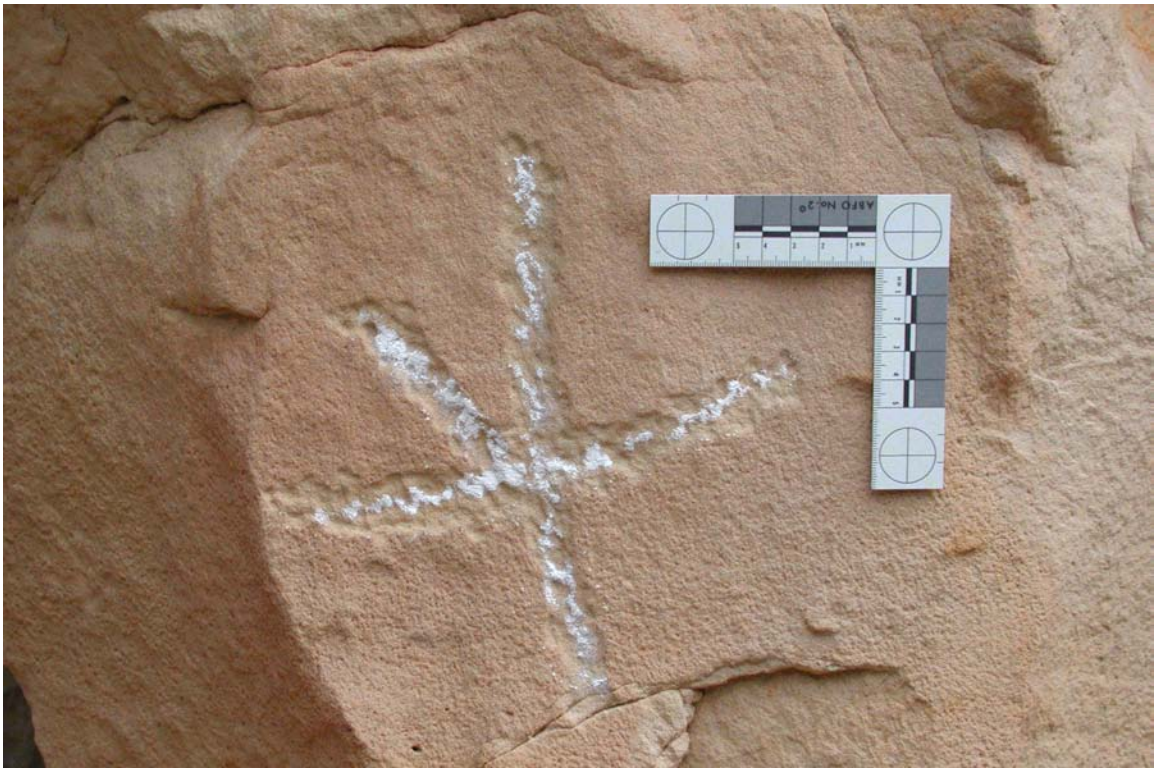

Figure 3. Example of the use of white chalk (CHALK) to highlight a petroglyph. (Site 39FA316).

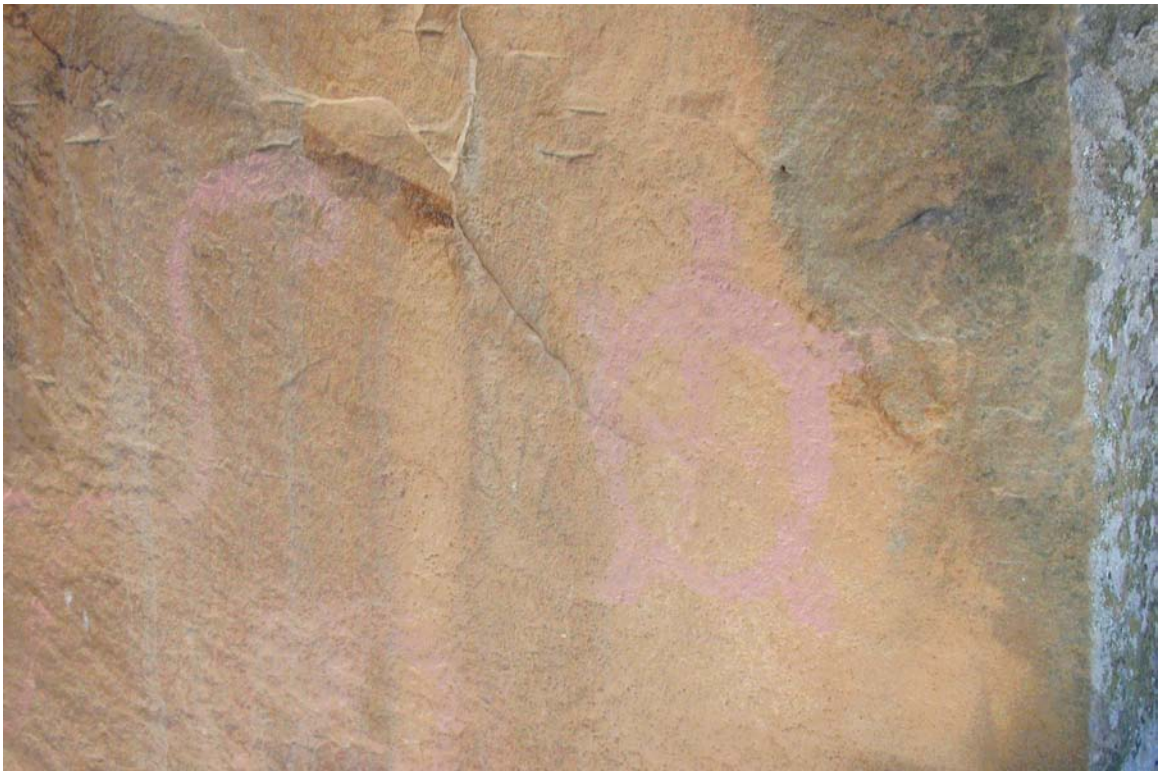

Figure 4. Example of paint (PAINT) in an apparent recent application near a rock art panel. (Site 39FA321)

Figure 5. Example of firearm discharge impact (GUNSHOT) at or near petroglyphs or pictographs of zoomorphic morphology (ZOOMORPH). (Site 39FA99)

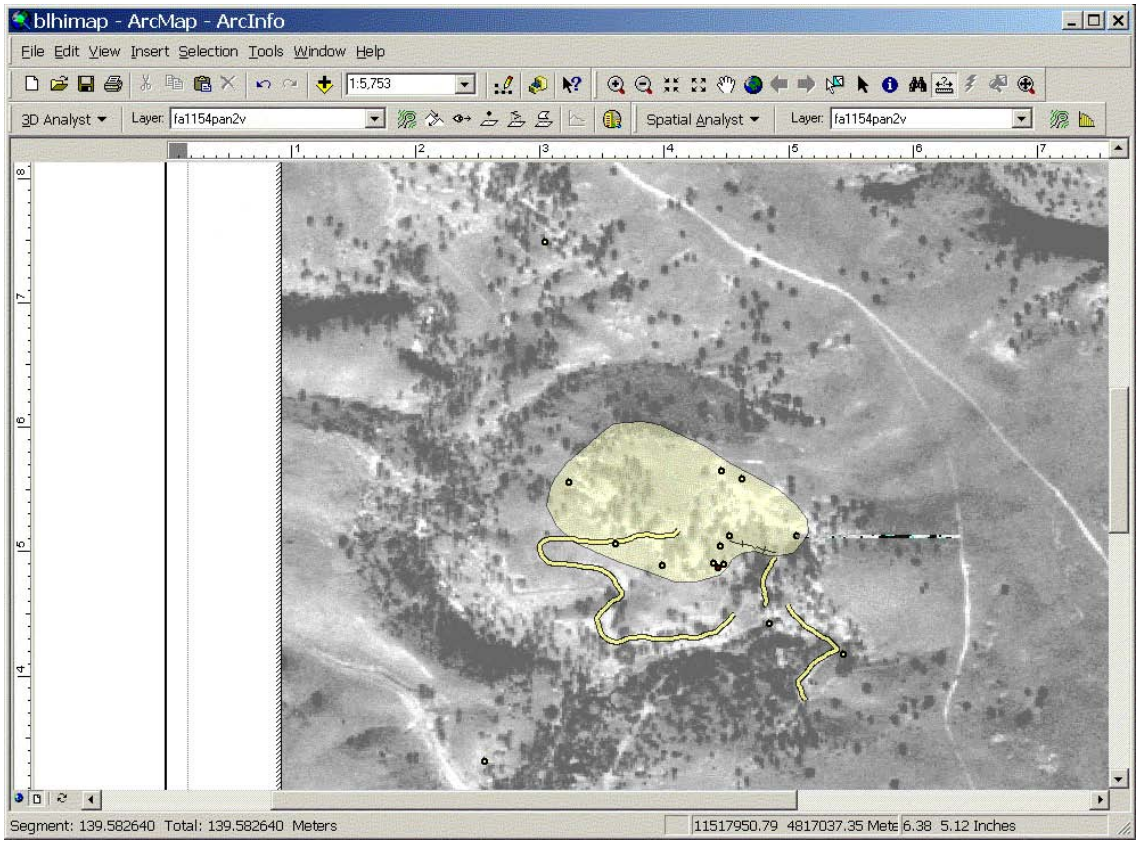

Figure 6. Site locations were overlain on orthophoto quads or topographic maps in the GIS to determine the distance to roads and streams. (Site 39FA1154)

Site setting information was determined through the use of Geographic Information Systems (GIS) and Global Positioning Systems (GPS). GPS readings of the site locations were taken in the field at the time of the site visits. The equipment used in 2000 was a Precision Lightweight GPS Receiver (PLGR) with an accuracy of about +/- 4 meters. The equipment used in 2001 included two Trimble GPS units, a GeoExplorer II (with accuracy of +/- 1 meter) and a ProXRS (with accuracy of +/- 50 cm). Site locations from the GPS readings were entered into a GIS System using ArcView 3.2 and ArcGIS 8. Site locations were overlain on Digital Raster Graphics (DRG) which are digital, georeferenced topographic maps, and Digital Ortho Quads (DOQ) which are digital orthographic USGS Quadrangles. Using the GIS we were able to measure the distance between the sites recorded location and features visible on the DRGs and DOQs such as roads and streams (Figure 6).

To determine if sites were visible from a road or other site or feature, the GIS was used to create a viewshed using the site and feature location and the elevation data in a Digital Elevation Model (DEM). In the case of sites that had been impacted by firearm damage, we were particularly interested in whether the sites were visible from nearby roads or trails (Figures 7 and 8). In determining the viewshed, the GIS calculates the elevation of the point designated as that of the observer from the DEM (in Figure 7 the observation point is along the road segment in the canyon bottom, indicated in black). Again using the DEM, each 30 by 30-meter cell is then used to determine the elevation for surrounding areas. A new coverage is created that contains 30 by 30-meter cells each assigned as visible or not visible.

Loglinear analysis was used in this study due to the binary nature of the data. Multivariate analyses (logit and binomial logistic regression) were performed using SYSTAT (v.8.0) and SPSS (v.7.5). These multivariate procedures permit the discovery of complex relationships between one or more dependent categorical variables and a set of nominally scaled independent variables. Although analogous to linear regression models interaction effects revealed in binary data using logit and logistic regression models are more difficult to evaluate.

The small sample of sites available for analysis make any statistical assessment highly vulnerable to falsely rejecting a hypothesized effect (Type II error). On the other hand, results in this context have the potential to be unstable and untrustworthy (Murphy and Myors 1998:6-15). Acknowledgement of this fact requires us to be explicit about our interest in building testable predictions of behavioral activities at these kinds of archaeological sites. With that in mind we also acknowledge the danger of using these procedures to extrapolate from this sample human behavior at the overall “population” of archaeological sites with rock art in the Black Hills environment. We, therefore, emphasize that this is not a definitive study.

Results

Results of these investigations constitute three sets of analyses, discovery, and predictions. Predictions about behavioral activities at these kinds of sites are formulated so as to be testable. It should be recognized, however, that it would be very rare in social science that such a small number of variables found to have association are unaffected by any other variables (see Fotheringham 1999).

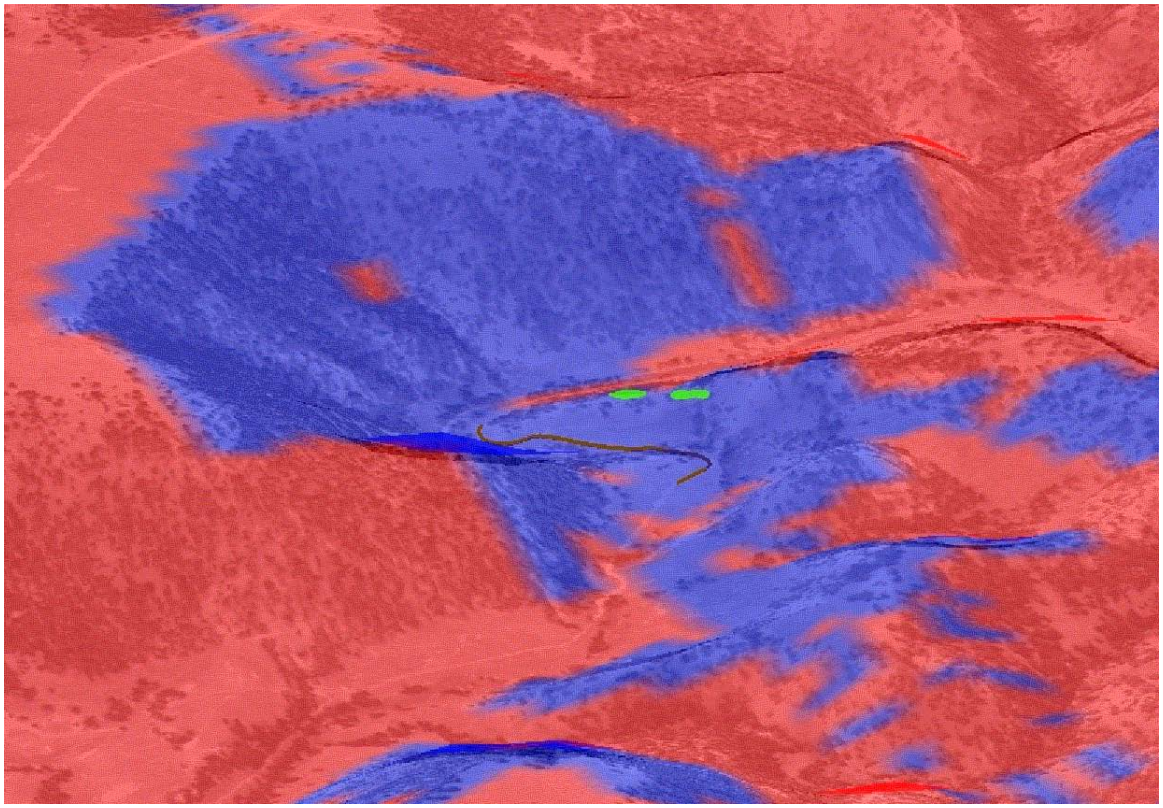

Figure 7. Sites 39FA99 and 39FA321 (green) along a cliff face in Craven Canyon. The sites are within the viewshed (blue shaded areas) from the road in the bottom of the canyon and are less than 100 meters from the road.

Figure 8. Site 39FA321 in Craven Canyon, looking north.

I. What topographical and environmental setting in which a site with prehistoric or historic Native American rock art is situated is associated with evidence of recent markings on the rock surface? What topographical and environmental features contribute to the odds of observing the presence of the markings within proximity to a road or trail?[2] How do the chances of these markings being present under these conditions vary between sites at rockshelters and non-rockshelters? (see Table 1)

Symbols of Identification:
Analyses suggest that one should expect the odds of observing identification markings (e.g. names, initials, and brands) at non-rockshelter sites to be increased when the site is near a river, stream or creek and less than 100 meters from a road or trail. These odds are increased when the site is situated at the head of a canyon or the rim of tableland up to 200 meters from a road or trail. At rockshelter sites the odds of observing identification markings are increased when the site is in proximity to a stock dam or pond, especially when more than 200 meters from road or trail.

Text & Date:
Despite the observed presence of the inscription of words and/or dates at non-rockshelter sites the topographical and environmental factors used in these analyses are unsuitable as predictors for this behavior. At rockshelters, however, one should expect that the odds of observing these kinds of markings will be increased when the site is near a river, stream, or creek, or stock dam or pond, and situated 100 meters or more from a road or trail.

Representational:
The topographical and environmental variables available for this study do not permit modeling of the odds of observing the presence of representational markings at either rockshelters or non-rockshelters.

Non-Representational:
Analyses suggest that one should expect the odds of observing markings that are non-representational to be increased when a non-rockshelter site is near a stock dam or pond and/or near the place of past resource extraction (e.g. mining) regardless of the site's distance from a road or trail. Proximity to a river, stream or creek also increases the chance of observing these markings. The odds of observing non-representational markings at rockshelter sites is increased slightly by proximity to places of resource extraction up to 200 meters from a road or trail.

Chalk:
Analyses suggest that one should expect the odds of observing the chalking of prehistoric petroglyphs at a non-rockshelter site to be increased slightly by the proximity of the site to a stock dam, pond, stream or creek or potentially when situated at the rim of tableland, regardless of the distance of the site from a road or trail. The odds of observing chalking at a rockshelter are expected to increase when the site is close to a stream or creek and secondarily, to the presence of a place of resource extraction activity or situated at the rim of tableland, again regardless of the site's distance from a road or trail.

Table 1. Markings and Site Settings.[3]

	Non-Rockshelter			Rockshelter		
	(n)	Variable	Odds Ratio	(n)	Variable	Odds Ratio
IDSYMBOL						
Road/trail						
<100m	(3)	HEADCNYN	(.111)	(1)	STKDAM	(.020)
		WATER	(.266)		WATER	(.015)
		RIM	(.167)		RIM	(.031)
100-200m	(6)	HEADCNYN	(.273)	(4)	STKDAM	(.015)
		RIM	(.073)		HEADCNYN	(.007)
		WATER	(.062)		WATER	(.019)
					RIM	(.004)
>200M	(3)	----------		(3)	STKDAM	(.371)
					HEADCNYN	(.041)
					WATER	(.049)
					RIM	(.043)
TEXTDATE						
Road/trail						
<100m	(3)	----------		(1)	----------	
100-200m	(6)	----------		(2)	STKDAM	(.602)
					HEADCNYN	(.827)
					WATER	(1.252)
					RIM	(.609)
>200m	(3)	----------		(4)	EXRACT	(.207)
					STKDAM	(.569)
					HEADCNYN	(.207)
					WATER	(1.295)
					RIM	(.019)
REPRESEN						
Road/trail						
<100 m	(2)	----------		(0)	----------	
100-200m	(2)	----------		(1)	----------	
>200m	(1)	----------		(1)	RIM	(.011)

Table 1. Markings and Site Settings (continued).

	Non-Rockshelter			Rockshelter		
	(n)	Variable	Odds Ratio	(n)	Variable	Odds Ratio
NONREPRE						
Road/trail						
<100	(3)	EXTRACT	(1.068)	(1)	EXTRACT	(.036)
		STKDAM	(1.243)		HEADCNYN	(.001)
		WATER	(.702)		WATER	(.017)
		RIM	(.401)		RIM	(.037)
100-200m	(2)	EXTRACT	(.886)	(1)	EXTRACT	(.058)
		STKDAM	(.988)		WATER	(.014)
		WATER	(.827)		RIM	(.014)
		RIM	(.233)			
>200m	(2)	EXTRACT	(.923)	(0)	----------	
		STKDAM	(1.056)			
		WATER	(.718)			
		RIM	(.221)			
CHALK						
Road/trail						
<100m	(4)	STKDAM	(.012)	(2)	EXTRACT	(.634)
		HEADCNYN	(.001)		WATER	(1.538)
		WATER	(.012)		RIM	(.913)
		RIM	(.012)			
100-200m	(3)	STKDAM	(.012)	(2)	EXTRACT	(.751)
		HEADCNYN	(.001)		WATER	(1.468)
		WATER	(.013)		RIM	(.740)
		RIM	(.012)			
>200m	(3)	STKDAM	(.012)	(2)	EXTRACT	(.618)
		HEADCNYN	(.001)		WATER	(1.626)
		WATER	(.012)		RIM	(.518)
		RIM	(.012)			
PAINT						
Road/trail						
<100m	(2)	EXTRACT	(.031)	(0)	----------	
		STKDAM	(.001)			
		RIM	(.009)			
100-200m	(1)	EXTRACT	(.029)	(0)	----------	
		WATER	(.008)			
>200m	(0)	----------		(0)	----------	

Table 1. Markings and Site Settings (continued).

	Non-Rockshelter			Rockshelter		
	(n)	Variable	Odds Ratio	(n)	Variable	Odds Ratio
SCRATCH						
Road/trail <100m	(4)	EXTRACT STKDAM	(.961) (.908)	(2)	EXTRACT STKDAM WATER RIM	(.029) (.022) (.010) (.026)
100-200m	(5)	EXTRACT STKDAM	(.575) (.287)	(3)	EXTRACT STKDAM WATER RIM	(.036) (.307) (.037) (.035)
>200m	(1)	EXTRACT	(1.054)	(5)	EXTRACT STKDAM WATER RIM	(.036) (.371) (.045) (.042)
INCISING						
Road/trail <100m	(3)	STKDAM HEADCNYN WATER RIM	(.011) (.011) (.011) (.010)	(1)	STKDAM WATER RIM	(.020) (.015) (.031)
100-200m	(5)	STKDAM HEADCNYN WATER RIM	(.011) (.011) (.011) (.010)	(4)	STKDAM HEADCNYN WATER RIM	(.015) (.007) (.019) (.004)
>200m	(5)	STKDAM HEADCNYN WATER RIM	(.021) (.021) (.012) (.020)	(3)	STKDAM HEADCNYN WATER RIM	(.371) (.041) (.049) (.043)

Paint:
Analyses suggest that one should expect the odds of observing paint, ink, crayon or charcoal at a non-rockshelter site to be increased very weakly by its proximity to a stock dam or pond. No expectations can be made concerning the use of these substances at rockshelter sites with data available for this study.

Scratch:
Analyses suggest that one should expect the odds of observing scratching of a rock surface at a non-rockshelter site to be increased by its proximity to a place of resource extraction or a stock dam or pond within less than 100 meters from a road or trail, and somewhat less of an increase when the site is greater than 100 meters but less than 200 meters from a road or trail. The presence of a place of resource extraction is expected to increase the odds more when the site is situated more than 200

meters from a road or trail. At rockshelter sites the odds of observing scratches are increased by proximity to extraction activities, a river, stream or creek, and especially a stock dam or pond, regardless of distance from a road or trail. A rockshelter situated at a rim is also expected to increase these odds (see Figures 9 and 10 for examples of site settings).

Incising:
Analyses suggest that one should expect the odds of observing some kind of incising of the rock surface at non-rockshelter sites to be increased slightly when the site is near a stock dam or pond and a river, stream or creek. And also when situated at the head of a canyon or at the rim of tableland, regardless of distance from a road or trail. Similarly the odds of seeing incising at rockshelters is increased slightly by these same factors, especially the presence of stock dams or ponds regardless of the distance of the site from a road or trail.

II. Is contemporary or recent marking on rock (e.g. graffiti) at a site behavior that is associated with or coincidental to transient occupation of the place? Do places with these markings reveal remains or evidence of other recent activities? How do markings and activities vary between rockshelter and non-rockshelter settings?

Analyses suggest that the presence of recent rock markings are, for the most part, independent of other transient activities at both rockshelter and non-rockshelter sites as revealed by the presence of fire-hearths and/or trash (see Table 2). Exceptions to this generalization are suggested by data that indicate (although models are very weak) that the odds of observing a rockshelter site with a recent fire-hearth may be increased slightly by the presence of recently made representational figures (MFR^2=.427) and less so by prehistoric rock art that is chalked (MFR^2=.215). This association is in contrast to that at non-rockshelter sites where the presence of fire-hearths is a weak predictor of a rock art surface that has undergone recent marking with paint, ink, crayon or charcoal (MFR^2=.259). The presence of trash does not appear to be a predictor of contemporary markings on rock at either rockshelters or non-rockshelters with prehistoric rock art as a component.

III. Does site setting condition a panel's vulnerability to firearm impact? Does the morphology of the rock art influence the vulnerability of the site to impact by firearms?

Analyses suggest that one should expect the odds of seeing indentations or spalling on the surface of rock art panels due to firearm discharge to be increased at non-rockshelter sites when the site is in proximity to a place of resource extraction and less than 100 meters or greater than 200 meters from a road or trail. At rockshelters the odds are increased slightly when the site is near a river, stream or creek or situated at the rim of tableland when more than 100 meters from a road or trail (see Table 3). The presence of non-representational rock art at both rockshelter and non-rockshelter sites increases the odds of seeing evidence of firearm impacts on the rock art panels. At non-rockshelter sites these odds are also increased by the presence of zoomorphic figures.

Discussion

Euro-American activities throughout the Black Hills intensified by the 1870's. During the late 19th and early 20th centuries mining, logging, and cattle raising activities brought thousands of people to the area. By 2002 the population density of Custer county in the southern Black Hills had almost tripled (7370) since 1900 and more than doubled in Fall River county (7392). We suggest that some of the graffiti that reveal identities, both of individuals and groups, and dates contain

Table 2. Markings and Recent Use of Sites.[4]

	NON-ROCKSHELTER (24)				ROCKSHELTER (17)			
	L^2(df=3)	p=	MFR^2	Best predictor	L^2(df=3)	p=	MFR^2	Best predictor
IDSYMBOL	2.96	.399	.089	---	2.791	.425	.119	---
TEXTDATE	2.96	.394	.089	---	2.939	.401	.128	---
REPRESEN	0.981	.806	.040	---	5.264	.153	.427	FIRE
NONREPRE	3.193	.363	.110	---	1.153	.764	.094	---
CHALK	3.760	.289	.115	---	4.751	.191	.215	FIRE
PAINT	4.681	.197	.259	FIRE	---	---	---	---
SCRATCH	3.760	.289	.115	---	2.939	.401	.128	---
INCISING	2.788	.426	.084	---	2.791	.425	.119	---

Table 3. Firearm Discharge Setting and Impact with Rock Art.

	Non-Rockshelter			Rockshelter		
	(n)	Variable	Odds Ratio	(n)	Variable	Odds Ratio
Road/trail <100m	(4)	EXTRACT	(.215)	(0)		
100-200m	(2)	----------		(1)	WATER RIM	(.032) (.026)
>200M	(1)	EXTRACT	(.119)	(3)	WATER RIM	(.032) (.021)
		ZOOMORPH NONREPGN	(.026) (.034)		NONREPGN	(.022)

Figure 9. Example of a rockshelter at the head of a canyon, near the canyon rim, and near a resource extraction location (mine), water (a spring is just below the rockshelter opening) and over 100 meters from a road or trail. (Site 39FA1154)

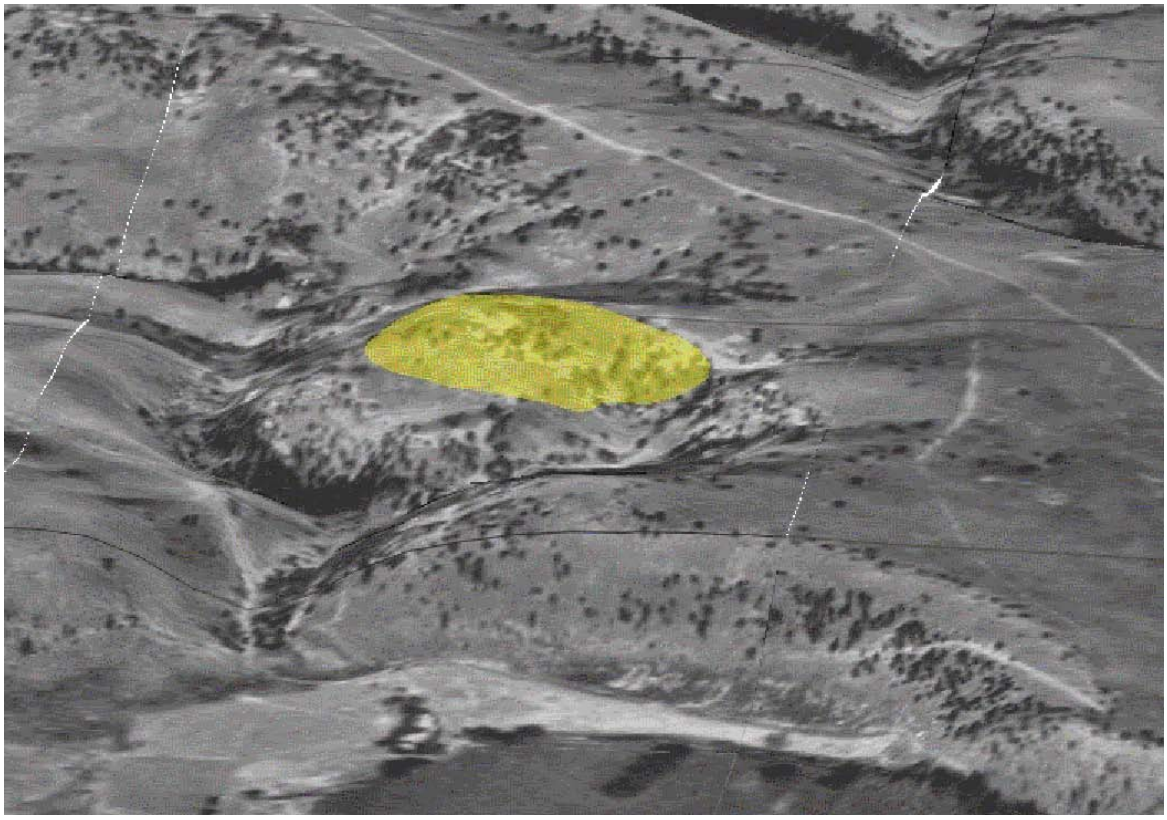

Figure 10. Setting of site 39FA1154 (yellow) displayed three dimensionally on the digital orthophoto.

information potentially useful for investigating historic rural land-use behavior at a fine-grained level.

Identifying or indexical types of information embedded in signs or symbols are observed in many species, especially where the individual producing the marking is a holder of valuable resources, usually territorial or dominant males. Permanent brands for cattle, for example, are symbols of ownership, useful when the potential presence of others, both competing holders of the same kind of resource as well as those coveting this resource, share the same environment – in this case grazing land. The placing of brand markings at sites used by those "owning" the brand is observed cross-culturally (Winkler 1947; Dickson 1951:419-429; Gramly 1975; Lynch and Robbins 1977; Loendorf 1989:65-66, 302-306). The placement of markings is often, but not always, found at locations of water or shelter used by the animals and/or their owners. Are symbols of propriety (e.g. brands) observed at places on the landscape and assigned to a kin-group (e.g. ranch family) distributed randomly on land accessible (historically documented) to that group or are patterns observable in the distribution that reveal intense or repeated use of areas? Is overlap in the distribution of particular brand markings observable and, if so, does this reveal changes in land-use through time or competition for access to areas of higher value?

We believe that some of the graffiti in the form of text or symbols reveal changes in the social environment of the region. Graffiti that reveals the contesting of space is known to be a mechanism of behavior where socio-economic stress defines an environment (e.g. Ley and Cybriwsky 1974; Rolston 1987; Sluka 1992; Peteet 1996). We suggest that attempts to define social borders in the southern Black Hills is represented in some graffiti (e.g., 'white man go home' was found incised at one site).

Symbols of affiliation to Christianity were also observed in the form of a cross or text referring to "Jesus" (see Figure 11). We can not make assumptions about an underlying intent to proselytize with this message. Nevertheless we contend that these kinds of "messages" are placed on the landscape in areas of pre-existing graffiti so as to presume an increased chance of the message being "received" by future visitors.

The content of some graffiti reveals the gender of the presumed "artist". Romantic relationships presumed or anticipated, is also a subject of graffiti display (see Figure 12). Some well-bounded drainages such as Stone Quarry Canyon contain graffiti of this kind as well as trash that suggest relatively intense visitation from historic through the contemporary period. Visual markings relating to courtship is directed by the "signaler" to not only the selected or potential mate but to potential competitors as well (Figure 13). In a place where a male (e.g. John) might carve, for example, "John loves Mary" within the outline of a heart suggests that it is in "John's" interest that the receiver of the message be "Mary", her associates, and any competing suitors. Other females can also find it beneficial, in terms of sexual strategies theory and their interest in resisting manipulation, to assess male "signalers" by "eavesdropping" on their message (Guilford and Dawkins 1991:9; Buss and Schmitt 1993:206; Gangestadd and Simpson 2000; Gosling and Roberts 2001:203-204). Is the gender of graffiti symbolizing identity primarily male or female? Where gender can be discerned does male identity graffiti concentrate in a drainage or other topographically defined area? Where graffiti symbolizing identity is superimposed on other graffiti is the gender discernable to male or female? Are identity symbols that reveal resource ownership (e.g. brands) placed on the landscape as status displays so as to increase the likelihood of potential mates being the receiver of the message?

Nearly 20% of the sites examined for this study exhibited evidence of being the target for firearm shooters. The caliber of firearms used appears to vary. Several other variables, however, influence the impact the projectile will have on the rock surface. Ballistic data for common contemporary and recent historic firearms reveal the surface impact projectiles have when fired at various distances from the target (Table 4). Knowing where guns of various caliber are fired when

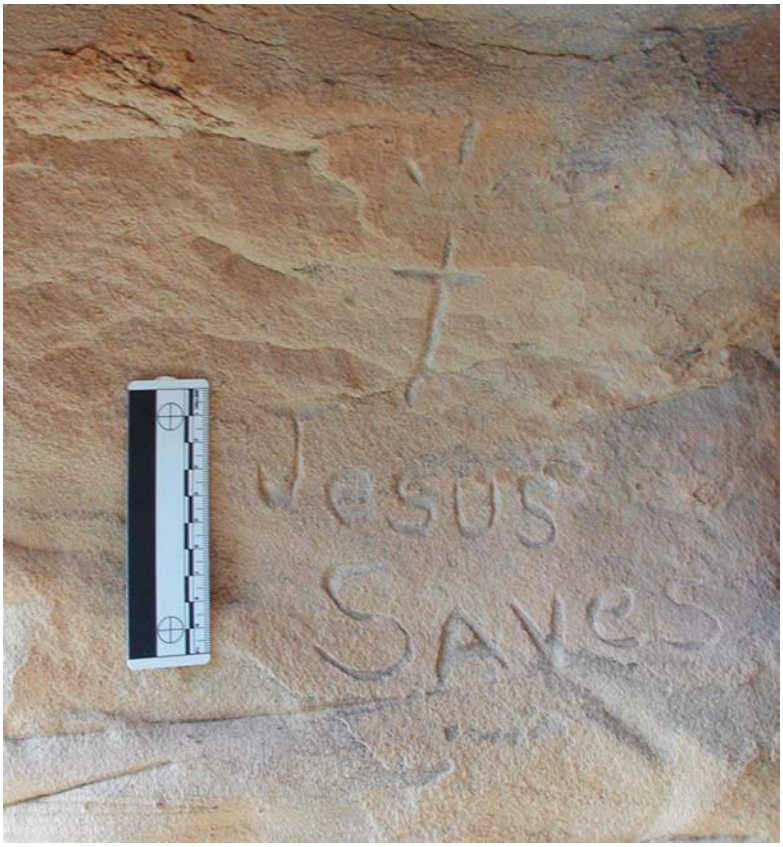

Figure 11. Example of a symbol of affiliation to Christianity (Site 39FA1010)

Figure 12. Example of identity and courtship. (Site 39FA321).

Figure 13. "HENDRICK IS A WHORE" graffiti at site 39FA1621.

Table 4. Velocity, Energy and Maximum Range of various common firearms.

Cartridge	Weight (Grains)	Velocity (ft.lbs) (yrds.) 100	200	500	Energy (ft.lbs.) (yrds) 100	200	500	Maximum Range (Yards)
.22 Long Rifle (Standard Velocity)	40	975	859	n/a	84	66	n/a	1589
.222 Remington	50	2635	2182	1172	771	529	152	2872
.243 Winchester	80	2924	2536	1563	1424	1071	407	3697
.270 Winchester	130	2849	2604	1941	2343	1957	1087	4793
.30-30 Winchester	150	2018	1684	1035	1356	904	357	3011
.30-06 Springfield	150	2656	2416	1773	2349	1944	1047	4635
.44 Remington Mag.	240	1374	1107	799	1006	653	340	2305
.45-70 Government	405	1168	1055	868	1227	1001	677	3119
.32 (8MM) Mauser	170	1969	1622	997	1463	993	375	3972

Notes: Taken from Matunas 1979.

aimed at targets with rock art is of interest when studying the current and historic land-use of the area. For example, does there exist an association between an observed increase in firearm impact at rock art sites with the hunting season of various game? Does projectile impact on sandstone that is in proximity to places of resource extraction, such as mid-20th century mining, differ from that at rock art sites not within shooting range of resource extraction environments?

With these initial analyses we have constructed some testable predictions that may offer insight into where and how contemporary visitors use prehistoric or historic Native American sites. In addition, we have framed questions resulting from the juxtaposition of theories of behavior and field observations in the southern Black Hills. We caution the reader, however, to accept these ideas for simply what they are, for as anthropologist John Hartung (cited in Alcock 1989:13) emphasized " in science you are wrong until you prove you might not be".

Endnotes

[1] In non-human behavior "overmarking" or "countermarking" with scent is conducted mostly by male resource holders in competition with intruders or subordinates of the same species (Gossling and Roberts 2001).

[2] In this analysis (I) we are not attempting to ascertain the overall applicability of the model as defined by a set of independent variables but rather to assess what factors can be hypothesized to positively influence behavior that results in these markings, holding other variables constant.

[3] Variables with odds ratios that indicate that a unit change in this variable is associated with an increase in the odds of the dependent variable being present, when all other variables are held constant. Due to the small sample size and binary nature of the dependent variable all variables identified here with "positive" odds ratios are considered as indicative of their potential to be topographical and environmental predictors of contemporary marking behavior. Variables are not statistically significant as set by convention (p=.05) and assumptions made here regarding the relative strength of these predictors are grounded in terms of their effect on the dependent variable's logged odds (Long 1997:53-54; Crown 1998:121-122; Murphy and Myors 1998:6-17).

[4] A convenient means by which to compare models is with computation of a pseudo-R^2. Several different measures are available that transform the likelihood-ratio statistic, measuring the strength of association between 0 and 1. McFadden's measure (MFR^2), deemed one of the more reliable measures, is used in this study and is considered very satisfactory when values are .20 - .40 (see Windmeijer 1995; Long 1997:104-105; Crown 1998:117).

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