

# QUANTIFYING DIMENSIONS OF THE LOOTING PROBLEM AT ARCHAEOLOGICAL SITES IN ALASKA

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## ABSTRACT

Protecting archaeological sites from intentional destruction requires an understanding of the dimensions of the problem. In this study, the proportion of archaeological sites in Alaska that have been looted or vandalized was quantified and statistically compared to factors thought to contribute to these activities. Three factors were significantly correlated with looting severity in Alaska: accessibility and site density were positively correlated, and the proportion of land in federal ownership was negatively correlated. Although data quality was a persistent problem and results should be considered preliminary, this analysis demonstrates that improved data on looting and vandalism are essential if we are to more effectively combat looting. Archaeologists are the ones who are in the best position to collect more systematic data on site looting, data which can then be used to more comprehensively address the looting problem.

**KEYWORDS:** historic preservation, subsistence digging, Alaska Heritage Resources Survey, monitoring

## INTRODUCTION

The looting and vandalism of archaeological sites is a serious threat to the study of Alaska's past. Although archaeologists and others have long recognized the problem, Bundy's dissertation (2005) was the first study to attempt to quantify the proportion of sites that have been affected and the cultural, geographic, and economic factors thought to contribute to looting and vandalism. In this paper, we report in abbreviated form some of the results of Bundy's (2005) study, with updated data on accessibility. Bundy divided Alaska into eight regions (Fig. 1) and estimated the proportion of looted and vandalized sites in each region. The estimates were then statistically correlated with six potentially contributing factors.

Although quantitative analysis was hampered by poor data quality and availability (estimates of the proportion of looted or vandalized sites are likely far too low), results

indicated that different factors are correlated with looting and vandalism. Gathering more systematic data on looting and vandalism activity in the future will allow more reliable analyses. Improving the quantity and quality of information on looting will be time-consuming and logistically difficult, but accurate assessments are required to address this ongoing threat to cultural heritage. With this study, we hope to offer an incentive to begin improving data by demonstrating the potential of quantitative analysis and evaluating how the quality of information on looting can be improved.

The terms "looting" and "vandalism" as they are used here refer to activities that damage sites, whether or not those activities are prohibited under any federal, state, or local law. These terms will refer to acts by individuals committed for the purpose of obtaining artifacts and/or

human remains or destroying cultural resources through vandalism. We do not address destruction of sites by construction related to development, recreational vehicle use, or other activities. Although different communities and individuals may choose to accept or reject nonprofessional digging, it clearly damages archaeological sites, and that is a concern to archaeologists and others.

## QUANTIFYING LOOTING AND VANDALISM

Assessing which factors contribute to looting and vandalism requires estimating the proportion of sites that are looted or vandalized (it is often impossible to tell when a site was looted, or how often, so a proportion of looted sites must be used rather than a rate of looting activity). Many different sources offer data about looted and vandalized sites. These datasets differ in scale, geographic coverage, and quality. Estimating the proportion of looted and vandalized sites is difficult because sites are numerous and many are rarely visited by archaeologists or other monitors. Even when sites are visited, updated condition reports may not be gathered together at the statewide level.

In addition to problems with the information available through various sources, not all archaeological sites are known or recorded. The target population for this study is “all archaeological sites,” the population available for study

is “known sites,” and the available population represents the target population to an unknown degree. Assuming an estimate can be made of the proportion of *known* sites that are looted or vandalized, how well does that estimate represent the proportion of *all* sites that are looted or vandalized? Differences between the proportion of looted sites among all sites and known sites may be significant but are impossible to quantify. For the purposes of this study, we assume that the proportion of looted and vandalized sites among known sites is similar to the proportion among all sites, with the understanding that this assumption has not been tested and may be incorrect.

With this caveat in mind, the proportion of looted and vandalized sites can be examined using several quantitative sources: responses from a survey of professional archaeologists conducted for Bundy’s (2005) study, agency annual reports, archaeological survey reports, national historic landmark condition assessments, and Office of History and Archaeology records. Survey and interview responses rely on individual perception and memory, but theoretically include all sites. Agency annual reports, national historic landmark condition assessments, and archaeological survey reports use data on file but only include a relatively small proportion of the population of known sites. State database records contain information on all known sites, but the data are often outdated or in-

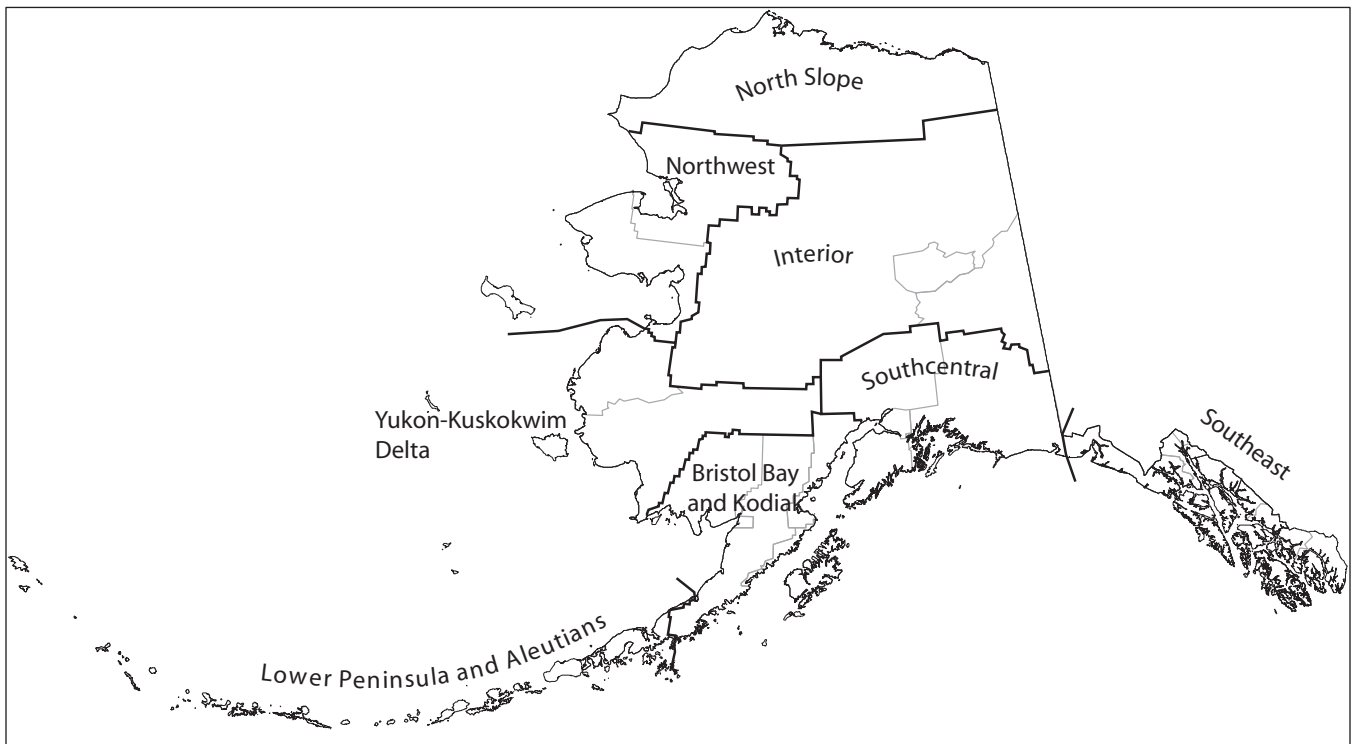


Figure 1. Alaska divided into eight regions.

complete. Consideration of these various sources reveals that the Office of History and Archaeology database offers the best quantitative data, but other sources also provide insight into the looting problem in Alaska.

## SURVEY AND INTERVIEW RESPONSES

Because so much important knowledge in cultural heritage protection is experiential and/or unpublished, 23 archaeologists with experience in Alaska were interviewed for this project. Interviews sought both quantitative data (answers which can be standardized and compared) and qualitative information (individuals' descriptions of their experiences combating looting and vandalism).

One question in the interview asked these archaeologists to estimate what percentage of sites in their region(s) has been looted or vandalized. Their responses are given in Table 1. Unfortunately, the survey and interviews proved to be a poor way to estimate looting and vandalism. Many people felt uncomfortable making an estimate, and a good number of respondents answered either "99 percent" or "1 percent" regardless of region. Some regions had very few respondents, and only Region 16 (Bristol Bay and Kodiak) had a significant number of respondents. Average estimates ranged from 5 percent for southcentral Alaska to 37 percent for the North Slope, but the number of respondents is too low and the standard deviations are too high for these data to be reliable.

## AGENCY ANNUAL REPORTS

Federal agencies compile annual reports of their cultural resources activities. Although the reports can be an excellent source of updated data, their geographical coverage

is limited and different management units may keep different statistics. The utility of the reports for generalizing to the larger region may also be limited because federal lands, especially in the national park and national forest systems, may be less likely to be looted than other lands (GAO 1987:26). Reports in some regions give an indication of looting severity, but these cannot be extrapolated to all regions in the state.

## NATIONAL HISTORIC LANDMARK CONDITION ASSESSMENTS

The National Historic Landmark (NHL) program requires that the condition of landmarks be assessed every two years, and landmark status is listed on the program's website (NPS 2005). A "satisfactory" status rating means that the landmark is not currently at risk from development, neglect, natural processes, vandalism, or looting. "Watch" or "threatened" status means that the landmark is currently at risk, and the risk is described. Past problems that have been corrected seem to be generally noted in the narrative. Because sites are regularly visited and narrative descriptions are provided on the website, condition assessments would seem to be a useful indicator of the proportion of sites that have been looted or vandalized. Unfortunately, there are relatively few NHL properties in Alaska, and most are historic structures. Although their condition is checked regularly, the scarcity and special status of the properties makes them an inadequate sample of known sites. The condition assessments do, however, provide some insight into different threats to archaeological sites. Table 2 summarizes the most recent NHL condition assessments.

Six of 11 historic-era archaeological landmarks in the state are listed as watch or threatened. In all but one case,

*Table 1. Survey respondents' estimates of looting and vandalism.*

Region	# of Respondents (# who estimated rate)	Proportion of Sites Looted or Vandalized	Standard Deviation
1. North Slope	6 (5)	37.4%	± 40.1
2. Northwest Alaska	13 (12)	20.2%	± 31.2
3. Interior Alaska	11	4.9%	± 7.6
4. Yukon-Kuskokwim Delta	8	6.6%	± 8.7
5. Southcentral Alaska	10	5.3%	± 8.0
6. Aleutian Islands and Lower Alaska Peninsula	8	19.7%	± 30.4
7. Bristol Bay and Kodiak	17	12.4%	± 13.0
8. Southeast Alaska	8	7.4%	± 9.1

the threat is neglect, development, or natural processes (such as erosion). At one historic-era site (the Japanese occupation site on Kiska Island in the Aleutian Islands), ongoing looting is reported. Of the 16 prehistoric landmarks, four are threatened by development or natural processes and six have been looted. Two of the looted sites or archaeological districts are in north Alaska (the Ipiutak and Iyatayet sites), one is on the Alaska Peninsula (Amalik Bay Archaeological District), two are in northwest Alaska (Cape Krusenstern Archaeological District and the Wales site), and one is in southcentral Alaska (the Palugvik site).

There are too few national historic landmarks to make a meaningful comparison between regions. However, looting and vandalism rates at landmarks illustrate an important point: even those sites given the highest designation of national significance and visited frequently are not protected from looting and vandalism.

#### ARCHAEOLOGICAL SURVEY REPORTS

Archaeological survey reports provide another source of data about the proportion of archaeological sites that have been looted or vandalized. Surveys give site condition information for a number (often dozens) of sites. To offer a recent and representative estimate of looting and vandalism, a survey report should have been published in the last 20 years, cover at least 50 sites, and describe looting and vandalism in the site condition discussion.

However, survey reports may not offer a reliable representation of sites in a region. First, the sites discussed in a survey report (newly discovered or revisited) are probably not a random sample of all sites in a region. The sample is likely biased towards sites that are easily visible, and these sites are more vulnerable to looting and vandalism. The surveyed area may not contain sites that are representative of those in the region as a whole. There may be little comparability between, or even within, survey reports. Many reports do not discuss looting and vandalism. On large surveys with several crews working independently, some crews may report looting while others do not, and these

differences may not be explained in the report. Not every region in Alaska has had a large survey with a published report describing looting activity. Despite these sampling problems, survey reports provide a data source that can be compared to Office of History and Archaeology records (which are discussed below).

Survey reports meeting the criteria for this project were available for a few of the eight regions. Although a large number of survey reports have been compiled (especially since the enactment of the 1966 National Historic Preservation Act), many reports only cover small geographic areas with one or two sites, are not generally available, or are outdated. Many of the large surveys in the state were completed in the 1960s or 1970s. Surprisingly, in most survey reports where more than a few sites are discussed, site condition is not mentioned even in passing. Although survey reports did not prove to be an adequate source of statewide data on looting activity, two examples of large, recent survey reports that give site condition demonstrate how this kind of information can be used to assess which kinds of sites are at risk for looting.

The report of a large recent survey, a 1989 investigation in Bering Land Bridge National Monument, is available for northwest Alaska (Schaaf 1989). The survey, conducted in 1985 and 1986, covered 9,700 ha. One hundred sixty-two new sites were located, and an additional 62 previously known sites were visited. Of these, seven sites had definite evidence of looting, and another three had possible looting (Schaaf 1989:191–206). These 10 sites represent 4.4 percent of the total, just slightly more than the 4.1 percent reported in the state database. Although many cite northwest Alaska as a heavily looted area, the report highlights some reasons why the total number of looted sites might seem low. Many of the sites recorded were surface lithic scatters, rock cairns, and historic reindeer herding and mining features. Looting is difficult to recognize at these types of sites, where digging is not necessary to recover artifacts. Other types of historic features, such as mining ditches, are not likely to be looted. Some northwest Alaska areas, including St. Lawrence Island, are

*Table 2. National historic landmark condition assessments as of December 2004.*

Site Type	Looting Activity <sup>a</sup>	No Looting Activity	Total
Historic Archaeological Sites and Districts	1 (9%)	10 (91%)	11
Prehistoric Sites and Districts	6 (38%)	10 (63%)	16
Total	7 (26%)	20 (74%)	27

<sup>a</sup> Including properties that are not currently listed as Watch or Threatened but have been in the past due to looting or vandalism.

well-known for looting (Staley 1993), but the kinds of prehistoric sites disturbed in these areas are not necessarily representative of all sites in the region as a whole.

A series of survey reports produced by the Alutiiq Museum in Kodiak discuss sites in Bristol Bay and Kodiak (Steffian et al. 2004). The surveys were conducted each year from 1999 to 2004. One hundred forty sites were discovered or revisited, and 22 (16 percent) showed evidence of looting (Steffian et al. 2004). Subsidence from the 1964 earthquake dropped many coastal shell middens on Kodiak into precarious positions on seacliffs that are actively eroding; hence these sites are readily visible and vulnerable to looting. The proportion of looted sites in the Alutiiq Museum survey is almost triple the 5.3 percent reported in the state database. The difference may be because sites were selected for monitoring due to their proximity to commercial fishing set net locations, and set net and recreational areas with known or suspected looting were prioritized for study (Amy Steffian 2006, personal communication). Since site monitors would not likely be asked to visit cairns or historic can scatters, but instead to focus on prehistoric village or midden sites, the proportion of looted sites may be larger than if all site types had been monitored with comparable intensity. These sampling issues, though, probably do not account for all of the difference between the Office of History and Archaeology and survey report rates. It is likely that the state database underreports looting in the region.

Archaeological surveys have the potential to offer detailed, up-to-date information on site condition but unfortunately, most do not. Survey reports that do meet the criteria for use in this project offer a more thorough treatment of looting and vandalism than state databases. The survey reports discussed here give estimates of looting activity that differ in varying degrees from estimates derived

from state databases. With so few survey reports meeting the criteria, however, no pattern could be discerned that would allow state records to be mathematically corrected using survey report data. Survey reports also do not reliably offer a representative sample of sites in a region. Although archaeological survey reports are a useful source of data on looting and vandalism, they cannot be used to derive an estimate of the proportion of looted sites in a region.

#### OFFICE OF HISTORY AND ARCHAEOLOGY RECORDS

In this paper, we refer to the Alaska state database, also known as the Alaska Heritage Resources Survey or AHRS. The following background on the history of the AHRS was kindly provided by Dave McMahan (2006, personal communication), deputy state historic preservation officer and state archaeologist. In 1970, the BLM and Alaska Methodist University began using the "Alaska Archaeological Index" to record sites encountered in the path of the Alaska oil pipeline. This inventory consisted of site records on 5 inch x 8 inch file cards. When the Alaska state historic preservation officer (SHPO) position was established in 1971, the AHRS began with 531 file cards. In 1985, the AHRS was computerized by Steve Klingler using dBase software. In 2002, the AHRS data were converted into an Oracle database table accessed through a secure web-based interface (Archaeological Database Maintenance System, or ADMS). The SHPO staff continue to develop the functionality of the database.

Currently, the AHRS site forms include spaces for "present condition" and "danger of destruction," and these forms are compiled into the database. Looting is noted for many sites on the AHRS, providing estimates of the proportion of looted sites in each region (Table 3). There are two main problems with the state database records,

*Table 3. Site data from Alaska Office of History and Archaeology files.*

Region	Sites	Looted Sites	% Looted
1. North Slope	4,435	26	0.6
2. Northwest Alaska	2,213	90	4.1
3. Interior Alaska	6,953	43	0.6
4. Yukon-Kuskokwim Delta	1,450	19	1.3
5. Southcentral Alaska	5,878	144	2.5
6. Aleutian Islands and Lower Alaska Peninsula	1,640	59	4.2
7. Bristol Bay and Kodiak	3,197	184	5.3
8. Southeast Alaska	4,650	108	2.3
Total	30,416	673	2.2



though. First, noting whether a site has been looted is not required, and looting was probably observed but not mentioned for many sites. Second, many records are outdated, since many sites have not been revisited since their initial recording. Estimates of the proportion of looted sites derived from the state database are probably far too low, but the database is still the most comprehensive available source. There is little reason to believe that the sample is biased in such a way that rates in different regions are not comparable.

The region with the highest estimated proportion of looted or vandalized sites is Kodiak Island/Bristol Bay, undoubtedly because of the visibility of sites on Kodiak (as discussed previously) and the Alutiiq Museum's monitoring program in which they update state database records. In addition, the National Park Service cultural resources staff have conducted several reconnaissance surveys in the last 10 years in Lake Clark National Park and Preserve, Katmai National Park and Preserve, Aniakchak National Monument and Preserve, and the Alagnak Wild River, which together comprise a large proportion of land in the region. The Kodiak/Bristol Bay region, then, may have the most up-to-date site information. The next highest proportion of looted or vandalized sites is in the Aleutian Islands/lower Alaska Peninsula region, followed by northwest Alaska. These three regions form a group with significantly higher proportions of looted sites than the remaining regions. Three other regions—Yukon-Kuskokwim Delta, southcentral Alaska, and southeast Alaska—form a middle tier. The North Slope and interior Alaska have significantly lower proportions of looted sites than the other regions. There may be biases in the sample, but these cannot be reliably identified or quantified, so the estimates will be accepted for the purposes of this analysis. The AHRS data set is problematic but is the only source of information appropriate for regional-scale analysis.

### IDENTIFYING CONTRIBUTING FACTORS TO LOOTING AND VANDALISM

Looting is associated with some, but not all factors. In this paper, we list factors that may contribute to looting and vandalism and assess which of these factors can be quantified at the regional level in Alaska. Quantifiable factors are then cross-tabulated with looting estimates to obtain a correlation coefficient. Statistically significant correlations are then discussed.

Conditions that contribute to looting and vandalism can be divided into three overlapping and related categories: cultural, economic, and geographical. Cultural factors relate to values and attitudes held by various groups. General public perceptions about sites, collectors, and archaeologists can affect looting (Fagan 1995; GAO 1987:23). If people believe that sites are important, archaeologists are benevolent professional scientists, and looters are greedy and destructive, they are more likely to support protection efforts and report looting. Conversely, if people generally feel that sites are unimportant or numerous, archaeologists are selfish snobs or greedy collectors, and looting is a wholesome family activity, they are unlikely to participate in protecting sites (Vitelli 1981). Public perception affects attitudes held by law enforcement personnel in two ways: first, officers are community members and are likely to share general public values and opinions; and second, the level of public support for protection efforts translates into legislation and funding that facilitate or hinder investigation and prosecution of looting and vandalism (Neumann 1995). Several interviewees mentioned that looting and vandalism are sometimes tied to other crimes, such as poaching or methamphetamine use. The rate of all crimes per capita and the rate of drug crimes per capita are cultural factors that may be correlated with looting and vandalism.

Economic factors discussed in the literature include local and national economic conditions, the value of artifacts, and the ease of bringing artifacts to market. Geographic factors can be divided into two categories: the geography of the past and the geography of the present. The geography of the past refers to the type and distribution of sites and their content. Coastal shell middens and rock shelters, for example, tend to be well preserved and often contain sought-after artifacts. The geography of the present refers to various modern geographic and sociopolitical factors, including population distribution, land ownership, archaeological presence, and development (such as roads or boat launch points). Vegetation and terrain also affect the visibility and accessibility of sites.

Dividing contributing factors into cultural, economic, and geographic categories is somewhat arbitrary in that many of the factors across categories are linked (e.g., socioeconomic conditions and the crime rate; site contents and the market for antiquities). The three types of factors work together to influence looting and vandalism behavior. A 1987 General Accounting Office (GAO) report, for example, listed three major factors and two minor factors that

influence looting and vandalism activity in the American Southwest (GAO 1987:23–29). Major factors were public attitudes, the probability of prosecution, and the prices offered for artifacts; minor factors were weather and economic conditions. The GAO (1987:23) concluded that “the public generally believes that archaeological sites are abundant and they do not understand the significance of individual sites or the need for site preservation.” Further, probability of detection and prosecution is low, and prices for artifacts are high. Seasonal good weather and economic downturns exacerbate the problem. Although the Southwest is different from Alaska in many ways, there are major and minor factors in Alaska looting as well. These factors can be identified in published and unpublished literature on looting and vandalism and also from responses to Bundy’s (2005) survey and interviews.

#### SURVEY AND INTERVIEW RESPONSES

Most of the published and unpublished literature about looting and vandalism in the United States relates to the American Southwest. Bundy’s (2005) survey/interview respondents, however, specifically addressed regions in Alaska. Their responses offer a different emphasis than the literature; respondents tended to focus more on geographic factors and less on cultural attitudes and law enforcement. Survey respondents overwhelmingly suggested that two factors contribute to the likelihood that a region will have a high proportion of looted or vandalized sites: visibility and accessibility. In a region with high visibility, many sites are visible on the surface of the ground or in erosional cuts such as sea cliffs and stream banks. Numerous roads and navigable waterways make a region highly accessible. Table 4 lists contributing factors cited by survey respondents.

#### PUBLISHED AND UNPUBLISHED LITERATURE

Much of the literature on site protection is focused on law enforcement: detecting and investigating violations of antiquities law, prosecuting offenders, and meting out sufficient punishment to deter recidivism. Only three of the respondents to Bundy’s (2005) survey, however, listed “lack of law enforcement” or “lack of punishment” as contributing factors (possibly because there has been so little enforcement in the state that it is difficult to assess its effectiveness). The GAO (1987:26) report emphasized the importance of land ownership, but only two survey

respondents mentioned it. These differences may reflect disparity between Alaska and the Southwest. They may also reflect the occupation and interests of the authors and survey respondents. All of the survey respondents are professional field archaeologists, while many authors are attorneys, law enforcement officers, or tribal cultural resources managers. Archaeologists may be more attuned to factors involving physical site characteristics. Different sources cite various factors as the strongest contributors to looting and vandalism; quantifying and statistically comparing factors with looting severity will help assess which of these are in fact most strongly associated.

### QUANTIFYING FACTORS CONTRIBUTING TO LOOTING AND VANDALISM

Some factors thought to be associated with looting and vandalism can be quantified and statistically compared to the estimate of looting severity. Others cannot be quantified even though they may be influential. Table 5 lists the factors derived from literature and survey responses and assesses whether the factor can be quantified and statisti-

*Table 4. Factors contributing to looting and vandalism according to survey respondents.*

Factor	Number of Times Cited
Visibility	16 (23%)
Accessibility	13 (19%)
Proximity to a Population Center	8 (12%)
Isolation	2 (3%)
Type of Artifacts	3 (4%)
Preservation	3 (4%)
Socioeconomic Conditions	3 (4%)
Type of Site	1 (1%)
Market for Antiquities	4 (6%)
Previous Disturbance to Sites	3 (4%)
Proximity to a Shoreline	3 (4%)
Archaeological Activity	2 (3%)
Availability of Published Guides to Area Sites	2 (3%)
Lack of Enforcement/Punishment	2 (3%)
Public Interest in Area Sites	1 (1%)
Random Opportunity	1 (1%)
Land Ownership	0
Few Archaeologists in Area	1 (1%)
<b>Total Responses<sup>a</sup></b>	<b>69</b>

<sup>a</sup> Responses outnumber respondents ( $n = 23$ ) because some respondents cited multiple factors.

*Table 5. All factors potentially contributing to looting and vandalism.*

Factor	Quantifiable?	Quantitative Data Available?
<b>GEOGRAPHIC</b>		
Visibility	Maybe	No. Site type, vegetation cover, or the two together could potentially be used as a proxy measure of visibility, but these data at the state-wide coverage level are not available.
Accessibility	Yes	Yes. GIS layers showing roads and rivers are available.
Remoteness	Yes	Yes. Population density can be used as a proxy measure of remoteness.
Land Ownership	Yes	Yes, but data are limited.
Type of Site	Yes	No
Type of Artifacts/Preservation	No	No
Site Density	Yes	Yes. The National Archaeological Database provides this information.
Archaeological Presence	Yes	Yes, the Society for American Archaeology maintains a member database.
<b>CULTURAL</b>		
Public Attitudes	No	No
Crime Rate	Yes	Yes, but data for Alaska are inadequate for this study.
Law Enforcement Presence	Yes	Yes, but data for Alaska are inadequate for this study.
<b>ECONOMIC</b>		
Socioeconomic Conditions	Yes	Yes. Census records include numerous measures of income and other economic factors.
Market for Antiquities	No	No

cally compared to the estimated proportion of looted sites. Potentially important factors that can be used in geostatistical analysis include accessibility, remoteness, land ownership, archaeological presence, and site density. Those that are not quantifiable or for which appropriate data do not exist include site visibility, site type, artifact type/preservation, public attitudes, law enforcement presence per square mile and per capita, the crime rate, and the state of the legal and illegal antiquities markets. Further, the co-occurrence of erosion with other types of site damage is beyond our ability to systematically incorporate.

Factors that can be quantified on the regional level are compared to the looting severity estimate by calculating the correlation coefficient, Pearson's  $r$ . The correlation coefficient, derived through linear regression, is an estimate of how much variation in one variable can be explained by variation in another variable (Drennan 1996:215). For example, a correlation of  $r = 0.5$  means that 50 percent of the variation in one variable can be explained by variation in the other variable. Values for  $r$  range from  $-1.0$  to  $1.0$ , with a negative value indicating a negative correlation and a positive value indicating a positive correlation. In a negative correlation, as one variable increases the other declines. In a positive correlation, as one value increases the other increases. The strength of the correlation is expressed by how close  $r$  is to  $1.0$  or  $-1.0$ . For example,  $r = -0.9$  is a strong negative correlation in which as one vari-

able increases the other decreases considerably, and  $r = 0.2$  is a weak positive correlation in which as one variable increases, the other increases slightly. Correlation does not imply causation.

For this project, the correlation coefficient indicates how much of the difference in the proportion of looted and vandalized sites between regions can be explained by differences in a given factor between regions. The F statistic and associated  $p$ -value offer an estimate of significance and confidence for the correlation coefficient. F is calculated based on  $r^2$  and the number of cases, and the associated  $p$  value is then found in a table. The  $p$  value represents the likelihood that the results could have been random;  $p = .25$  means that there is a 25 percent probability that the results are because of chance. Factors will be compared to looting severity, correlation will be expressed using  $r$  to measure direction and intensity of the correlation, and  $p$  will be used to measure the significance of the result. A correlation with a  $p$  value of greater than  $0.5$ , indicating greater than a 50 percent chance that the correlation was the result of random chance, will be rejected.

#### VISIBILITY

The visibility of archaeological sites in a region (i.e., the proportion of sites that are visible on the surface or through erosion) is a function of site type, vegetation cover, and geo-



morphology. Any or all of these could be used as proxy measures of visibility, but data at the necessary scale are unavailable. In the AHRS, site type description is left to the researcher entering the data, and many only entered “site.” Vegetation cover is an important aspect of site visibility, and some data on vegetation are available. Datasets are often limited in geographic scope, though, and adjacent coverages may come from different sources (e.g., ground survey vs. remote sensing). A question on the survey conducted for Bundy’s (2005) research asked about site visibility. Although survey respondents considered visibility the most important factor determining whether a site is looted or vandalized, they were not comfortable estimating the proportion of sites in their region that are highly visible. Archaeological survey reports are a potential source of information on site visibility, but surveyed areas may not be representative of the region as a whole. Also, as discussed above, survey reports with detailed descriptions of site condition are comparatively rare. Although it is clearly an important factor, it is not possible to quantify the proportion of sites in a region that are visible on the surface and compare that to the proportion of looted sites.

#### ACCESSIBILITY

Accessibility, the proportion of a region that is accessible from a populated place, major highway, or major river, can be calculated in a geographic information systems (GIS) environment. GIS vector<sup>1</sup> layers are available for populated places, highways, coastlines, and major rivers (defined as large, navigable waterways). Each vector layer can be turned into a raster, in this case with cells 1 km<sup>2</sup> in size. A value can be assigned to each cell based on its distance from features. Populated places and highways have more

traffic than rivers, and cells near those were assigned higher values. A cell within 10 km of a populated place was assigned an arbitrary value of two, and a cell between 11 and 20 km was assigned a value of four. The same value/distance scale was applied to highways. Values were halved for distance from major rivers and coastlines because water travel is available to far fewer people than road travel; cells within 10 km received a value of one and cells from 11 to 20 km received a value of two. Cell values for each region were then averaged to produce a regional accessibility score (Table 6). Accessibility was positively correlated with the proportion of looted and vandalized sites ( $r = 0.35$ ,  $p = .35$ ). Although the correlation is not strong, it appears that as accessibility increases in Alaska, looting severity increases.

The accessibility layer used in Bundy’s (2005) analysis did not include value scores for land adjacent to saltwater shorelines. That research produced a weak negative correlation between looting severity and accessibility. The inclusion of coastal values here produced a positive correlation. If accessibility is calculated using only distance from the coast (i.e., without values for distance from roads, rivers, or populated places), an even stronger positive correlation emerges. Using only distance from the coast,  $r = 0.51$  and  $p = 0.13$ . This reflects low looting severity scores in regions with a lower ratio of coastline to interior lands—the southcentral and interior regions—and high looting severity scores in regions with relatively more coastline. Correlation does not necessarily reflect causation, and accessibility may not be causing looting. Interior areas tend to have different types of sites than coastal areas. In fact, because distance from roads, rivers, and populated places was weakly negatively correlated with looting (Bundy 2005), while distance from the coast was positively correlated, it seems that access alone does not jeopardize sites.

*Table 6. Accessibility scores.*

Region	Accessibility Score	Accessibility Score without Coastlines	Coastline Only Accessibility Score
1. North Slope	0.55	0.38	0.11
2. Northwest Alaska	0.81	0.41	0.37
3. Interior Alaska	1.12	1.12	0.00
4. Yukon-Kuskokwim Delta	1.24	0.89	0.40
5. Southcentral Alaska	1.53	1.24	0.28
6. Aleutian Islands and Lower Alaska Peninsula	2.58	0.51	1.94
7. Bristol Bay and Kodiak	1.18	0.55	0.79
8. Southeast Alaska	2.27	0.55	1.58

1 A vector layer is a collection of individual features. A raster layer is a collection of cells, each with a value. Examples of vector data sets include roads, buildings, or populated places. Examples of raster datasets include elevation, landcover, or average annual temperature.

## REMOTENESS

Remoteness, an expression of the degree to which a region is developed and contains major population centers, can be estimated using population density. The 2000 U.S. Census recorded population density by county, and these data were aggregated into the regions used in this project (Table 7). We recognize that this measure does not account for differences in remoteness during different seasons. Population density was not strongly correlated with the proportion of looted or vandalized sites ( $r = -0.04$ ,  $p = .92$ ). The correlation does not have a  $p$  value less than 0.50 and must be rejected.

## LAND OWNERSHIP

Land ownership in a region can be divided into categories in several ways. A simple scheme might categorize land as either government-owned or private; a complex one might put each landowner in a separate category. For the purposes of this project, it is necessary to assess which categories might affect the proportion of sites that have been looted or vandalized. Private ownership can be considered

a single category, regardless of whether the owner is an individual, a group, or a corporation, because cultural resource laws offer the same protection (or lack thereof) to sites on all private lands. While some private lands may be less protected (large, poorly monitored tracts), it is impossible to assess different protection levels on private land.

Government ownership is a more complex issue. Sites on federal lands are probably less likely to be looted or vandalized than sites on private land, especially in Alaska where no legal protection is offered to sites on private land. The GAO (1987:26) report indicated that sites on federal lands are protected to varying degrees, depending on the land management agency. This variation probably exists on state lands as well, with sites on conservation-oriented lands, such as state parks, possibly more protected than those on other state properties. As one of our anonymous reviewers commented, however, the Alaska Historic Preservation Act has never been used to prosecute looting, and some “quasistate” agencies (University of Alaska, Mental Health Trust, Alaska Railroad) debate the applicability of this statute to their lands. Furthermore, land ownership in some areas of Alaska is complex, and not all users may know the land ownership status or be aware of site protection laws (Amy Steffian 2006, personal communication).

Despite these complications, land ownership for this project could be divided into six categories: private, federal conservation unit (national park land and U.S. Fish and Wildlife Service land), national forest, Bureau of Land Management, state park, and other state land. However, land ownership datasets with enough detail to compile all six categories do not exist for all regions. The limitations of available data meant that only two categories could be used: federal lands and nonfederal lands. In each region, the proportion of federal land in each category was calculated (Table 8). There was a statistically significant negative correlation ( $r = -0.47$ ,  $p = 0.26$ ) between the propor-

*Table 7. Population density by region.*

Region	Population per square km
1. North Slope	0.03
2. Northwest Alaska	0.11
3. Interior Alaska	0.17
4. Yukon-Kuskokwim Delta	0.16
5. Southcentral Alaska	16.01
6. Aleutian Islands and Lower Alaska Peninsula	0.30
7. Bristol Bay and Kodiak	0.44
8. Southeast Alaska	1.39

*Table 8. Federal land ownership by region.*

Region	Federal Land Area (km <sup>2</sup> )	Total Land Area (km <sup>2</sup> )	Proportion of Federal Land
1. North Slope	181,749	231,578	78%
2. Northwest Alaska	120,629	155,197	78%
3. Interior Alaska	357,405	500,588	71%
4. Yukon-Kuskokwim Delta	118,365	155,467	76%
5. Southcentral Alaska	128,547	206,766	62%
6. Aleutian Islands and Lower Alaska Peninsula	16,435	22,404	73%
7. Bristol Bay and Kodiak	66,545	132,931	50%
8. Southeast Alaska	80,462	88,348	91%

tion of federal land and looting severity, indicating that as the amount of land managed by the federal government increases, looting activity declines.

#### SITE TYPE AND CONTENTS

Survey responses and published literature indicate that looting activity is often directed at certain types of sites, either because they are easy to locate and access or because their contents are valuable on the antiquities market. Eroding shell middens, historic cabins and dumps, and prehistoric sites with surface depressions are easily visible. Rock shelters, shell middens, historic sites, wet sites, ivory-bearing sites, and sites containing stone tools made of sought-after lithic material are targeted because artifacts are rare, valuable, or well-preserved.

Limited data are available about site types. The AHRS contains a site description field, but the contents vary widely. A large prehistoric village, for example, might be described as a village site, a prehistoric village, house pits, or simply a site. Site descriptions do not usually address content, which is often unknown at the time of recording. Finally, a short description of site type may not contain information useful for assessing vulnerability to looting and vandalism. For example, the term “village site” does not indicate whether depressions or midden mounds are visible on the surface or in erosional exposures, and visibility likely enhances vulnerability to looting.

Site type and contents affect the likelihood that an individual site will be looted or vandalized. On the regional level, broad areas can be characterized by the type of sites that are common. A region with many shell middens, such as the Kodiak/Bristol Bay region, would probably have a higher proportion of looted sites than a region with artifact-poor sites that are difficult to locate, such as interior Alaska. Within a region, site type differences may mask the extent of the looting problem. The proportion of sites that are looted or vandalized in a region may be low overall, but very high for certain site types.

The Kodiak archipelago offers a unique opportunity to examine the effects of site type on estimates of looting activity. Many sites in the area have been recently visited and their records updated as part of archaeological surveys following the *Exxon Valdez* oil spill in 1989 (Haggarty et al. 1990), cultural resource work by Native corporations, and research and monitoring by the Alutiiq Museum and Archaeological Repository. There are 1,430 sites in five USGS quadrangles (Kodiak, Karluk, Afognak, Kaguyak, and Trinity Islands, excluding sites not in the Kodiak archipelago) in the AHRS for which site type could be determined. The sites can be roughly divided into 11 categories (Table 9). Counts are approximate because some sites are minimally described.

Ten percent of the sites in the Kodiak archipelago are listed as looted or vandalized in the state database. Seven of the 11 site types, however, have higher rates. Among burial areas, shipwrecks, aircraft crash sites, and prehistoric and

*Table 9. Kodiak archipelago site types and looting estimates.*

	Sites	Number of Looted or Vandalized Sites	Percent of Sites Looted or Vandalized
<b>PREHISTORIC</b>			
Artifact Scatter or Isolate	36	1	3%
Burial Area	5	2	40%
Feature (e.g., cairn, petroglyph)	14	2	14%
Subsurface Site	517	53	10%
Midden	208	40	19%
<b>HISTORIC</b>			
Structure	432	11	3%
Subsurface Site	40	5	13%
Shipwreck/Aircraft	5	2	40%
Cemetery	3	1	33%
<b>PREHISTORIC AND HISTORIC OR DATE UNKNOWN</b>			
Subsurface Site	137	13	9%
Midden	33	13	39%
<b>Total</b>	<b>1,430</b>	<b>143</b>	<b>10%</b>

historic or “date unknown” middens, around 40 percent are looted or vandalized. Many sites in the third group are abandoned historic-era villages or camps built on or near prehistoric sites. These are probably well-known locally and easy to find. Burial areas, shipwrecks, and aircraft are relatively rare site types, so their high rates of looting and vandalism are obscured in the regional estimate. The disturbances to prehistoric burial areas and historic cemeteries are particularly troubling in light of their significance to local communities. Historic structures, artifact scatters, isolates, and subsurface nonmidden sites are least likely to be looted, although removing artifacts from the first three types of sites is unlikely to leave evidence. The 432 historic structures are mostly military buildings and buildings on Woody Island. The low rate of reported looting for these structures depresses the rate for the archipelago as a whole. Overall, categorizing records by site type shows that looting and vandalism is underestimated for most site types and conceals the fact that some site types are in considerable jeopardy.

The process of reading each record and assigning site type is laborious and cannot be repeated for the entire state database; Kodiak was chosen as an example because it is likely to have the most updated records. Site type and contents across Alaska are likely strongly correlated with looting and vandalism, but data appropriate for comprehensive regional analysis are not available for comparison. Improving data on site type would greatly enhance our ability to understand which sites most need protection.

#### SITE DENSITY

Site density can be easily calculated by dividing the number of sites in a region by the area of the region. The number of sites can only include known sites, a sample of the population of all sites. All sites may be looted, regardless of whether they are recorded, so the relationship of known

sites to all sites must be consistent for the comparison to be valid. The proportion of known sites may vary between areas because many places in Alaska have never been visited by archaeologists. Places with active survey and monitoring programs, such as the Kodiak archipelago, probably have relatively more known sites. However, regions are large, which may smooth differences between areas. Site density in all eight regions is shown in Table 10.

Site density ranges from 7.3 sites per 100 km square to less than one. The highest site density is in the Aleutian Islands/lower Alaska Peninsula region and the lowest density is in the Yukon-Kuskokwim Delta region. The average number of sites per 259 km<sup>2</sup> is 7.6. These numbers represent a combination of the actual distribution of sites and factors that influence the collection of site data, such as geography, population density, development, and the frequency of site monitoring. Site density was weakly positively correlated with looting severity ( $r = 0.39$ ,  $p = 0.35$ ).

#### ARCHAEOLOGICAL PRESENCE

The number of archaeologists working in an area may have an effect on the rate at which looting is reported. The Society for American Archaeology maintains a database of members that can be sorted by state (Table 11). Membership in the SAA is not required of professional archaeologists, and the membership represents a sample of all archaeologists.<sup>2</sup> This may not be a random sample, and it is possible that it is biased geographically; that is, that archaeologists in one region are more or less likely to join than archaeologists in another region. The database lists home or office addresses, not field work locations. The sample, then, is biased towards Anchorage and Fairbanks, population centers that host the state’s two largest university campuses and many government and state offices. Archaeologists living for most of the year outside of their field work areas may provide less surveillance, though. The

*Table 10. Site density by region.*

Region	Sites	km <sup>2</sup>	Sites per 100 km <sup>2</sup>
1. North Slope	4,105	231,593	1.8
2. Northwest Alaska	2,213	155,207	1.4
3. Interior Alaska	6,953	500,620	1.4
4. Yukon-Kuskokwim Delta	1,450	155,476	0.9
5. Southcentral Alaska	5,878	206,776	2.8
6. Aleutian Islands and Lower Alaska Peninsula	1,640	22,403	7.3
7. Bristol Bay and Kodiak	3,197	132,938	2.4
8. Southeast Alaska	4,650	88,352	5.3

*Table 11. Number of archaeologists by region.*

Region	Number of Archaeologists in SAA Directory
1. North Slope	2
2. Northwest Alaska	3
3. Interior Alaska	21
4. Yukon-Kuskokwim Delta	1
5. Southcentral Alaska	35
6. Aleutian Islands and Lower Alaska Peninsula	2
7. Bristol Bay and Kodiak	4
8. Southeast Alaska	9

number of archaeologists living in a region was negatively correlated ( $r = -0.24$ ,  $p = 0.57$ ), but that correlation is not statistically significant.

#### PUBLIC ATTITUDES

Commonly held feelings and attitudes among several different groups likely influence the proportion of sites in a region that have been looted or vandalized. Staley (1993) suggested that negative perceptions of archaeologists contribute to the looting problem on St. Lawrence Island, although economic need is the primary motivation. Hollowell (2004) has pointed out that the legal status of looting on the island, the lack of steady jobs, and the high market value of ivory and bone artifacts explain the actions of St. Lawrence Islanders. Other researchers have also described a positive view of artifact collecting as a laudable hobby (GAO 1987). Several studies have quantified public attitudes toward archaeologists and archaeological resources (e.g., Pokotylo and Guppy 1999; SAA 2000). Many of these studies do not have a geographic component, however, and are unsuitable for determining different attitudes in the various regions in this study. Amy Steffian (2006, personal communication) reports a “growing respect for sites and artifacts with the re-awakening of Alutiiq traditions on Kodiak,” due in part to educational outreach of the Alutiiq Museum. Although we recognize that public attitudes in Alaska influence looting and vandalism activity, the limits of currently available data preclude us from considering all regions in the state, hence we cannot present correlations.

#### SOCIOECONOMIC CONDITIONS

Looting around the world is associated with poverty (e.g., Lindsay 2004; Renfrew 1993). In Alaska, anecdotal evidence indicates that looting activity is more severe in economically depressed areas. Ten percent of archaeologists surveyed for this project cited socioeconomic conditions or the market for antiquities as contributing factors to looting. Some researchers, however, note that the link between looting and poverty is assumed “without more than cursory investigation” (Kaiser 1993:347). Comparing economic measures with looting activity will help evaluate the accuracy of anecdotal reports.

The 2000 U.S. Census collected data about income, including a measure of median household income. Table 12 shows median household income in all regions. The North Slope has the highest median annual household income while the Yukon-Kuskokwim Delta has the lowest, and the average median income is \$45,352. Income was very weakly and negatively correlated with looting severity ( $r = -0.06$ ,  $p = 0.89$ ). The negative correlation coefficient would suggest that as median annual income decreases, looting severity increases slightly. The high  $p$  values, however, indicate that these correlations should be rejected.

#### CRIME RATE

Several archaeologists interviewed for this project mentioned that looting activity in some cases is linked with other crimes. The Federal Bureau of Investigation (2002) maintains crime rate statistics for many, but not all, U.S. cities and counties. The “crime index” is derived by adding together the number of reported offenses in seven catego-

*Table 12. Median annual income by region.*

Region	Median Annual Household Income
1. North Slope	\$63,173
2. Northwest Alaska	\$43,240
3. Interior Alaska	\$33,832
4. Yukon-Kuskokwim Delta	\$32,943
5. Southcentral Alaska	\$51,904
6. Aleutian Islands and Lower Alaska Peninsula	\$39,914
7. Bristol Bay and Kodiak	\$46,581
8. Southeast Alaska	\$51,226

2 One anonymous reviewer of this paper commented that some Alaska archaeologists have chosen to belong to the Society for Historical Archaeology instead of the SAA.



ries. The crime rate is derived by dividing the crime index by population.

All Alaska crime statistics used by the FBI are reported by the Alaska State Troopers (2002), who compile data by local agency. However, offenses reported to the state troopers rather than to a local agency are not compiled geographically. Because Alaska State Troopers provide the only law enforcement for many remote areas, the crime index for more rural regions in the state is artificially low and the data set is unacceptable for comparison to looting estimates.

LAW ENFORCEMENT DENSITY AND SURVEILLANCE

The FBI compiles statistics on law enforcement agencies across the nation, including the number of sworn officers (FBI 2002). To obtain the surveillance index, the number of officers can be normalized by population density to produce the number of officers per capita. For law enforcement density, the number of officers can be normalized by area to produce the number of officers per square kilometer. However, data on law enforcement officers employed by state and federal agencies do not indicate the location where the officers are stationed, and therefore cannot be included in this project because many places in Alaska have no local law enforcement and are served by the Alaska State Troopers. As with the crime rate, better geographic data are necessary to assess the effect of law enforcement on looting.

THE ANTIQUITIES MARKET

Many archaeologists feel that the market for antiquities is the root cause of looting and vandalism (e.g., Renfrew 1993). This stems from the belief that commercial looting, while practiced by relatively fewer people, is more damaging than hobby looting (where artifacts are taken for personal collections, not for immediate sale). Staley (1993:352) found that “economic conditions provide the primary motive” for looting (or “subsistence digging”) by residents of St. Lawrence Island communities. Ivory artifacts, the most sought-after pieces, can be sold to dealers through several different outlets, and some pieces command prices in the thousands of dollars (Hollowell 2004). Across the United States, antiquities dealers try to maintain high profits through “the encouragement of continued mining of known sources for objects of established salability” (Kaiser 1993:347). The high prices paid on the antiquities

market and the vagaries of what becomes popular among dealers and collectors clearly drive a significant amount of looting in Alaska, but there is no way to quantify this activity on the regional level. This important factor cannot be included in geostatistical analysis.

CORRELATIONS AND THEIR IMPLICATIONS FOR THE LOOTING PROBLEM IN ALASKA

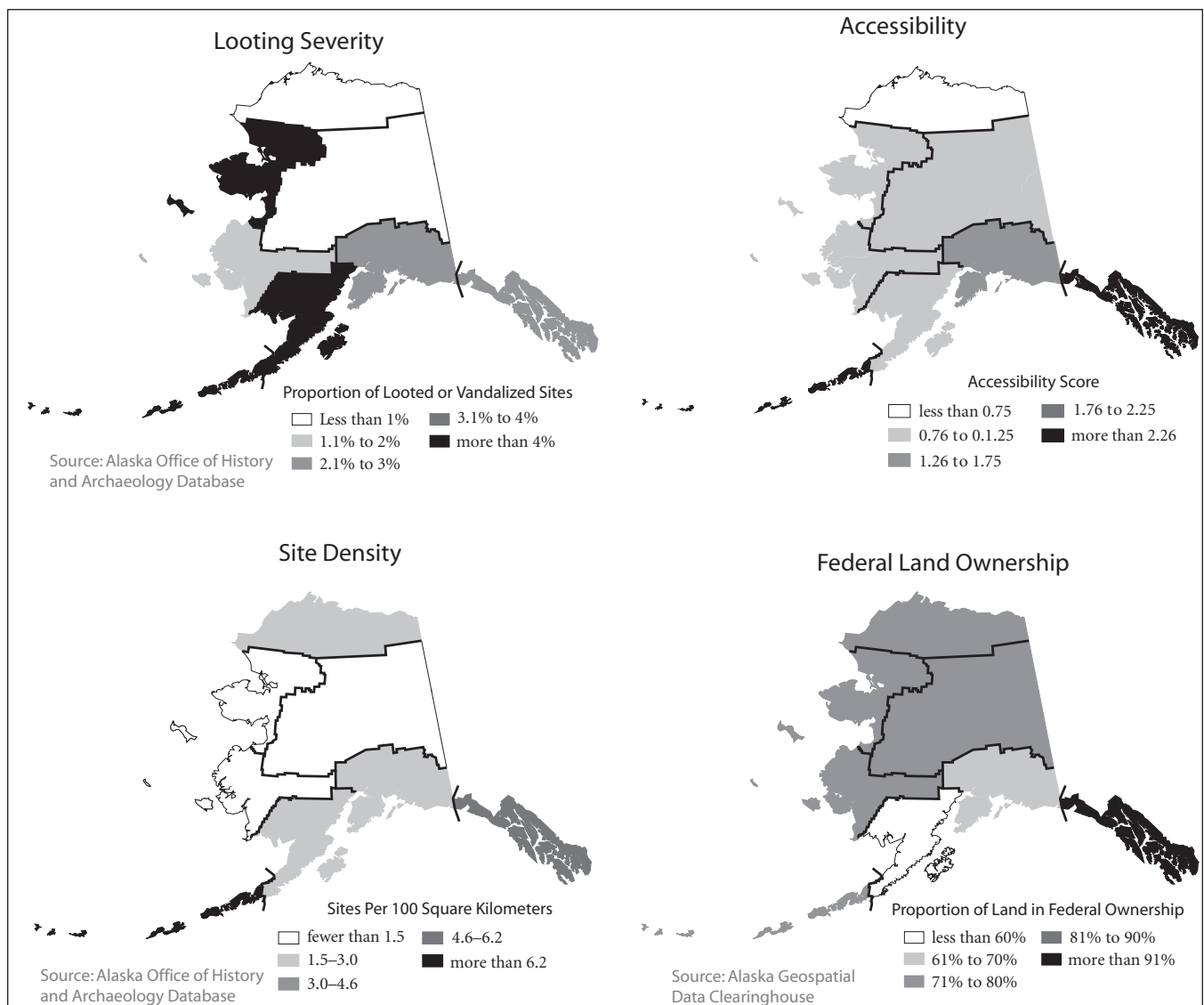
Three factors were significantly correlated with looting severity in Alaska: accessibility, site density, and federal land ownership. Table 13 summarizes the correlations and Fig. 2 shows maps of significant correlations. Of the three, federal land ownership was most strongly correlated with looting. The negative correlation means that as the proportion of federal land in a region increases, the proportion of looted sites decreases. The majority of federal land in Alaska is in the conservation system (national parks, national forests, and wildlife refuges), and apparently the land managers in these agencies are having some success protecting archaeological sites. It is also possible that the general public is more aware of limitations on removing things from conservation lands (GAO 1987:26).

The positive correlation between looting severity and accessibility fits expectations. The strong positive correlation between coastline areas and looting (together with the weak negative correlation between other accessible places and looting) likely indicates that looters target the kinds of sites found along the Alaska seacoast rather than indicating that accessibility alone contributes to looting. Many survey respondents cited accessibility as a contributing factor in looting and vandalism. In the Kodiak area, the experience of the Alutiiq Museum staff shows that areas with more boat and floatplane traffic and those near active villages, fish camps, lodges, and set net sites have more looting and vandalism (Amy Steffian 2006, personal

Table 13. Statistical correlations between factors and looting severity.

Variable	Correlation (r)	Significance (p)
Population Density	-0.04	0.92
<b>Accessibility</b>	0.29	0.35
<b>Site Density</b>	0.39	0.35
Income	-0.06	0.89
<b>Federal Land Ownership</b>	-0.47	0.26
Archaeological Presence	-0.24	0.57

<sup>a</sup> Significant correlations are in bold.



*Figure 2. Factors significantly correlated with looting.*

communication). While such locations are accessible to individuals with boats, they can simultaneously be fairly remote, away from regular monitoring by professional archaeologists or routine surveillance by law enforcement personnel.

Site density is positively correlated with looting in Alaska, meaning that as the density of sites increases, looting severity increases. This reflects relatively high site density in the Aleutian Islands and Bristol Bay/Kodiak regions, which had high looting severity (and a higher rate of site monitoring). Southeast Alaska also has high site density but a relatively low proportion of looted sites. This may be due to dense vegetation in the area, local cultural attitudes towards looting, under-reporting of looting, or other factors. The North Slope region, conversely, has low-

er site density but higher looting severity. This may be due to site contents (many northern sites contain sought-after ivory artifacts and preservation is often very good in the cold environment) or local cultural attitudes. Although site density is positively correlated with looting in the state as a whole, local factors are clearly important.

## DISCUSSION

Given the problems with estimating looting activity and its contributing factors, the results of this analysis should be considered preliminary. When better data are available, statistical correlations can be tabulated again and the results interpreted with greater confidence. At a minimum, information on which sites have been looted or vandalized

needs to be updated. It would also be helpful to improve the quality of information about site type, a factor that cannot be quantified with current information but might provide significant insight into patterns of looting and vandalism. Better information on site type, when coupled with more reliable data on looting, would allow archaeologists to better assess which resources are most threatened and direct protection efforts and public attention there. For example, the public might not be concerned that 10 percent of all archaeological sites in an area are looted, but if it can be ascertained that 90 percent of cave sites in the same area have been looted, interest in protecting those sites may rise. Also, archaeologists could more effectively direct law enforcement officers and site monitors to the most endangered sites.

Improving data quality is problematic. The Office of History and Archaeology, the designated central repository for site information in the state of Alaska, is the best location to store data about looting and vandalism. However, there are several obstacles to updating state site data. First, the AHRS is generally used for purposes other than studying looting and vandalism. It is designed to help archaeologists involved in research or compliance identify sites in a specific area and find information on those sites, as well as allow them to efficiently add new site information. Flexibility is—and should be—prioritized over precision, with the idea that an archaeologist needing to know more about a site can go back to the original report. Including more information on site type and condition may not fit with the priorities of the office. Changing database structure after thousands of records have been added has the potential to create serious problems and would likely be very time-consuming. Second, information about site condition has not been required in site records. Finding information about site condition and retroactively adding it to records for tens of thousands of sites is not practical without additional staffing and funding, which may not be feasible.

Several solutions are possible. At the least, information on looting should be required of archaeologists submitting new or updated site forms. One option is to make site condition a mandatory field. Another option is to make a separate mandatory field for looting during the next database software update. In records after the update, the field would contain data; in previous records, it would have to be entered. The process of entering information

(it could be limited to a simple yes or no) for thousands of sites would be aided by the fact that vandalism is already noted in the database; paper records would not have to be checked. Querying for records that contain the word “vandalism” in the site condition field and entering a “yes” into the new field for those records could be feasible. A third option is to track looting and site type somewhere other than the AHRS.

Changes to current methods of tracking looting and vandalism and site type require review of existing policies and a significant commitment of staff time. The resulting updated database would only be as good as the information in the paper records. The failure of archaeologists over the years to provide information on looting and vandalism cannot be rectified and thus databases will certainly underestimate looting. Updating the process would begin a new set of reliable records and offers the best information possible from older records. Database software itself must periodically be updated, and these intervals might prove to be an appropriate time to make changes. Although the process is imperfect, it will result in better data than are currently available. Mounting evidence that many archaeological sites are damaged may inspire archaeologists, local communities, and others to advocate for more comprehensive legal protection for archaeological sites. Other approaches are complementary to the statewide quantitative one we have taken here; Hollowell's (2004) in-depth case study and more detailed surveys and monitoring of particular regions (e.g., Crowell 1985; Schaaf 1988; Steffian et al. 2004) provide models for future research and management efforts.

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