CENTER FOR DESERT ARCHAEOLOGY
a nonprofit corporation

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President and CEO

November 23, 2011

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BUREAU OF LAND MANAGEMENT

BLM, Phoenix District
LS-SDNM RMP
21605 North 7th Avenue
Phoenix, AZ 85027

Dear RMP Team Leader:

The following comments are submitted by the Center for Desert Archaeology, a non-profit organization based in Tucson Arizona working in the Greater Southwest to preserve the places of our shared past. Our comments are directed towards those aspects of the plan that promote the long-term preservation of cultural resources.

1. Alternatives: 2.7.3 Cultural & Heritage Resources, 2.7.11 Wilderness Characteristics (WC), and 2.9.1 Areas of Critical Environmental Concern (ACEC)

Specific Comments:

- Page 54. We strongly support all the Goals identified in 2.7.3.2, particularly Goal 3.
- Page 56. We do not support identification of Butterfield West as a Public Use allocation. Alternatively, we recommend that portion of the Butterfield Overland Stage Route east of the Painted Rocks Campground site. It's proximity to the main paved road will facilitate Public Use as opposed to the proposed area which is remote and in close proximity to sensitive petroglyph sites.
- Page 56. We request that the following management actions be included in the final preferred alternative:

"Complete Class II (sample) field inventories to identify cultural resource sites and evaluate their eligibility for listing on the National Register of Historic Properties in accordance with Section 110 of the NHPA. Priority shall be given to the Lower Sonoran Desert National Monument, and the Saddle Mountain and Lower GilaTerraces and Historic Trails ACECs."

"Follow guidance developed by the BLM_SHPO Cultural Resources Data Sharing Partnership (CRDSP). Ensure that cultural resources information is provided in an acceptable format for entry into the AZSITE database."

- Page 57. We request that the following management actions be included in the final preferred alternative :
"Maintain and expand annual monitoring program that focuses on condition assessment of listed and eligible NRHP cultural resource sites with priority given to Lower Sonoran Desert National Monument, and the Saddle Mountain and Lower Gila Terraces and Historic Trails ACECs."

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- Page 108 2.7.11. As stated below in our comments to the Affected Environment section, access to sites facilitated by roads/routes open to motorized use has been demonstrated to foster impact to cultural sites (Ahlstrom et. al 1992; Center for Desert Archaeology 2010, unpubl report; Coconino National Forest 2011; Lightfoot 1978; Nickens et al 1981; Plog et al 1978; Schroeder 2010, Williams 1978). Roadless conditions or management actions that restrict vehicular access can provide substantive protection to cultural resources. We support managing the lands within the Gila Bend Mountains and Saddle Mountain identified in Alternative D for wilderness characteristics given the significant cultural resource values and roadless conditions found in these areas.

  In addition, we request that lands within the Sentinel Plain area north and south of Interstate 8 be managed for wilderness characteristics in the final preferred alternative (Figure 1). A proposal that we assisted in preparing for this area is included in comments submitted by The Wilderness Society. To the best of our knowledge the lands identified in Figure 1 have not been inventoried by BLM at any time in the past.

- Page 194. We strongly support the proposed designation of Lower Gila Terraces and Historic Trails ACEC and the Saddle Mountain ACEC. Both these areas possess extraordinary cultural resource values and commend the BLM for acknowledging this in their draft preferred alternative.
- Page 195. AC-1.1.2. We strongly support this management direction. We request that "core roadless areas" should be mapped and in areas where 5000 contiguous acres of roadless area exists (i.e. Gila Bend Mountains and Sentinel Plain) that these areas be identified as lands possessing wilderness characteristics. Road/route reclamation should be included as a stated management action in roadless areas.
- Page 196. AC-1.1.10. We strongly support this management action.
- Page 196. AC-1.1.11. We strongly support this management action.
- Page 196. AC-1.1.12. We strongly urge you to include this management prescription in the final preferred alternative.
- Page 196. AC-1.1.14. We strongly support this management action.
- Page 198. AC-1.1.36. This management action should be included in the final preferred alternative. The purpose for the ACEC designation, as the name signifies, is in part related to the historic trails through the area. The importance of the designation is undermined if appropriate management action is not taken to protect and restore historic trail segments.
- Page 198. AC-1.1.39. The final preferred alternative requires that specific portions of the ACEC be explicitly identified where mineral materials disposal and seismic exploration is closed. Our strong recommendation is to close the entire ACEC area to these activities.
- Page 198. AC-1.1.45. This management action is meaningless in the context of an ACEC designation since it provides no greater level of protection than undesignated public lands. We request that a No Surface Occupancy be stipulated. This will not only ensure protection of important cultural resources but further protect the natural area qualities that are the basis for the ACEC designation.

2. *Affected Environment* ***3.2.4 Cultural & Heritage Resources***

General Comments:

The narrative regarding cultural resources is an accurate depiction but is lacking in descriptive information. Some context on the nature of the known cultural resources (e.g. rock art sites, habitation sites, historic trails) and their prehistoric and current cultural affiliation is needed to get a better sense of the resources. More importantly, cultural resources are inherently diverse and as such are affected by decisions in different ways that require better articulation in the plan. For example, village sites and petroglyph areas, caves and rock shelters are more prone to vandalism impacts while artifact scatters and trails are more often damaged by off highway vehicles and road/route construction (Ahlstrom 1992; Williams 1978). A good example is provided in the Ironwood National Monument Final RMP page 3-32 through 3-35.

Specific Comments:

Page 265. Specific reference should be made to vandalism in and of itself as a significant threat especially for petroglyph areas which are often subject to spray painting, target shooting and occasionally removal by chipping, or if the rocks are small enough, theft.

Page 265. It unclear why there is not quantified information on damage from intentional vandalism, OHV damage and artifact collecting. BLM participates in the Site Steward program and as a starting point an examination of Site Steward reports for a ten year period should provide some quantified information on site impacts. In addition, by your own estimate roughly 70-90 sites are visited each year so BLM has data over the last ten years for hundreds of sites. AZSITE and BLM site records often have some information on site condition. At a minimum, a summary of this information is necessary to provide at least some quantified data to better guide management decisions. We request that this information be reviewed and evaluated and reported on in the final plan documentation.

We also believe that some targeted survey efforts are needed to better inform decision-making in the plan. This is especially true in the Monument where a higher standard of management is required for Monument objects, such as cultural resource sites. At a minimum we propose that in the Sonoran Desert National Monument surveys be conducted within ½ mile either side of the road/route centerline to more fully inform travel management decisions. With little quantified information in the plan, it is unclear how decisions have been made with respect to protection of these Monument objects. In areas outside the monument, we urge that a site condition assessment be conducted on all NRHP listed properties within ½ miles of the centerline of a known road/route to develop a better understanding of impacts to cultural sites.

Page 265. The impacts attributed to ATV use or motorized vehicle uses are understated. In particular, there is solid documentation that the proximity of sites to routes open to motorized use typically experience higher rates of vandalism than sites that are farther from routes open to motorized use. These indirect impacts are discussed by Schroeder on pages 15-16 of the Apache-Sitgreaves Cultural Resource Specialist report (2010) prepared in support of Forest wide Travel Management Planning for the Apache-Sitgreaves National

Forest and in Chapter 3 of the Coconino National Forest Final Environmental Impact Statement for Travel Management pages 95-107 (2011). In both cases the discussions are directly relevant to public lands managed by BLM. These reports specifically reference Ahlstrom 1992, Lightfoot et al 1978, Nickens 1981 and Plog et. al 1978. We include three of these reports for your review along with our own research on the Tonto National Forest (Center for Desert Archaeology 2010). We did not enclose Ahlstrom et. al 1992 since this was a Bureau of Land Management study that involves lands managed by the BLM in the Phoenix District and we assumed you have ready access to this report. Each of these studies demonstrates a significant relation between site proximity to routes open to motorized use and vandalism, including looting and casual surface artifact collection. Our research on the Tonto National Forest found that sites closer to roads open to motorized uses were classified in poor condition in greater frequency than sites classified in fair or good condition.

Williams (1978) provides an overview of types of damages, causes of site damage and site management recommendations. Other than outright removal, road closure was identified by surveyed land managers as the most effective protection strategy for sites subject to vandalism. His recommendation was that roads be closed within ½ mile of sensitive sites. Absent compelling information to the contrary, we strongly recommend this standard be applied to roads/routes in the Sonoran Desert National Monument.

3. Impacts on Cultural & Heritage Resources 4.4

This section lacks even minimal information upon which to assess impacts. We are left with vaguely worded, generalized statements and little to no documentation to evaluate the adequacy of the analysis nor how to evaluate differences in impacts among alternatives. Given that there is a fair amount of information in hand as discussed earlier and that targeted surveys in sensitive areas is not unreasonable we believe the impact assessment presented herein is totally inadequate. This is especially problematic for lands within the Sonoran Desert National Monument since cultural resource sites are Monument objects.

- Page 403. 5th paragraph BLM states: "Many uses eg LUAs and livestock facilities, may have secondary effects because they create new vehicle ways , which often lead to inadvertent damage from vehicle traffic and ***increases in the threat of vandalism*** (emphasis added) of fragile cultural resources". This indicates to us that BLM is aware of the indirect impacts of motorized road access. It stands to reason that if new roads increase the threat of vandalism, than existing roads pose an existing threat from vandalism. This would then suggest that travel management decisions must take this into account as part of the decision-making on motorized route/road designation.
- Page 405. 1st complete paragraph. We strongly disagree with this statement regarding quantification of impacts. There are Site Steward reports, BLM internal inventories, and the need to actually conduct targeted surveys as part of the planning effort. In addition, there are numerous AZSITE and BLM records that provide some measure of quantification with respect to site type, location and potential relationship to impacts (i.e. proximity to roads).
- Page 405. 5th complete paragraph please add that motorized use of routes/roads fosters public access to sites.
- Page 431. 3rd complete paragraph. We strongly object to the lack of inventory statement as it relates to travel management and route designation for the SDNM. Compliance with

cultural resource management objectives requires that a reasonable effort be made to inventory ½ mile either wide of the centerline of a route/road in areas where there is a high likelihood of encountering cultural resource sites subject to vandalism and looting including casual surface artifact collecting. BLM acknowledges this impact earlier in this section as it relates to new roads and as we point out in our comments above, the same rationale should necessarily apply to existing roads. In concert with the reports we have provided, travel management decision-making is a critical dimension of cultural resource management on public lands, including the protection of Monument objects. Given the lack of resources available to better steward sites and provide for public use and interpretation, travel management may be the single most important cultural resource management tool that is readily available to public lands managers.

Page 908. 4.25.2. From Table 30 it appears that many analysis areas of the National Monument were not analyzed at all with respect to Archaeological and Historical Sites. This is not acceptable and the analysis performed should occur Monument-wide.

The first assumption states that the APE considered is ¼ mile either side of all routes. This is a good step forward in travel management impact assessment but given that the literature varies on this distance threshold, a more expansive approach would extend the APE to ½ mile either side of all routes. Since cultural resource sites are Monument objects and their long-term protection is paramount, an expansive approach is justified at least for purposes of analysis.

Sixth assumption should make reference to motorized uses facilitating access such that decisions on travel management can have a direct bearing on reducing impacts to Monument objects.

- Page 909. First paragraph draws attention to the lack of inventory information. For all of the reasons stated above this is unacceptable, and using the example of Ironwood National Monument, we request that all routes/roads that are currently proposed open to motorized use be surveyed within 1/2 miles of the route/road center line to inform final travel management decisions on the Monument. We would be willing to discuss helping to organize volunteer assistance in this effort.

Based on existing information in AZSITE, we enclose three maps of areas in Areas 11 and 18 that depict prehistoric habitation sites and/or petroglyph occurrences. These are sites that are highly prone to casual surface artifact collecting and vandalism, including looting. We recommend specific route/road closures to public use as shown on the attached maps. Given the well documented information on motorized access and site impacts for these types of sites and the lack of any documentation on these sites in the plan, it is unclear how these Monument objects are adequately protected by continuing to designate these routes as open to pubic use. Proclamation language specifically references the Vekol Valley as "an important prehistoric travel corridor" and that "Signs of large villages and permanent habitations sites occur throughout the area, and particularly along the bajadas of Table Top Mountains". These sites are representative examples of this Proclamation language.

An additional consideration is that two of the three routes "dead end" at the southern Monument boundary which inadvertently facilitates trespass onto the Tohono Oodham

Nation and Barry Goldwater Bombing Range. Given reported concerns regarding use of this area by drug and human smugglers, we would support allowing these routes/roads to remain open for administrative use.

4. Appendix B 1.9 National Historic Preservation Act

Because the drafting of a land use plan is an "undertaking," Section 106 review must occur prior to approving the plan in the record of decision. BLM indicates that it complies with the NHPA through the 1997 Programmatic Agreement with the Arizona State Historic Preservation Office. While this agreement meets your requirements as it pertains to the State Historic Preservation Officer, it does not provide compliance with your other consultation responsibilities as it relates to other parties identified in the Sec 106 regulations. In particular are tribal historic preservation officers or other tribal representatives along with "individuals and organizations with a demonstrated interest in the issue".

The NHPA stipulates that consultation among agency official(s) and other parties with an interest in the effects of the undertaking on historic properties commence at the early stages of project planning, focusing on the opportunity to consider a broad range of alternatives. 36 C.F.R. § 800.1(c). Compliance with Section 106 is applicable "at *any stage* where the Federal agency has authority . . . to provide meaningful review of . . . historic preservation goals." *Morris County Trust for Historic Preservation v. Pierce*, 714 F.2d 271, 280 (3d Cir. 1983) (emphasis added); *Vieux Carre Property Owners v. Brown*, 948 F.2d 1436, 1444–45 (5th Cir. 1991). Therefore, the agencies cannot rely on later review process as a justification for refusing to comply with the NHPA.

Because of the sensitive nature of cultural resources and the corresponding lack of specific information about cultural resources in the plan, our comments to the proposed resource management plan do not meet the requirements under Section 106 to consult with interested parties. As such we request that formal consultation be initiated and completed before issuance of the Record of Decision. The Center for Desert Archaeology has a long standing interest in the planning area and cultural resources in the Southwest. As way of further background information, I have enclosed a recent issue of our flagship publication Archaeology Southwest on a portion of the planning area.

References:

Ahlstrom, Richard V.N., Malcolm Adair, R. Thomas Euler, and Robert C. Euler. 1992. Pot hunting in Central Arizona: The Perry Mesa Archeological Site Vandalism Study. USDI. Bureau of Land Management and USDA Forest Service, Southwest Region, Cultural Resources Management Report No. 13, Albuquerque.
Center for Desert Archaeology, 2010. Condition and Damage Assessment of 96 Previously Recorded Sites Located on the Tonto National Forest, Gila, Maricopa, Pinal and Yavapai Counties, Arizona. Unpubl. Rpt.
Coconino National Forest. 2011. Final Environmental Impact Statement Travel Management on the Coconino National Forest. USDA Forest Service Southwest Region MB-R3-04-12; Chapter 3 pages 95-107.

Lightfoot, K.G. 1978. The impact of casual collection on archaeological interpretion through regional surface surveys in An Analytical Approach to Cultural Resource Management, Fred Plog (ed.). Joint Publication of Arizona State University and the USDS Forest Service. Cultural Resources Report 19.
Nickens P.R. et. al (1981). A Survey of Vandalism to Archaeological Resources. DOI BLM Cultural Resources Series report 11.
Plog, Fred (1978) An Analytical Approach to Cultural Resource Management, Fred Plog (ed.). Joint Publication of Arizona State University and the USDS Forest Service. Cultural Resources Report 19.
Schroeder, Melissa. 2010 Cultural Resources Specialist Report for the Travel Management EIS. USDA Forest Service Southwest Region. Pages 15-16.
Williams, Lance R. 1978. Vandalism to Cultural Resources of the Rocky Mountain West. USDA Forest Service, Southwestern Region, Cultural Resources Report No. 21, Albuquerque, NM.

We appreciate the opportunity to provide these comments. We look forward to discussing how we might assist you in your future planning efforts.

Sincerely

Andy Laurenzi

Encl: reports and maps

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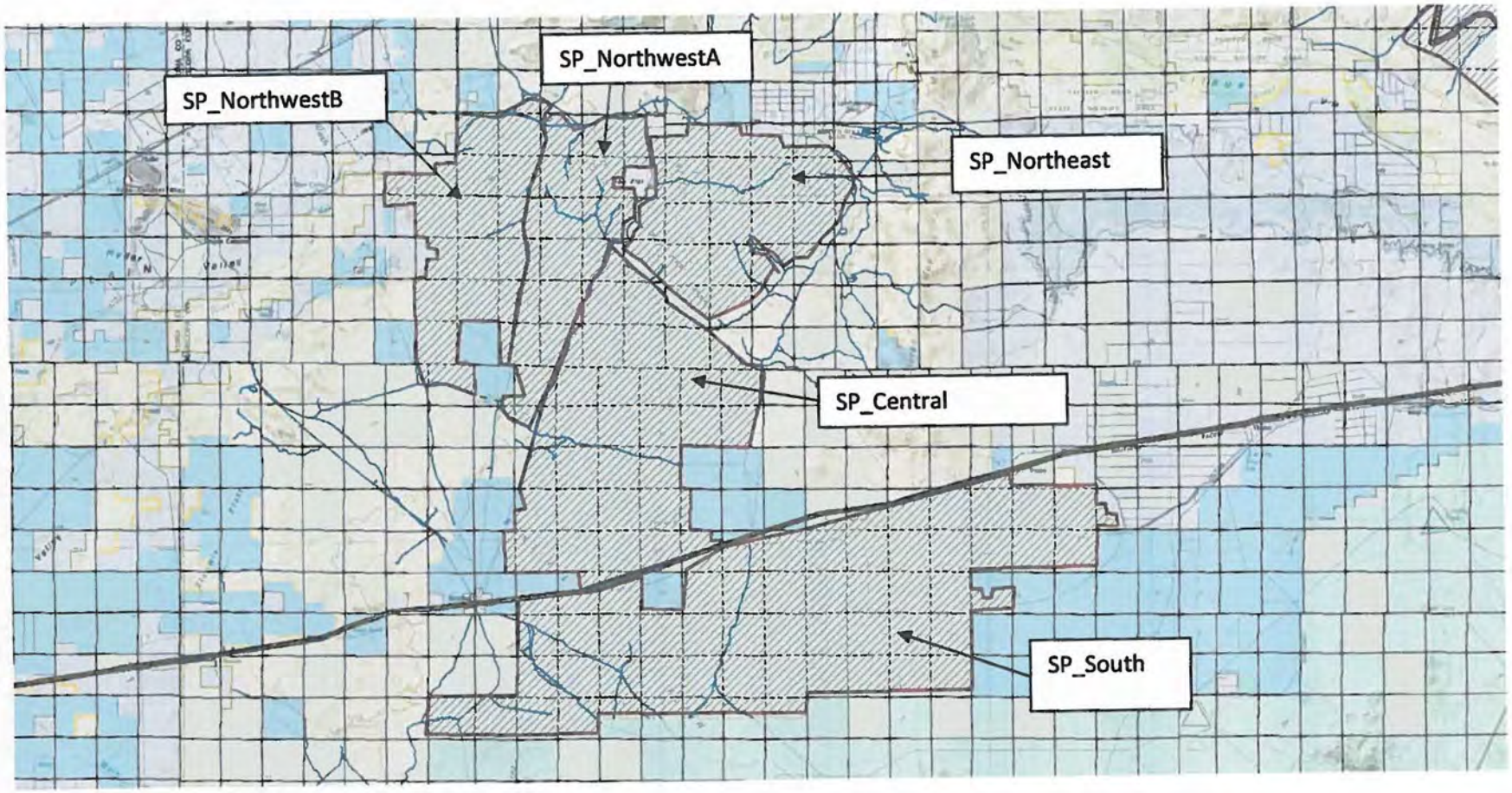
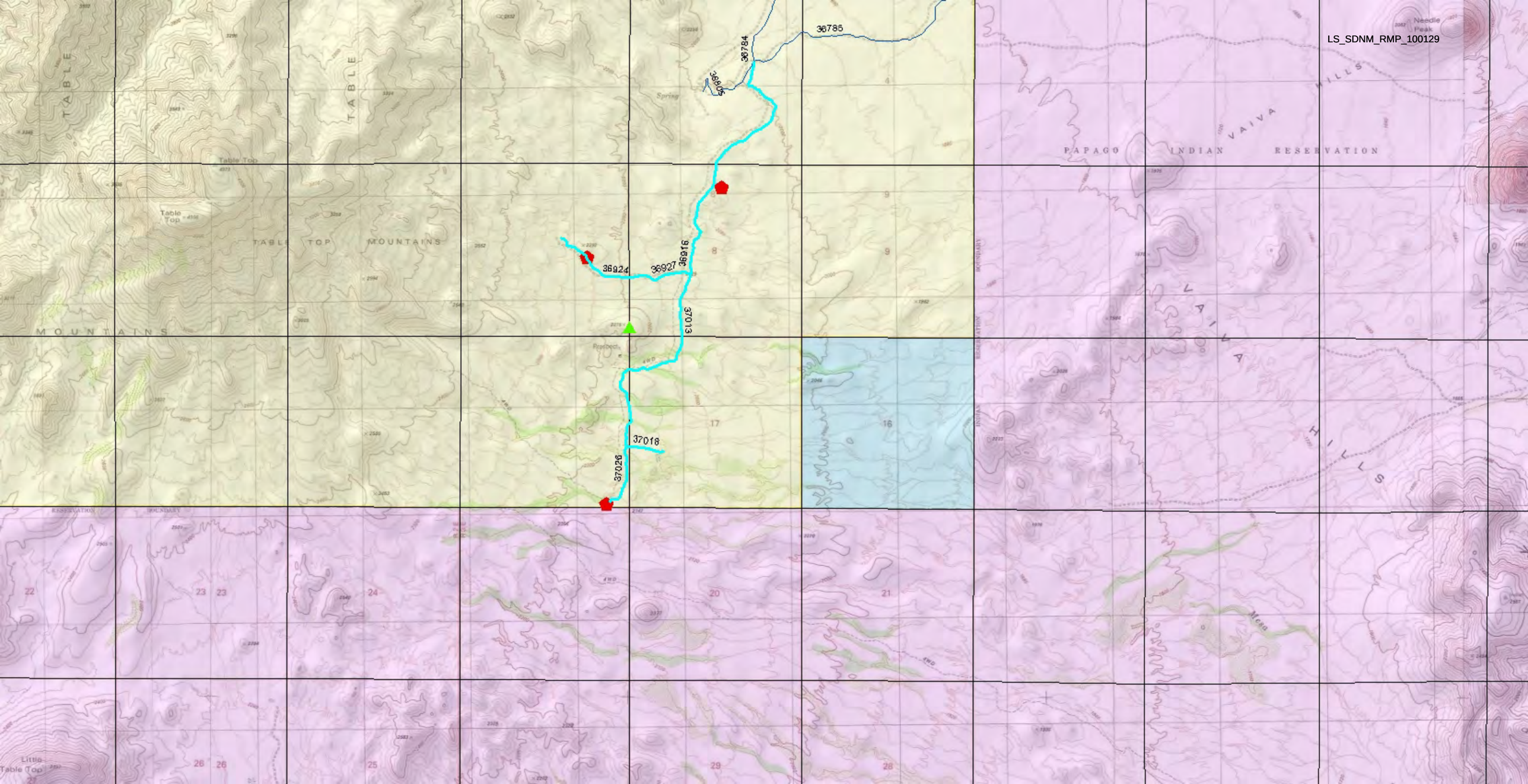


Figure 1. Sentinel Plains Wilderness Complex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- Increased nonmotorized recreation in areas previously used for motorized recreation
- Increase in use of private businesses that cater to motorized recreation experiences less available on the Forest
- Increase in use of other public lands to substitute for motorized recreation experiences less available on the Forest
- Increased nonmarket values to surrounding areas from resource benefits (e.g., clean water, increased wildlife populations) resulting from decreased motorized recreation on the Forest

Alternative 4

Direct, Indirect, and Cumulative Effects

The economic effects of this alternative would be similar to those of alternative 3, but would include 50 additional miles of motorized trail and 326 miles of designated road (almost 11 percent more road than alternative 3). In addition, this alternative would emphasize long distance motorized trail activity by people riding dirt bikes, ATVs, OHVs and other high-clearance vehicles by including the 50-mile single-track Challenger Trail and the Long Route, which includes 187 miles of mostly primitive road. While alternative 4 would add some opportunities for motorized use, and therefore may reduce the decline in motorized recreation expenditures compared with alternative 3, the overall difference between the two alternatives is too small to calculate in this economic analysis.

Cultural Resources

Introduction

Cultural resources are managed under three broad classifications: isolated occurrences, such as an arrowhead or the remains of an abandoned Model-T Ford; archaeological sites, such as a prehistoric pueblo or a pioneer's cabin; and traditional cultural properties, such as the San Francisco Peaks or the Red Rocks country near Sedona. The Coconino National Forest strives to manage all cultural resources to make the best use of their scientific, educational, recreational, and cultural values for both present and future users of the Forest. Many laws, regulations, rules, and policies protect sites and provide guidelines the Forest Service must follow when determining the potential effects of a proposed project or activity on cultural resources. These include formal consultations with tribes having ancestral connections to the Forest, and project reviews by the State Historic Preservation Office, and sometimes the Advisory Council on Historic Preservation.

The Coconino National Forest has recorded almost 10,000 archaeological sites and anywhere from 100 to 300 new sites are added each year. Most of these are found when archaeological surveys are conducted to determine the types and densities of sites that are present in a proposed project area. Cultural resources require specific consideration in order to evaluate the potential impacts to them by the various uses and projects that take place on the National Forest:

- Cultural resources are fragile – they can be easily damaged when bulldozers or other heavy equipment are used on a project, or through the rutting and erosion resulting from unauthorized OHV-created roads.

- They are unique – archaeological sites can be grouped into categories, such as time or likely function, but no two are exactly alike. Human behavior is much too diverse to be easily pigeonholed.
- They are nonrenewable – with special care and protection, we can grow more rare plants or improve habitat to raise more endangered animal species, but we cannot grow another field house constructed in A.D. 900.

Affected Environment

This analysis is looking at changes to motorized use on the Coconino National Forest based on implementation of the Travel Management Rule. It is not an analysis of the entire existing National Forest Road System. The current road system is the result of past projects and land management planning efforts that have gone through road management evaluations, National Environmental Policy Act review, and analysis.

Archaeological Survey Status of Forest Roads – Of the approximately 7,484 miles of road under Forest Service jurisdiction, slightly more than a third (35 to 40 percent) have been archaeologically surveyed to some degree.

Archaeological Site Density and Distribution of Roads –For purposes of evaluating the potential effects of designating various combinations of roads as open or closed to vehicle use, we are defining **site sensitivity** as the potential site density of the area that could theoretically be impacted by road maintenance and use. Five site density classes were defined, which we used to produce an overall site density map for the Forest (figure 32, appendix B). For more information on how site sensitivity and site density classes were developed, please see the full Cultural Resources specialist report.

Table 28 and figure 17 show how the 7,484 miles of roads on the Coconino National Forest (or otherwise under Forest Service jurisdiction) are distributed throughout the Forest. Most roads are located in areas classified as site density 2 (low site density; 4,285 miles), or site density 5 (very high site density; 1,675 miles). In general, very low to low density areas correspond with the high ponderosa pine forest above the Mogollon Rim. However, the ponderosa pine zone on the east side of the San Francisco Peaks, northeast of Flagstaff, is a high site density area. High to very high-density areas occur in the pinyon-juniper zone, particularly in the Verde Valley, along the base of Anderson Mesa, east of Flagstaff, and north of the cinder belt.

Table 28. Archaeological site density classes defined for the Coconino National Forest

Cultural sensitivity level	Color code	Estimated site density
Very low	**dark blue**	0 sites/square mile
Low	light blue	1 - 10 sites/square mile
Moderate	green	11-20 sites/square mile
High	orange	21-30 sites/square mile
Very high	red	30+ sites/square mile

B: Cultural Resource Density Map

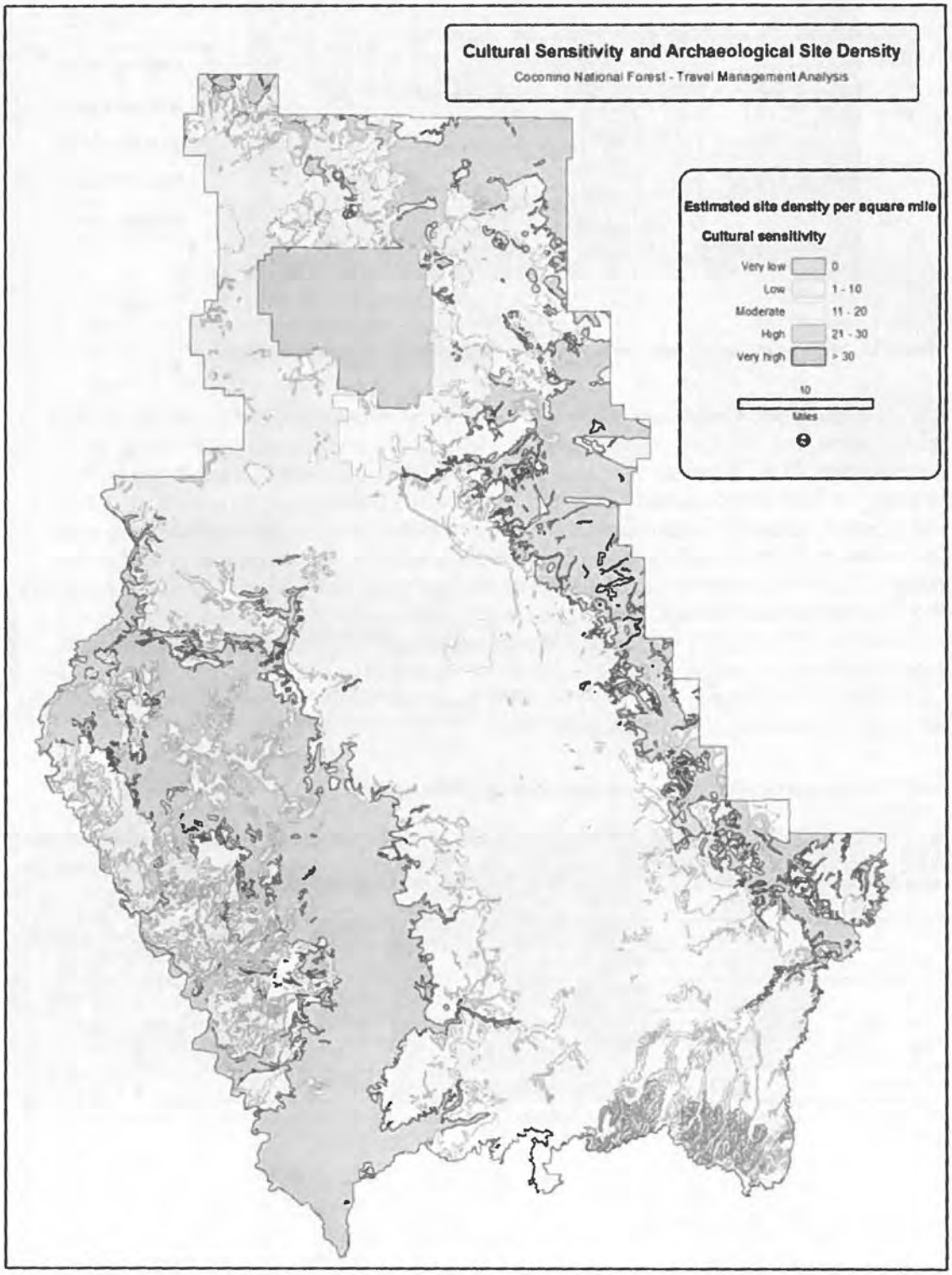

Figure 32. Predicted archaeological site density areas within the Coconino National Forest

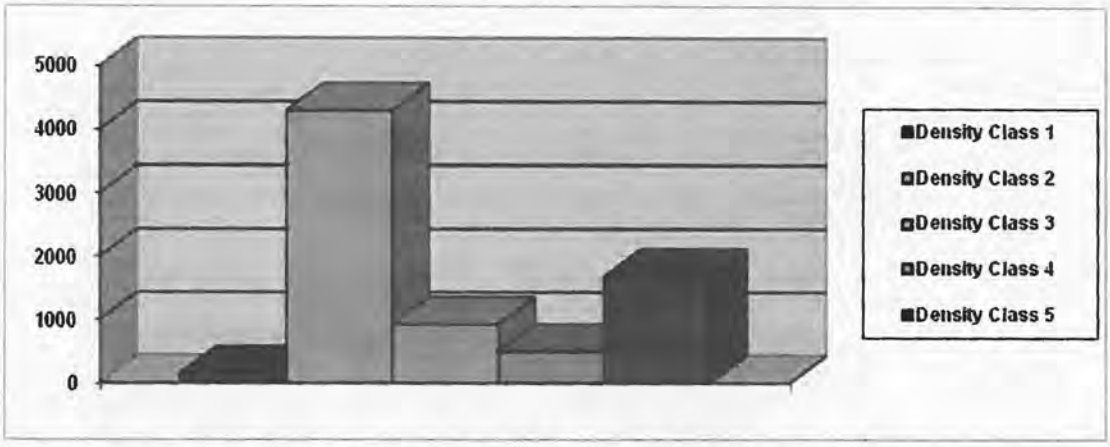

Figure 17. Miles of roads on the Coconino National Forest by site density class

Archaeological Site Condition – Information on the condition of archaeological sites is found in the Archaeological Site Log, where condition information is available for 4,806 sites as of December 30, 2010. When sites are recorded, their condition is noted on a 0 to 5 scale, where 0 indicates an undisturbed site and 5 indicates a site that has been completely destroyed. Table 29 and figure 18 shows site conditions in different parts of the Forest, as represented by the seven former ranger district boundaries, which still form the basis for the designation of sites on the Forest. The table shows that site conditions on the two Verde Valley Districts (D-1: Beaver Creek and D-6: Sedona) are identical, as is the case for the area around the San Francisco Peaks (the D-2: Elden and D-3: Flagstaff Districts). The area around the San Francisco Peaks has the most undisturbed sites, as well as the most highly disturbed sites. The districts in the high pines (D-4: Long Valley, D-5: Mormon Lake, and D-7: Blue Ridge) are dissimilar to one another as well as to the Verde Valley and San Francisco Peaks areas.

Table 29. Percent of sites in each site condition by administrative unit on the Coconino National Forest

	Undisturbed	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5
Beaver Cr.	16%	20%	18%	18%	16%	
Sedona	14%	17%	18%	19%	22%	
Elden	23%	17%	23%	19%	20%	
Flagstaff	13%	18%	20%	18%	17%	
Long Valley	2%	5%	5%	7%	7%	
Mormon Lake	11%	9%	6%	8%	13%	
Blue Ridge	21%	14%	10%	11%	6%	

Site conditions range from 0 to 5, where 0 indicates an undisturbed site and 5 indicates a site that has been completely destroyed.

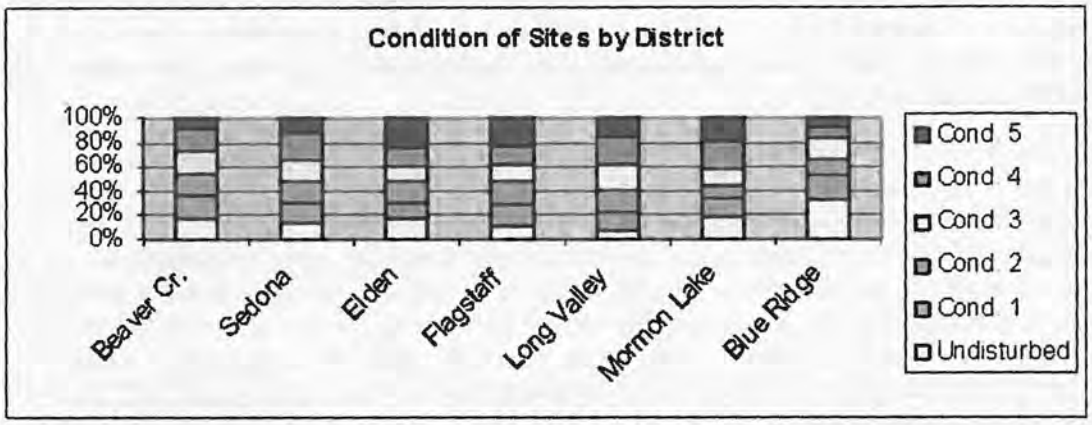

Figure 18. Site conditions on the Coconino National Forest by administrative unit

Table 30 shows the various causes of site damage, with roads being the single-most prevalent cause of site damage (20 percent), followed by vandalism and pot hunting (7 percent). Site condition data, however, has not distinguished between damage due to highways, secondary/graded roads, or off-road vehicle use. Other causes of damage, such as logging, juniper eradication, fire suppression, etc., are significantly less.

Table 30. Number of sites on each administrative unit disturbed by various causes*

Condition	Beaver Creek	Elden	Flagstaff	Long Valley	Mormon Lake	Sedona	Blue Ridge	Total	Percent
Undisturbed	356	520	284	53	225	305	315	2,058	48%
Roads	61	151	218	48	171	121	67	837	20%
Pot hunting & vandalism	41	106	21	7	17	98	30	320	7%
Burned	2	59	74	0	11	2	8	156	4%
Logging	0	24	70	35	14	6	26	175	4%
Recreation	9	29	20	12	13	40	12	135	3%
Power/ phone line	7	65	9	21	6	28	3	139	3%
Juniper eradication	14	65	0	2	4	2	33	120	3%
Grazing	36	9	23	13	11	17	9	118	3%
Construction	5	20	37	2	12	24	6	106	2%
Fire suppression	0	15	45	0	12	7	0	79	2%
Trails	5	12	2	0	0	7	5	31	1%
TOTAL	536	1,075	803	193	496	657	514	4,274	100%

* based on archeological site reviews

Across the Forest, road damage is variable, ranging from a low of 11 percent of sites in the Beaver Creek area to a high of 34 percent in the Mormon Lake area. The Sedona area has a higher proportion of site damage caused by roads (18 percent) than the Beaver Creek area (11 percent), while to the north, more sites have been damaged by roads on the west side of the Peaks

(Flagstaff Ranger District: 27 percent) than on the east side of the Peaks (Elden Ranger District: 14 percent). The percentage of sites damaged by roads in the high pine forest is also variable, ranging from 13 percent in the southeast part of the Forest around Blue Ridge to 34 percent in the Mormon Lake country.

Besides direct impacts to sites caused by roads, there is also an indirect impact from roads due to the access they provide to archaeological sites. Many studies of site vandalism in the Southwest find a direct correlation between looting of sites and their proximity to roads. Land managers throughout the western United States agree that the most important factor contributing to vandalism was accessibility by vehicle: 42 percent consider two-wheel drive vehicle access the most important and 27 percent consider four-wheel drive access the most important (Williams 1978). Often, unauthorized two-track roads have been developed for no other purpose than to provide access to archaeological sites (Lightfoot and Francis 1978; Ahlstrom et al. 1992). Lightfoot noted the amount of illegal artifact collecting on sites was related to its distance and visibility from a road (Lightfoot 1978). Researchers report a range of distances relating proximity to roads to illegal digging. In southwestern Colorado, there was an overwhelming preference for pothunted sites within about ¼ mile of a road capable of two-wheel drive access (Nickens et al. 1981). In the Colorado Planning Unit, artifact collecting seemed most intensive on sites located within 492 feet of a road (Francis 1978). The Perry Mesa vandalism study found most vandalized sites were within 600 feet of a road (Ahlstrom et al. 1992). On the Apache-Sitgreaves National Forest, all looted sites are within 100 feet of a road (Schroeder 2010), and on the Coconino National Forest, 76 percent of looted sites are within 0.25 mile (1,320 feet) of a road and 82 percent are within 0.3 mile (1,600 feet) of a road (Daquila 2008).

Proximity to roads is not the only major factor in determining which sites are looted, in fact one study did not find a direct relationship to looting and proximity to roads. Site type is also an important factor (Ahlstrom et al. 1992). Large pueblos, cave sites, and pit house villages with obvious trash or burial mounds have always been major targets of pot hunters and looters.

To summarize site condition, about 48 percent of all sites on the Forest are undisturbed and 52 percent are disturbed. Of the disturbance, 11 percent is due to natural causes, such as erosion and bioturbation, while 89 percent is due to human causes. Specific causes of damage vary considerably across the Forest (table 30), but roads are the single greatest cause of damage on every part of the Forest, affecting about 20 percent of all recorded sites. Data, however, do not distinguish which types of road or off-road vehicle use is the cause of site damage. Areas that stand out as being different from the norm consist of the south end of the Verde Valley (Beaver Creek Ranger District) where only 11 percent of sites have been impacted by roads, and Long Valley Ranger District, where 28 percent of recorded sites have been disturbed by roads.

Desired Future Conditions

Coconino National Forest Plan: Cultural Resources Direction

The forest plan provides management direction for desired future conditions for the cultural resources of the Coconino National Forest (forest plan, pp. 52-3 to 55) and in subsequent area planning documents. Collectively, they provide the criteria that have been used to evaluate the need for future closures or restrictions, and were among the guidelines used by the Forest's travel management interdisciplinary teams. Specific criteria applicable to cultural resources can be found in the Cultural Resources specialist report.

Environmental Consequences to Cultural Resources

Methodology for Analysis

For the effects discussion, alternative 1 is used as representative of the existing condition; the analysis measures the change in effects to cultural resources when compared to alternative 1. The intent is to portray the effects programmatically and to show the change from the existing condition for each alternative. Effects are evaluated in terms of substantive issues that were identified through external and internal scoping. This analysis evaluates direct and indirect effects from designation on cultural resource sites and traditional cultural properties across the alternatives.

Although this analysis addresses the anticipated environmental effects to cultural resources, it does not address site-specific effects from the perspective of the National Historic Preservation Act (NHPA) of 1966, as amended. For specific information on methods used for compliance with the National Historic Preservation Act, please see the full Cultural Resource specialist report.

The forest plan and subsequent updates provide several criteria that were used as part of the interdisciplinary analysis that resulted in the open and closed road and motorized trail configurations proposed in alternatives 3 and 4. These include consideration for:

- Roads that provide access to cultural sites that have been identified for current or future development as interpretive or recreation use sites or areas
- Roads necessary to meet peoples' needs and values, such as American Indians' traditional gathering of plants and access for various purposes, and access to sites and areas needed for the maintenance of cultural and religious values
- Roads necessary to manage special use sites and areas

As table 30 shows, roads are the main cause of damage to archaeological sites, impacting about 20 percent of sites recorded on the Forest. As a way of comparing the relative effects of the three alternatives, table 31 estimates the potential average number of sites that may be impacted or protected under each alternative. It assumes an area of potential effect to be 45 feet wide—a 15-foot-wide roadway and 15 feet on each side of the road. Road miles for each alternative by site density class were computed by GIS, computed into low and high estimates of the potential number of sites using the Forest Terrestrial Ecosystem Soil site density model ranges (above) and the high and low estimates averaged to facilitate comparison.

Alternative 1 – Direct and Indirect Effects

Alternative 1would not meet the direction or requirements of the Travel Management Rule. However, it would have the following effects (see table 31 and Appendix 2 in Heritage specialist report):

- Of roads open to the public, 93.3 percent are within 0.5 mile of the nearest road.
- All 125 miles of the currently known motorized trail system would remain open. No trails would be closed.
- Between 22 and 44 sites (average 33) would remain affected by the current motorized trail system. No sites would be removed from the area of potential effect.

Table 31. Potential average number of sites impacted or protected by alternative, assuming 45-foot-wide potential impact area

	Alternative 1 - No Action			Alternative 3			Alternative 4		
	Existing Amount	Sites Impacted	Sites Protected	Proposed Amount	Sites Impacted	Sites Protected	Proposed Amount	Sites Impacted	Sites Protected
Roads Open	7,486 mi.	1,074	-	3,097 mi.	440	-	3,426 mi.	477	-
Closed Roads	0	-	0	4,387 mi.		633	4,061 mi.	-	599
Trails Open	125 mi.	33	-	39 mi.	10	-	89 mi.	29	-
Closed Trails	0	0	0	87	-	23	37	-	4
Motorized Camping	1,545,552 acres	44,741	-	43,313 acres	839	-	43,313 acres	839	-
Total Sites	-	**45,848**	**0**	-	**1,289**	**656**	-	**1,345**	**603**

- All 7,486 miles of the current road system would remain open. No roads would be closed.
- Between 650 and 1,497 (average 1,074) sites would continue to be within the area of potential effect related to continued road use, designated motorized travel routes, and dispersed camping. No sites would be removed from the area of potential effect. An unknown number of sites would continue to be potentially affected by continued cross-country travel.
- Off-road travel for big game retrieval and any other activity would continue except in closure areas, which include approximately 1.46 million acres. Unrestricted off-road travel would likely result in minor direct and indirect impacts over time as archeological sites are incidentally driven through or are affected by erosion from areas that receive repeated use.

Under this alternative, it is expected that archeological sites and cultural resource areas would continue to be impacted from direct impacts including use of existing roads on archeological sites and creation of new roads or trails on archeological sites from off-road travel. In addition, this alternative is expected to continue indirect impacts of facilitating access to high-density areas of the Forest for pot-hunting and other previously recorded illegal activities.

This alternative would not help the Forest achieve desired conditions of limiting impacts in National Historic Landmarks and National Historic Districts. Currently there are 7 miles of roads in these areas, of which approximately 0.25 mile are unauthorized routes. These routes and the potential for new unauthorized routes from cross-country motorized use in these areas would move conditions away from the desired conditions stated in the forest plan.

Also under this alternative, approximately 19.7 miles of forest roads, 1.36 miles of which are unauthorized roads, would be within 100 feet of the General Crook Trail. This level of motorized use adjacent to the historic trail would continue to not comply with Forest Plan direction to emphasize foot and horse travel only on this trail. Allowing unrestricted cross-country use in the

area would also limit the effectiveness of management to limit motorized use on the trail as indicated in the forest plan.

Alternative 3 – Direct and Indirect Effects

This alternative would designate 3,097 miles as open and 4,317 miles would be designated as closed. The Cinder Hills OHV Area would remain open to motor vehicles. Designated roads within existing seasonal closure areas would continue to be seasonally closed to motor vehicles.

Issue 1: Prohibit Cross-country Motorized Travel – Motorized off-road travel would be prohibited, except when authorized by permit or where designated it is occurring in designated areas (Cinder Hills), in camping corridors, or in designated motorized big game retrieval areas. A significant, but unknown number of sites would be protected from potential effects and excluded from the area of potential effect by restricting motorized cross-country travel.

Permits could be authorized for specific purposes, such as to gather firewood, to continue activities related to grazing permits, or for traditional cultural practices. Access to the Forest for traditional cultural purposes, such as plant collecting, would continue to be authorized by tribally specific Memoranda of Agreements, Forest policy, and the recently authorized Department of Agriculture Farm Bill.

Issue 2: Reduce the Number of Roads – The current open road mileage is about 7,484 miles and 99 percent of all roads are within 1 mile of another. Alternative 3 would close approximately 4,317 miles of road. This alternative would reduce road density by approximately 20 percent; 78.6 percent of roads open to the public are within 0.5 mile of the nearest road. Since proximity to roads is a significant factor resulting in the looting of sites, reducing the number of roads within 0.5 mile of another by almost 14 percent would help protect an unknown number of sites from possible looting. Between 266 and 614 sites (average 440) would continue to be within the area of potential effect of the designated miles of road but 383 to 883 (average 633) sites would be removed from the area of potential effect (table 32 and Appendix 1 in Heritage specialist report).

Table 32. Percentages of roads open to the public within 4 miles of nearest road by alternative (outside of wilderness areas)

Miles to nearest road open to public	Alternative 1 – Current Situation	Alternative 3	Alternative 4
0 - 0.5 miles	93.3 %	78.6 %	81.5 %
0.5 – 1 mile	5.7 %	17.1 %	14.8 %
1 – 2 miles	0.8 %	3.7 %	3.2 %
2 – 4 miles	0.2 %	0.6 %	0.5 %
> 4 miles	0	0	0
Total	100 %	100%	100%

On the Coconino National Forest, pinyon-juniper vegetation is where the large majority of archeological sites exist. Roads have been identified as the main cause of impacts to sites on the Forest. This alternative would decrease impacts to archeological and cultural resources by closing 66 percent of the currently existing routes in pinyon-juniper vegetation types.

This alternative would help achieve desired conditions of reducing road-related effects to National Historic Landmarks and Districts by closing approximately 35 percent of the roads in those areas (Appendix 4 in Heritage specialist report) and would also remove all unauthorized roads from historic landmarks and districts. This would have the greatest impact to the Ridge Ruin National Historic District by removing portions of five different unauthorized roads located in the district.

Also under this alternative, the miles of forest roads within 100 feet of the General Crook Historic Trail would be reduced by one third. This alternative would eliminate all but 0.07 mile of unauthorized roads 100 feet from the General Crook Historic Trail. This reduction in the level of motorized use adjacent to the historic trail would help achieve Forest Plan direction to emphasize foot and horse travel on this trail.

This alternative would designate 30 miles of unauthorized road for motorized use. None of the 30 miles of the unauthorized routes are expected to result in impacts to cultural sites because these routes would need to be fully surveyed and all potential site impacts would need to be addressed prior to inclusion on the motor vehicle use map (in accordance with the Protocol).

Issue 3: Motorized Trail System – Approximately 37 miles of existing system motorized trails would be kept as part of the system and 1.8 miles of unauthorized motorized trails would be designated (Lower Smasher Canyon Trail). Eighty-nine miles of unauthorized motorized trails would be closed to motorized use. Smasher Canyon Trail is an unauthorized trail in the southwest edge of the Forest that follows the bottom of a wash and ends about 1 mile east of the Verde River. The lower 1.5-mile section would be designated as an approved motorized trail. The upper section would not be designated. Smasher Canyon Trail would require an archaeological survey before it could be made available for public use on the motor vehicle use map; any sites found would need to be avoided or excavated to the extent needed to mitigate impacts from use as a motorized trail.

Although the trail has not been archaeologically surveyed, its designation is expected to have little archaeological impact since no sites were identified during a cursory examination of it by the Red Rock District Archaeologist. Furthermore, it is located in a part of the Forest that has a very low archaeological site density. Between 7 and 13 sites (average 10) would still be within the area of potential effect of the motorized trail system, but 15 to 30 sites (average 23) would be removed from the area of potential effect of the motorized trail system (Appendix 2 in Heritage specialist report).

Issue 4: Dispersed Camping – Roadside parking and camping for the length of a vehicle would be allowed throughout the Forest. This alternative would designate 300-foot-wide corridors along both sides of 581 miles of designated road and along one side of 32 miles of designated road for the sole purpose of motorized access to dispersed camping. This would result in 43,313 acres of motorized dispersed camping corridors on the Forest. Many changes were made to the draft EIS to remove corridors that overlapped with known archeological sites. Selected sites would be monitored to ensure they are not being adversely impacted by camping activities, and if they are, corridors would be modified or deleted to protect sites from further impacts.

Potentially 453 to 1,226 (average 839) sites could be affected by designation of 613 miles of dispersed camping corridors. However, impacts due to dispersed motorized camping are most likely to be in corridors that are in high site density areas. Of the 613 miles of proposed

designated motorized camping corridors, only 103 are in high site density areas as corridors containing high site densities or particularly sensitive or significant sites were deleted from consideration during the corridor evaluation process. Nine corridors with potentially very sensitive sites would not be listed on the motor vehicle use map until they have been inspected by Forest archaeologists and determined whether motorized camping should be allowed in their vicinity, or if modifications should be made to the corridor to ensure their protection. Sixteen additional sites within approved corridors would be monitored to ensure they do not receive additional impacts due to motorized camping. Protective measures would be taken if such impacts are found. Any additional proposed dispersed camping areas would use information from archaeological surveys and State Historic Preservation Office consultations, as required by the Travel Management Rule Protocol, to minimize effects and the number of sites that could be impacted.

Issue 5: Motorized Big Game Retrieval – No motorized big game retrieval would occur except in Arizona Department of Game and Fish Management Units 7W and 8, where the Coconino would authorize off-road travel for retrieval of elk. This is estimated to result in approximately 74 individual off-road vehicle trips for motorized big game retrieval per year in an area of about 49,478 acres. This would be a very large decrease in off-road motorized use from current conditions. Although it is possible that off-road use for motorized big game retrieval could result from the estimated 74 vehicle trips per year, this is almost a 100 percent decrease in impacts from off-road travel under existing conditions.

Prohibiting cross-country use in the area and not allowing off-road travel for motorized big game retrieval in the vicinity of the General Crook Historic Trail and National Historic Landmarks and Districts would help achieve Forest Plan direction to limit motorized use in these areas.

Alternative 4 – Direct and Indirect Effects

This alternative would designate 3,991 miles as closed, and would add approximately 51.8 miles of motorized trail (includes system designation of the Lower Smasher Canyon and Challenger unauthorized motorized trails). The Cinder Hills OHV Area would remain open for cross-country motorized travel. Designated system roads within existing seasonal closure areas would continue to be seasonally closed to motor vehicle use.

Issue 1: Prohibit Cross-country Motorized Travel – This alternative would have the same effects as alternative 3 (see page 102). A significant, but unknown number of sites would be protected from potential effects and excluded from the area of potential effect by restricting motorized cross-country travel.

Issue 2: Reduce the Number of Roads – This alternative would close 3,991 miles of road and designate 36 miles of unauthorized roads. Between 285 and 669 sites (average 477) would continue to be within the area of potential effect of the designated roads. Between 365 and 832 (average 599) sites would be removed from the area of potential effect (table 32 and Appendix 1 in Heritage specialist report). None of the 36 miles of the unauthorized routes are expected to result in impacts to cultural sites because these routes would need to be fully surveyed and all potential site impacts would need to be addressed prior to inclusion on the motor vehicle use map (in accordance with the Protocol).

As stated previously, pinyon-juniper vegetation is where the large majority of archeological sites exist on the Forest. Roads have been identified as the main cause of impacts to sites on the Forest. This alternative would decrease impacts to archeological and cultural resources by closing 53 percent of the currently existing routes in pinyon-juniper vegetation types.

This alternative would move toward desired conditions of reducing road-related effects to National Historic Landmarks and Districts by closing approximately 34 percent of the roads in National Historic Landmarks and Districts (Appendix 4 in Heritage specialist report). This alternative would remove all unauthorized roads from historic landmarks and districts. This would have the greatest impact to the Ridge Ruin National Historic District by removing portions of five different unauthorized roads located in the District. This alternative would designate a portion of road to provide access to the C. Hart Merriam Historic Landmark, which would be closed under alternative 3.

Also under this alternative, the miles of Forest roads within 100 feet of the General Crook Historic Trail would be reduced by one third. This alternative would eliminate all but 0.07 mile of unauthorized roads 100 feet from the General Crook Historic Trail. This reduction in the level of motorized use adjacent to the historic trail would help achieve Forest Plan direction to emphasize foot and horse travel on this trail.

Issue 3: Motorized trail system – This alternative would add 51.8 miles of nonsystem motorized trails. Thirty-seven miles of nonsystem motorized trails would not be designated as open. In addition to Lower Smasher Canyon Trail, the Challenger Trail would be added as a motorized trail. Between 20 and 39 sites (average 29) would still be within the area of potential effect of the motorized trail system but 2 to 6 sites (average 4) would be removed from it (Appendix 2 in Heritage specialist report).

The Challenger Trail is an existing unauthorized route that circles the San Francisco Peaks between about 8,000 and 8,500 feet. Its west end is the Snowbowl Road, just northeast of Little Leroux Spring, and its east end is in Schultz Pass. Each end would connect with the currently designated Fort Valley Trail System. Only scattered segments of the Challenger and Fort Valley Trail System have been archaeologically surveyed; however, 20 historic or prehistoric sites are known to be on or near the trail routes. These include prehistoric field houses, and historic period homesteads, ranches, logging railroad beds, and aborted water diversion ditches (see Appendix 1 in Heritage specialist report). Three specific areas of ceremonial and traditional significance to the Hopi and Navajo are along or near the Challenger Trail, and its entire route is within the San Francisco Peaks traditional cultural property boundary, an area that is sacred to at least 13 tribes.

Before the Challenger Trail could be designated, archaeological surveys would need to be conducted to determine if any damage has occurred to any of the 18 known sites, and if there are any other sites that may be damaged by use of the trail. Formal consultations would need to be made with the 13 tribes known to have significant religious and traditional reverence for the Peaks to determine their specific concerns about a designated motorized trail there, and whether those concerns could be mitigated in some way. Based on the cultural significance of the area, it is highly likely that designation of the Challenger Trail as a motorized system trail would result in a negative impact on the values that are part of the religious and traditional significance of the area.

Issue 4: Dispersed Camping – This alternative would have the same effects as alternative 3 (see page 103).

Issue 5: Motorized Big Game Retrieval – Motorized big game retrieval off of designated routes for legally harvested cow and bull elk would be permitted for 1 mile off all designated routes on the Forest. This is expected to result in an average of approximately 2,922 off-road vehicle trips per year on the Coconino National Forest for elk, based on 2009 Arizona Game and Fish Department hunting statistics. Although it is highly probable that one or more of these trips may result in a vehicle running over scattered artifacts or structural elements of cultural significance, it is expected the effects from one or two passes from a rubber-tired vehicle would be negligible. Additionally, restrictions limiting motorized game retrieval and requiring use of the most direct and least ground-disturbing route would also minimize potential impacts to cultural sites from this activity to negligible levels.

Alternative 4 would leave 326 more miles of road open than would alternative 3 and would thus have the potential to impact more archaeological sites than alternative 3. However, specific effects could be different because of their locations. Under alternative 4, the area of land outside of designated wilderness within ½ mile from a designated route would be decreased by 14.7 percent, which is only slightly more access than under alternative 3.

Cumulative Effects

To understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

No cumulative effects have been identified for any of the alternatives, since any sites cut by roads have already been affected, regardless of which alternative is considered. Sites that already have roads through them have already been affected by construction, maintenance, and use. Routine maintenance of such sites should be limited to areas that have previously been affected by use and maintenance and any disturbance would take place in areas that have previously been disturbed. Some improvement in condition to sites presently cut by roads, or those that have roads leading to them, can be expected should those roads be closed. However, sites would still be reasonably accessible since expected road density should result in no areas being more than about 0.5 mile from road access.

All alternatives would continue to allow access to tribal governments for traditional religious purposes, regardless of road closures. Areas that are needed for traditional religious purposes, plant collecting, or other special needs may still be accessed by individuals requesting a permit for this purpose. Areas would be provided where fuelwood may be collected, also under permit. Since access for traditional and cultural purposes would not be affected by any of the alternatives, there would be no cumulative effects.

No change would result by designating 30 to 36 miles of unauthorized roads or allowing pull-off parking or camping to take place within one vehicle length of existing roads, since this use has been allowed in the past and would continue to be allowed. Both the unauthorized routes and the acres to be designated as corridors for dispersed camping have previously been available for this activity and efforts have been made to keep popular camping areas available in designated

corridors. Areas where potential conflicts may exist between archaeological sites, traditional uses, and dispersed camping would receive archaeological survey first to determine whether such areas may be designated, and monitoring would be recommended in potentially sensitive areas to determine if designations should be changed. Since there would be no direct or indirect effects to archeological sites from designation of dispersed camping corridors, there would be no cumulative effects.

Contemporary Indian Uses

Affected Environment

The American Indian people of the Southwest have a relationship and respect for the land that extends back into antiquity. To many, their people have been here for centuries, with roots in the various prehistoric traditions that once lived on the land now delineated as the Coconino National Forest. One of the most important places to virtually all tribes in the Southwest is the San Francisco Peaks, but they are particularly important to the Hopi and Navajo. Other examples of this for the Yavapai people include the Red Rock country around Sedona and Montezuma Well, a national monument within the Coconino National Forest. The *Dil zhé'é* (Tonto Apache) also hold Montezuma Well as a significant place in addition to Fossil Creek, an important area for their culture and history.

The Coconino Forest staff routinely consults 13 tribes about proposed projects and management policies. These are the: Pueblo of Acoma, Apache (San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, and Yavapai-Apache Nation), Havasupai Tribe, Hualapai Tribe, Hopi Tribe, Navajo Nation, San Juan Southern Paiute Tribe, Pueblo of Zuni, and Yavapai (Yavapai-Prescott Tribe, Ft. McDowell Yavapai Nation, and Yavapai-Apache Nation). Specific consultations are also conducted with various Navajo Chapters that border the forest—Cameron, Coalmine, Dilcon, Gap-Bodaway, Leupp, Tolani Lake, and Tuba City. Besides public involvement activities—such as open houses, meetings, presentations, newspaper articles, information on the forest web page, etc.—special efforts were made to consult with tribal groups living in proximity to the forest and known to use the forest and collect forest products for religious and ceremonial purposes (see chapter 4, "Tribal Consultations"). Among the concerns expressed was the potential for damage and desecration to traditional cultural properties and sacred places as the number of people using motor vehicles for recreation purposes on the forest increases. Similarly, increased off-road use may threaten or destroy seasonal or scarce plant populations. Overcollection of plants used for ceremonial and traditional purposes by nontribal people is another concern resulting from increased visitation, access to plant collecting areas, and off-road vehicular use.

The Coconino National Forest is important to the tribes for many reasons, but the most common uses can be roughly summarized by six general categories:

1. Traditional cultural properties, including natural features such as mountains, springs, shrines, and other places where people go to give prayers and offerings.

2. Collecting forest products such as plants, soil, pigments, and water for ceremonial, medicinal, and other traditional uses.

3. Collecting firewood for ceremonial fires and home heating purposes

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Forest
Service

Cultural Resources Specialist Report
For the Travel Management Environmental Impact Statement

USDA Forest Service Southwestern Region
Apache-Sitgreaves National Forests

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can be damaged by campers exploiting rock materials from structures and features for fire pits and for other camping activities, digging holes for latrines or trenches for discharging gray water; surface collecting and rearrangement of artifacts into piles, using pieces of collapsed wooden historic structures as firewood, and clearing of space for tents and other equipment. Some site records document damage from individuals removing stones from masonry structures to construct fire rings.

Looting and Vandalism

Looting and vandalism have been discussed as indirect effects of motorized and OHV access; however, they can and should be addressed as direct effects as well. Intentional looting and vandalism of sites on public lands is a problem throughout Arizona. Some of these activities are conducted for recreation and others for illegal gain. When a site is looted significant contextual information and parts of our history are stolen and destroyed. As transportation technology has advanced (i.e. four wheel drive) a greater number of roads have provided access to remote areas. The increasing number of roads provides access to remote sites and provides looters a convenient method to easily transport heavy, awkward or delicate archaeological items and/or larger quantities of those items that previously would have been difficult to remove from the backcountry.

Studies conducted in the late 1970's and early 1980's on the behavior and impacts by looters documented that these individuals prefer small to large prehistoric masonry sites that are accessible by maintained roads, within a driving distance of 1-20 miles, and do not require walking more than a few hundred yards (Nickens, Larralde and Tucker 1981). Lightfoot and Francis (1978) conducted studies on the forests. They documented that unimproved jeep roads and trails within the Little Colorado Planning Unit appeared to have no other purpose than to provide access directly to sites. Lightfoot (1978) found there is a correlation between the amount of illegal surface collecting of artifacts from sites and the distance and visibility of the site from a road. Francis (1978:130) determined that the degree of casual collection appears to be the most severe on sites that are located within 150m (492ft) of unimproved roads such as 4-wheel drive jeep trails.

A recent study conducted in 2006 to assess site condition and vandalism in Arch Canyon, San Juan County Utah, documented vandalism and impacts from ORV use (Spangler 2006). Recent comments from the public have indicated that the results and recommendations from this study should be considered in designating the routes open on the forests for motorized travel. Arch Canyon is a well known destination to view archaeological sites and for off-highway vehicle (OHV) recreation. Although some of the impact types noted in study may be found on the forests, most of the areas on the forests with moderate to high site density do not have similar intensity of use or visitation like Arch Canyon. Most of the forests known high intensity use areas, proposed fixed width corridors and motorized trails are located in areas of very low to moderate site density (i.e. mixed conifer-pine forests, southwest area of the Black Mesa Ranger District). The majority of sites on the forests are located within the pinyon juniper woodland which tends to have less intensive recreational use. In the few areas where user-created OHV roads/trails are being used in higher site density areas, the forest is proposing designated motorized trails to minimize and manage the potential impacts from OHV use. Where current trails have been established on the Lakeside Ranger District, it appears that OHV users are staying on the established trails and not causing inadvertent disturbance and damage to archaeological sites.

Of the site records reviewed, 98 sites documented impacts by looting and vandalism. Looting/pot hunting is listed for 73 sites, and surface collection for 13 sites. The Black Mesa and Lakeside Ranger

Districts had 19 and 29 sites, respectively, that were "pot hunted." One site was pot hunted in the Alpine Ranger District, 11 in the Clifton Ranger District, and six in the Springerville Ranger District. Pot hunting is used to describe when someone by hand or, in one case, with a backhoe, excavated structures or other features in search of artifacts. Vandalism, which can represent the removal of artifacts or intentional damage, was listed for 17 sites. One site that consisted of a historic C.C.C. explosive storage building in Saffel Canyon was blown up by a small bomb by individuals trying to enter the building.

Of the 98 sites that have been looted; 38 sites are within 30ft of the road, and 63 are within 100ft of the road. Almost all of the looted sites are located along unmaintained (closed) and high clearance roads (maintenance level 2). Records document additional sites that are farther than 300ft of a system road that have been looted, damaged and accessed by user created roads (Taylor 2006; Mahalic 2005; Schroeder 2009). Most of the sites that have been looted are near communities.

Motorized Big-Game Retrieval

No data were available for previous impacts to sites due to MBGR. Information is available about permits and successful hunts. Table 4 provides information about harvest numbers of elk, mule deer and bear within Game Management Units (GMUs) associated with the Forests: 1, 3A, 3B, 3C, 4A, 4B, 27 and 28. Data were available for several species, but only the data for species being considered for MBGR in the alternatives is being analyzed. Site densities within GMUs vary from 0.45 to 4.74 sites per square mile (see Table 5). The GMUs with the highest site densities, 3C, 4A, and 4B, all are within the Black Mesa and Lakeside Ranger Districts. These GMUs are the most vulnerable to OHV impact from MBGR.

However, as seen in Table 4 and 5, few animals would need to be retrieved using an OHV, the game units cover large areas, and in general the potential impact to sites is widely dispersed and unpredictable. In addition, not all hunters use motorized vehicles to recover game. There is no existing quantifiable data for impacts to sites caused from MBGR on the forests, but thousands of acres of forests lands have been surveyed for cultural resources and archaeologists have not noted any impacts to sites specific to motorized game retrieval. At present, the impacts from cross-country motorized travel for MBGR have been negligible and are not known to have caused adverse effects to the character and use of cultural resources.

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Sign and Date Report for the Record

Melissa R Schroeder 5/2010

Revised Report in Response to Public Comments on Draft

Condition and Damage Assessment of 96 Previously Recorded Archaeological Sites Located on the Tonto National Forest in Gila, Maricopa, Pinal, and Yavapai Counties, Arizona.

Prepared by Saul L. Hedquist and Leigh Anne Ellison
Center for Desert Archaeology November 2010

Introduction

This report summarizes a condition and damage assessment of a sample of cultural resource properties located on and managed by the Tonto National Forest (TNF, Forest). The project was motivated by the desire of the funding partners[1] to more effectively engage in upcoming public processes related to TNF travel management and Forest planning efforts. Specifically, this study seeks to better understand the relationship between site condition/damage and TNF road proximity. TNF is proposing to develop a forest-wide travel plan in order to implement the Travel Management Rule and information from this assessment will assist the partners in their efforts to inform the applicable public processes (National Environmental Policy Act and National Historic Preservation Act Section 106). Field inspections were conducted to examine the current condition of sampled properties, to record the degree and type of observed damage (if applicable), to identify potential factors affecting site condition and damage and, in light of this information, to develop recommendations regarding site stewardship.

Sites were initially identified using three sources of information: the TNF Priority Heritage Asset (PHA) list[2] (provided by TNF archaeologist J. Scott Wood, dated October 2009); the Coalescent Communities GIS Database (created by the Center for Desert Archaeology [CDA], Museum of Northern Arizona, and Geo-Map, Inc., see Wilcox et al. 2003), which includes spatial and temporal data on post-A.D. 1200 sites in the Southwest; and a database of large Hohokam archaeological sites developed by Dr. William Doelle, CEO and President of CDA. There are 197 sites listed as PHAs and over 400 sites in the Coalescent Communities and Doelle databases located within the administrative boundaries of the TNF. Many sites are shared among these three sources.

From these overlapping databases, and in consultation with TNF archaeologist J. Scott Wood and CDA staff, an initial target list of sites was chosen according to the following criteria:

1) Site temporality (late prehistoric A.D. 600 – A.D. 1450), type (habitation), and size (architecture containing a minimum of 10 rooms or prominent architectural features such as platform mounds and/or ballcourts). These historic properties are considered particularly

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[1] National Trust for Historic Preservation, Center for Desert Archaeology, The Wilderness Society, and Center for Biological Diversity

[2] The PHA list comprises properties of distinct public value that are or should be actively maintained and that meet one or more of the following criteria:

a. The significance and management priority of the property is recognized through an official designation; such as listing on the National Register of Historic Places, State Register of Historic Places, etc.
b. The significance and management priority of the property is recognized through prior investment in preservation, interpretation, and use.
c. The significance and management priority of the property is recognized in an agency-approved management plan.

susceptible to human visitation and associated impacts (e.g. vandalism, recreational damage, off-highway vehicle [OHV] damage) given their size, prominence, accessibility, and/or visibility.

2) Site significance (eligibility for the National Register of Historic Places [NRHP] and presence on the list of TNF PHAs); nearly all assessed sites are either listed on or considered eligible for inclusion on the NRHP and the majority are also considered PHAs.
3) Proximity to the nearest Forest Service (FS) road[3]. Priority was placed upon sites located less than 2 km from a FS road. However, in an effort to better assess the relationship between site condition/damage and road proximity, several sites located beyond 2 km of FS roads were also examined for comparative purposes. Table 1 separates the distribution of assessed sites by FS road proximity.

Ninety-six of 135 initial target sites were visited (Figure 1 and Appendix A), representing a 1.1 percent non-random sample of all known prehistoric and historic sites located on and managed by the TNF. Logistical factors such as inaccessibility due to high water levels, rugged topography, impassible road conditions, and/or private property restrictions prevented visitation of all targeted sites. CDA archaeologists Saul L. Hedquist and Leigh Anne Ellison conducted the 96 site condition and damage assessments between June 5 and July 25, 2010. For most of these sites, TNF was able to provide site maps, site records or previous site condition reports that greatly assisted the current assessment.

[3] For the purposes of this report, "FS road" refers to all roads/routes displayed on the publicly available TNF Map and/or TNF GIS Maps and Data (available at **http://www.fs.fed.us/r3/gis/ton_gis.shtml**). Collectively, these sources include all roads/routes open to public travel via motorized vehicle, regardless of vehicle type.

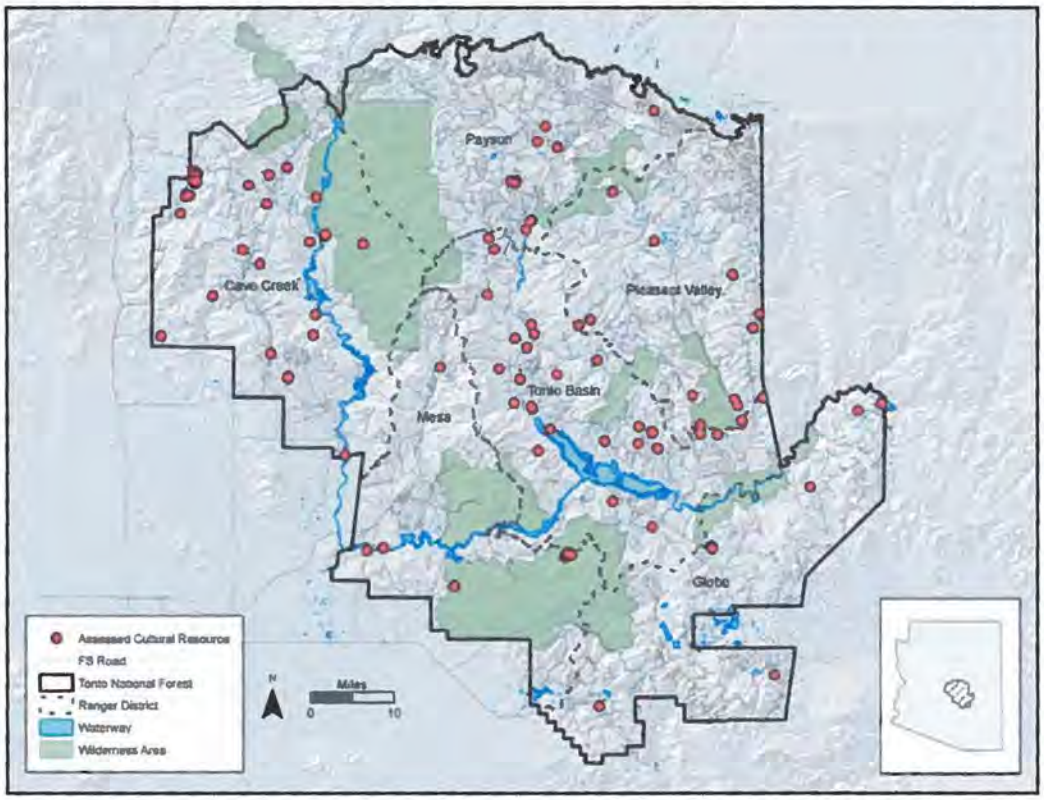

Figure 1. Project area, showing the location of examined archaeological sites.

Field Methods

Field methods and documentation followed the TNF *Site Inspection/Maintenance Assessment* form (Appendix B) in an effort to maintain consistent recording standards and to assist in future condition assessments and resource management. Information collected during each site condition assessment included general site condition (good, fair, poor); damage (if present) both by type and estimated age (if discernable); proximity to the nearest FS road; FS road condition; and action/mitigation recommendations regarding signage (e.g. ARPA), access (e.g. road closure), and monitoring (e.g. site stewards), as appropriate. Appendix C includes completed *Site Inspection/Maintenance Assessment* forms for all assessed sites. All recent damage was mapped and photographed. Associated data not included in this report have been made available to TNF personnel.

Site Condition: Site condition is a qualitative measure of accumulated damage to a site and may result from a variety of cultural and/or natural processes. For each site, condition was categorized according to criteria listed on the TNF *Heritage Assets Priority Property Condition Survey* form (Appendix D). The 96 assessed sites were assigned a condition of *good* (site is generally intact, stable, and in need of no repair), *fair* (site shows some signs of deterioration needing attention, though the property is generally in sound condition), or *poor* (deterioration and/or damage affects at least 25 percent of the site).

Damage Types: Observed damage types include those caused by intentional vandalism of archaeological features (e.g looting and graffiti); recreational reuse of archaeological features (e.g. dismantling of masonry walls for use in constructing modern features such as campfire rings); and vehicle use (driving on or around architecture or artifacts) (Figure 2).

Estimated Age of Damage: Documented damage was separated into two age categories (old or recent) using previously recorded information and/or field observations. Age categories were primarily determined using dated TNF site records, plan maps, and/or inspection maintenance forms denoting the presence (or absence) and type of observed damage. In the rare absence of previously recorded information, subjective age determinations were made according to field observations (e.g. degree of weathering and/or extent of vegetative overgrowth). Damage is here considered *recent* if it occurred within the last five years, as indicated by previous documentation, a lack of previous documentation (e.g. site records, plan maps, and/or inspection maintenance forms do not note damage), and/or lack of weathered sediment. In contrast, damage is considered *old* if it occurred more than five years ago. Most old damage has been previously recorded and/or largely stabilized by natural weathering processes.

Figure 2. Representative examples of observed damage types: looter's pit (top row left), campfire ring constructed of stone from archaeological features (top row right), graffiti (defacement of petroglyph panel, bottom row left), and OHV tracks (bottom row right).

For each assessed site, a straight-line distance to the nearest FS road was calculated[4] along with the road's current condition (see Appendix A). We defined FS road condition classes as: *good* (regularly maintained for use by low-clearance passenger vehicles), *fair* (infrequently maintained; may not be passable by low-clearance passenger vehicles), *poor* (road in disrepair; high-clearance and/or four-wheel drive necessary for passage), or *impassible* (impassible by most vehicles with the possible exception of certain OHVs).

Observations

Human-related impacts were observed at 87 (90.6 percent) of the 96 assessed sites (see Appendix A). These disturbances are dominated by old looter's pits, which often appear as shallow, weathered, and overgrown depressions (Figure 3).

Figure 3. Representative examples of old looter's pits.

Evidence of recent human-related damage (less than 5 years old) was observed at 15 of the 96 assessed sites (Table 1). Nine of these 15 sites have been impacted by recent vandalism, three by recreational activity, two by OHV use, and one by both recreation and OHV use (Appendix A). Eighty percent of recently damaged sites (12 of 15) are located within 200 m of a FS road. No recent human-related damage was observed at sites located beyond 1 km of a FS road. Ten of the 96 examined sites remain in good condition, while 33 are in fair condition. The majority of assessed sites (53 of 96) currently lie in poor condition.

Given the relative concentration of recent damage at sites near FS roads, a chi-square test was performed to evaluate whether there is a statistical association between the occurrence of recent human-related damage and FS road proximity. Analyses were performed using 5 distance thresholds: 100 m, 200 m, 300 m, 400 m, and 500m[5]. A statistically significant difference in distribution ($p<0.05$) of sites was found when contrasting the presence/absence of recent damage and FS road proximity at 100 m, 200 m and 300 m distance thresholds (Table 2). As mentioned previously, the overwhelming majority of recently damaged sites lie within 200 m of a FS road.

[4] These "as the crow flies" distances represent the most direct route between road and site, but do not necessarily reflect actual walking distances, which may be greater due to topography, vegetation, etc.

[5] It is not possible to obtain a statistically significant distribution of sites in relation to the presence/absence of recent site damage for distance thresholds in excess of 500 meters due to the small number of sites assessed at distances greater than 500 meters.

Table 2. Distribution of sites with recent damage and no recent damage at different distance thresholds.

	0-100m	>100m		0-400m	>400m	
No Recent Damage	27	54		52	29	
Recent Damage	10	5		13	2	
	$X^2 = 4.61$ df=1 p=0.0318			$X^2 = 1.99$ *df = 1* *p = 0.159*		
	0-200m	**>200m**		**0-500m**	**>500m**	
No Recent Damage	36	45		56	25	
Recent Damage	12	3		14	1	
	$X^2 = 5.06$ *df = 1* *p=0.0245*			$X^2 = 2.63$ *df = 1* *p = 0.105*		
	0-300m	**>300m**				
No Recent Damage	44	37				
Recent Damage	13	2				
	$X^2 = 4.23$ *df = 1* *p = 0.397*					

Given the aforementioned statistical association, we compared general site condition and associated FS road proximity, using 100 m, 200 m and 300 m distance thresholds, (although site condition is related to both natural weathering and human-related impacts, our observations indicate that human-related impacts play a significant role in determining site condition classification; see condition criteria above). In all three analyses there was a statistically significant difference in the distribution of sites among site condition class and distance from a FS road (Table 3). In examining the chi-square standardized residuals (the difference, between the observed frequency and the expected frequency in each cell expressed as a standardized score), poor condition sites were found in greater frequency than expected closer to a FS Road and less frequently than expected at greater distances from a FS Road. The association is reversed for both fair and good condition sites.

Table 3. Distribution of sites among site condition classes and FS road distance thresholds.

	0-100 m	> 100 m		0-200 m	>200 m		0-300 m	>300 m
Poor	26	27	**Poor**	31	22	**Poor**	37	16
Fair	7	26	**Fair**	13	20	**Fair**	16	17
Good	2	8	**Good**	2	8	**Good**	2	8
	1.52	-1.15		1.11	-1.07		1.09	-1.29
	-1.45	1.1		-0.71	0.68		-0.76	0.88
	-0.86	0.65		-1.28	1.22		-1.17	1.39
X^2= 8.11 *df* = 2 *p* = 0.017			X^2= 6.46 *df* = 2 *p* = 0.04			X^2=7.49 *df* = 2 *p* = 0.024		

General road conditions were recorded along with road proximity information in an effort to better understand the relationship between road condition and site condition. As noted above, FS roads in good or fair condition are potentially accessible to TNF visitors operating most highway vehicles. These maintained roads generally demonstrate regular, and in many cases recent use by passenger vehicles. In contrast, use of unmaintained FS roads in poor to impassible condition remains generally limited to visitors traveling by high-clearance highway vehicles, and/or OHVs.

We compared general site condition and road condition for examined sites located within 200 m of a FS road (n=48). These sites are considered have a higher likelihood of experiencing recent human-related damage given the aforementioned analyses. Among sites located near maintained FS roads, 70 percent are currently in poor condition. Proportionally fewer sites (55.6 percent) were observed to be in poor condition when nearby FS roads have fallen into disrepair (Table 4). Likewise, a greater proportion of sites accessed by unmaintained roads are in good to fair condition (44.4 percent) than that of sites accessed by maintained roads (30.0 percent). A chi-square test does not indicate a statistically significant association. ($p < 0.05$).

Table 4. Comparison of General Site Condition and FS Road Condition among sites within 200 m of FS Roads (percentages shown are column percentages)

		FS Road Condition	
		Good to Fair (n=30)	Poor to Impassible (n=18)
Site Condition	Good to Fair (n=17)	9 (30.0%)	8 (44.4%)
	Poor (n=31)	21 (70.0%)	10 (55.6%)
X^2= 0.49; *df*=1; *p*=0.484			

Summary

Impacts related to human activity (both old and recent) remain evident at 87 (90.6 percent) of the 96 assessed sites, indicating that damage to prehistoric properties has been and remains an important cultural resource management issue on the TNF. Most observed damage is now decades old, as indicated by previously recorded information and/or field observations. Evidence of recent damage (less than five years old) related to vandalism, recreational activity, and/or OHV activity was observed at 15 sites, 12 (80.0 percent) of which are located within 200 m of a FS road. No recent damage was observed at sites located beyond 1 km of a FS road. These observations demonstrate a statistically significant relationship between the presence/absence of recent human-related damage to these sites and FS road proximity (sites within versus sites beyond 300 m of a FS road). Similarly, site condition varies in relation to proximity to a FS road with sites in poor condition found more frequently than expected nearer to a FS road while sites in fair and good condition were found more frequently than expected farther from a FS Road.

This study indicates that vehicular accessibility increases the likelihood that prominent late prehistoric sites on TNF will continue to sustain human-related damage. Data to not indicate that road condition is a factor. These findings are consistent with those of recent studies demonstrating a correlation between road proximity and vandalism among archaeological sites located on lands administered by the Bureau of Land Management in Utah (e.g. Spangler 2006; Spangler et al. 2006). However, it is important to recognize the factors related to site damage are complex and that the observations reported herein represent in essence a snapshot in time, and do not adequately account for the complicated history of land use, FS road use, and archaeological site visitation on the TNF. Vehicular access to cultural resources has changed over time in conjunction with land management strategies. Sites readily accessible decades ago may now be inaccessible to many visitors, as they are currently located deep within a designated Wilderness Area (off-limits to motorized vehicles) or near an unmaintained FS road in disrepair. Indeed, a large proportion of currently inaccessible sites were at one time readily accessible by motorized vehicle, as evidenced by road fragments and/or parking areas observed within or adjacent to site boundaries. In a number of cases, site access appears to have been the sole function of FS roads now in disrepair. In addition, other means of transportation (e.g. horseback) may have facilitated site visitation in the past (prior to motorized vehicular access), when many severe acts of vandalism likely occurred (J. S. Wood, personal communication 2010).

More importantly, over the last 30 years cultural resource management on the TNF has benefited from stricter laws/law enforcement and educational/interpretive programs designed to increase public awareness of the importance and non-renewable nature of historic properties. These measures have led in large part to a general improvement in public attitudes toward cultural heritage, thereby reducing the overall frequency of vandalism at archaeological sites on public lands. Our observations revealed certain mitigation efforts to be particularly successful in deterring human-related damage to archaeological sites on the TNF. Among the most effective measures are clearly displayed signs noting the penalties of violating the Archaeological Resource Protection Act of 1979 (ARPA). ARPA signs were observed at 14 sites, most of which are rela-

tively prominent sites located within 200 m of regularly used FS roads. Of these 14 sites, only one (AR-03-12-01-55) has sustained recent damage related to human activity.

Figure 4. ARPA sign posted at AR-03-12-01-65 (Blue Mountain Fort).

Recommendations

Given the observations summarized herein, we recommend the following three management actions for further consideration by the TNF:

1. Road Closure
FS roads are closed to public vehicular use if a) the road/route is located within 200 m of a significant archaeological site (e.g. NRHP listed property and/or Priority Heritage Asset) and b) continued public vehicular use of the road/route cannot be reasonably justified.

Numerous FS roads lie within remote areas of the TNF and are infrequently (if ever) used for vehicular travel (as evidenced by unmaintained road conditions, a lack of visible tire tracks, overgrown vegetation, etc.). While most of these FS roads do not provide direct access to private land, Forest administrative facilities, or developed recreational facilities (e.g. campgrounds or trailheads), many pass within close proximity (≤ 200 m) of one or more significant archaeological sites. As such, these FS roads conflict with the protection and management of TNF cultural resources while providing no additional access to developed TNF facilities. Twenty-two such FS roads were identified through this project and are recommended for closure (Table 6, see Appendix A).

Table 5. Recommended Road Closure Candidates

TNF Road	Nearest Site(s)	Distance to Nearest Site
FR 1063	AR-03-12-01-188	Direct FR Access[6]
FR 1070	AR-03-12-02-202, AR-03-12-02-376	200 m
FR 1555	AR-03-12-06-54	Direct FR Access
FR 1617	AR-03-12-04-68	Direct FR Access
FR 1670	AR-03-12-05-657	Direct FR Access
FR 18	AR-03-12-01-58	Direct FR Access
FR 1985/FR 1985A	AR-03-12-01-1292	Direct FR Access
FR 1993	AR-03-12-01-345	Direct FR Access
FR 2019	AR-03-12-01-1289	Direct FR Access
FR 2150	AR-03-12-01-210	Direct FR Access
FR 3164	AR-03-12-01-55	Direct FR Access
FR 425	AR-03-12-06-52	Direct FR Access
FR 433	AR-03-12-04-35	Direct FR Access
FR 527	AR-03-12-02-1495	150 m
FR 542	AR-03-12-04-106, AR-03-12-04-221	200 m
FR 574	AR-03-12-01-650	Direct FR Access
FR 588	AR-03-12-01-28, AR-03-12-01-29	150 m
FR 604	AR-03-12-06-549	Direct FR Access
FR 699	AR-03-12-06-2020	Direct FR Access
FR 81	AR-03-12-06-70	Direct FR Access
Unnamed	AR-03-12-04-105	Direct FR Access
Unnamed	AR-03-12-04-222	Direct FR Access

2. ARPA Signage

ARPA sign use be expanded to all NRHP listed properties and/or Priority Heritage Assets located within 200 m of FS roads. This action is strongly recommended when road closure is impractical. ARPA signage represents a notably effective and cost-efficient tool that allows site visitation and enjoyment while also discouraging vandalism. As noted above, ARPA signs were observed at 14 examined sites, most of which are relatively prominent sites located near regularly used FS roads. Only one of these sites has sustained recent human-caused damage.

3. Site Monitoring

Monitoring efforts be focused on properties located within 200 m of FS roads. Given the potential challenges of organizing regular site visitation, monitoring efforts should be directed where the likelihood of damage is highest. Volunteers with the Arizona Site Steward Program currently monitor 35 of 96 sites examined herein, 22 of which are located within 200 m of a FS road (see Appendix A). Seven (20 percent) of the 35 monitored sites exhibit evidence of recent damage. Twenty-six other assessed sites lack regular monitoring despite their close proximity (≤ 200 m) to one or more FS roads. In conjunction with ARPA sign use, regular monitoring by trained personnel would provide additional protection to these resources and ensure timely reporting of new damage and/or suspicious behavior should they occur.

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2003 Coalescent Communities GIS Database. Museum of Northern Arizona, Center for Desert Archaeology, GeoMap Inc. Manuscript on file, Center for Desert Archaeology, Tucson.

Appendix A:

Assessed TNF Cultural Resource Properties

Site Number	NRHP Status	Priority Heritage Asset	Site Condition	Damage Evident	Recent Damage Evident	Recent Damage Category	Nearest Road	Distance to Nearest Road	Condition of Nearest Road	ARPA Signage Present	Site Steward	Mitigation Recommendation
AR-03-12-01-01	Eligible	Yes	Poor	Yes	No	N/A	FR 269/ FR 24	Direct FR Access	Good	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-01-1116	Eligible	Yes	Fair	Yes	No	N/A	FR 2015	350 m	Impassible	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-1183	Eligible	Yes	Poor	Yes	Yes	Recreation	FR 17	Direct FR Access	Fair	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-1245	Eligible	No	Good	No	No	N/A	FR 269	9 km	Fair	No	No	N/A
AR-03-12-01-1289	Eligible	Yes	Fair	Yes	No	N/A	FR 2019	Direct FR Access	Impassible	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-1292	Eligible	Yes	Poor	Yes	No	N/A	FR 1985/ FR 1985A	Direct FR Access	Poor	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-133	Eligible	No	Fair	Yes	No	N/A	FR 269	3.5 km	Fair	No	No	N/A
AR-03-12-01-1342	Eligible	Yes	Good	No	No	N/A	FR 588	800 m	Poor	No	No	ARPA Signage, Monitoring
AR-03-12-01-188	Eligible	Yes	Poor	Yes	No	N/A	FR 1063	Direct FR Access	Poor	Yes	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-210	Listed	Yes	Poor	Yes	Yes	Recreation, OHV	FR 2150	Direct FR Access	Fair	No	Yes	ARPA Signage, Fencing, Monitoring, Road Closure
AR-03-12-01-28	Listed	Yes	Fair	Yes	No	N/A	FR 588	150 m	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-29	Listed	Yes	Poor	Yes	No	N/A	FR 588	300 m	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-31	Eligible	Yes	Poor	Yes	No	N/A	FR 593	Direct FR Access	Fair	Yes	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-33	Listed	Yes	Poor	Yes	No	N/A	FR 593	150 m	Fair	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-345	Eligible	No	Fair	Yes	No	N/A	FR 1993	Direct FR Access	Impassible	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-369	Eligible	Yes	Good	Yes	No	N/A	FR 53	400 m	Poor	Yes	Yes	ARPA Signage, Monitoring, Road Closure

Site Number	NRHP Status	Priority Heritage Asset	Site Condition	Damage Evident	Recent Damage Evident	Recent Damage Category	Nearest Road	Distance to Nearest Road	Condition of Nearest Road	ARPA Signage Present	Site Steward	Mitigation Recommendation
AR-03-12-01-42	Listed	Yes	Poor	Yes	No	N/A	FR 14	Direct FR Access	Fair	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-01-43	Listed	Yes	Poor	Yes	No	N/A	FR 14	Direct FR Access	Fair	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-01-53	Listed	Yes	Fair	Yes	No	N/A	FR 205	450 m	Good	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-01-55	Listed	Yes	Fair	Yes	Yes	Vandalism	FR 3164	Direct FR Access	Poor	Yes	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-58	Eligible	Yes	Poor	Yes	No	N/A	FR 18	Direct FR Access	Impassible	No	No	ARPA Signage, Road Closure
AR-03-12-01-583	Eligible	Yes	Poor	Yes	No	N/A	FR 269	Direct FR Access	Fair	Yes	No	ARPA Signage, Monitoring
AR-03-12-01-64	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 578/ FR 3170	300 m	Fair	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-643	Eligible	No	Poor	Yes	No	N/A	FR 269	5.5 km	Fair	No	Yes	ARPA Signage
AR-03-12-01-65	Eligible	Yes	Poor	Yes	No	N/A	FR 2096	1.1 km	Poor	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-01-650	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 574	Direct FR Access	Poor	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-66	Eligible	No	Poor	Yes	No	N/A	FR 2096	800 m	Poor	No	No	ARPA Signage, Monitoring
AR-03-12-01-72	Listed	Yes	Poor	Yes	Yes	Vandalism	FR 14	450 m	Poor	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-01-74	Listed	Yes	Good	Yes	No	N/A	FR 261	Direct FR Access	Good	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-02-106	Eligible	Yes	Fair	Yes	No	N/A	FR 989	200 m	Good	No	No	ARPA Signage
AR-03-12-02-1495	Eligible	Yes	Poor	Yes	No	N/A	FR 527	150 m	Fair	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-02-181	Eligible	Yes	Fair	Yes	No	N/A	FR 645	600 m	Good	No	No	ARPA Signage, Monitoring
AR-03-12-02-202	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 1070	200 m	Fair	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-02-219	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 473	Direct FR Access	Good	No	No	ARPA Signage, Monitoring
AR-03-12-02-376	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 1070	200 m	Fair	No	No	ARPA Signage, Monitoring, Road Closure

Site Number	NRHP Status	Priority Heritage Asset	Site Condition	Damage Evident	Recent Damage Evident	Recent Damage Category	Nearest Road	Distance to Nearest Road	Condition of Nearest Road	ARPA Signage Present	Site Steward	Mitigation Recommendation
AR-03-12-02-377	Eligible	No	Poor	Yes	No	N/A	FR 1070	600 m	Fair	No	No	ARPA Signage, Monitoring
AR-03-12-02-577	Eligible	No	Good	No	No	N/A	FR 382	1 km	Good	No	No	ARPA Signage, Monitoring
AR-03-12-03-07	Eligible	Yes	Fair	Yes	No	N/A	FR 22	550 m	N/A	No	Yes	ARPA Signage, Monitoring
AR-03-12-03-11	Eligible	No	Fair	Yes	No	N/A	FR 212	5 km	Good	No	No	ARPA Signage
AR-03-12-03-12	Eligible	No	Fair	Yes	No	N/A	FR 212	5 km	Good	No	No	ARPA Signage
AR-03-12-03-139	Eligible	No	Poor	Yes	No	N/A	FR 78	2.5 km	Good	No	Yes	ARPA Signage, Monitoring
AR-03-12-03-17	Eligible	No	Poor	Yes	No	N/A	FR 212	5 km	Good	No	No	ARPA Signage
AR-03-12-03-51	Eligible	Yes	Fair	Yes	No	N/A	FR 204A	Direct FR Access	Good	No	No	Monitoring
AR-03-12-03-534	Eligible	No	Fair	Yes	No	N/A	FR 212	5.5 km	Good	No	No	ARPA Signage
AR-03-12-03-55	Eligible	No	Poor	Yes	No	N/A	FR 204	Direct FR Access	Good	No	No	N/A
AR-03-12-04-105	Eligible	Yes	Poor	Yes	Yes	OHV	Unnamed	Direct FR Access	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-04-106	Eligible	Yes	Fair	Yes	No	N/A	FR 542	200 m	Impassible	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-04-111	Eligible	Yes	Poor	Yes	No	N/A	FR 412	100 m	Good	Yes	No	ARPA Signage, Monitoring
AR-03-12-04-22	Eligible	Yes	Poor	Yes	No	N/A	FR 476	150 m	Good	No	Yes	ARPA Signage, Monitoring
AR-03-12-04-221	Eligible	No	Fair	Yes	No	N/A	FR 542	250 m	Impassible	No	Yes	ARPA Signage, Road Closure
AR-03-12-04-222	Eligible	Yes	Poor	Yes	No	N/A	Unnamed	Direct FR Access	Poor	No	Yes	ARPA Signage, Road Closure
AR-03-12-04-35	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 433	Direct FR Access	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-04-580	Eligible	Yes	Fair	Yes	No	N/A	FR 417	Direct FR Access	Good	No	Yes	ARPA Signage
AR-03-12-04-581	Eligible	No	Poor	Yes	No	N/A	FR 417	Direct FR Access	Good	No	No	ARPA Signage, Monitoring
AR-03-12-04-68	Eligible	Yes	Fair	Yes	Yes	Recreation	FR 1617	Direct FR Access	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure

Site Number	NRHP Status	Priority Heritage Asset	Site Condition	Damage Evident	Recent Damage Evident	Recent Damage Category	Nearest Road	Distance to Nearest Road	Condition of Nearest Road	ARPA Signage Present	Site Steward	Mitigation Recommendation
AR-03-12-05-05	Eligible	Yes	Good	No	No	N/A	FR 487	100 m	Good	No	No	ARPA Signage
AR-03-12-05-173	Eligible	Yes	Poor	Yes	No	N/A	FR 609	100 m	Fair	No	No	ARPA Signage, Monitoring
AR-03-12-05-188	Eligible	Yes	Poor	Yes	Yes	Vandalism	FR 609	Direct FR Access	Fair	No	Yes	ARPA Signage, Monitoring
AR-03-12-05-312	Eligible	Yes	Fair	Yes	Yes	Recreation	FR 130	800 m	Good	No	No	ARPA Signage, Monitoring
AR-03-12-05-382	Eligible	Yes	Poor	Yes	No	N/A	FR 202	300 m	Fair	No	Yes	ARPA Signage, Monitoring
AR-03-12-05-383	Eligible	Yes	Poor	Yes	No	N/A	FR 202C	300 m	Fair	No	No	ARPA Signage
AR-03-12-05-46	Eligible	No	Fair	No	No	N/A	FR 189	1 km	Fair	No	No	ARPA Signage
AR-03-12-05-56	Eligible	No	Poor	Yes	No	N/A	FR 203	250 m	Good	No	No	ARPA Signage
AR-03-12-05-657	Eligible	No	Fair	Yes	No	N/A	FR 1670	Direct FR Access	Poor	No	No	ARPA Signage, Road Closure
AR-03-12-05-868	Eligible	No	Fair	Yes	No	N/A	FR 203	500 m	Good	No	No	ARPA Signage
AR-03-12-05-87	Eligible	Yes	Fair	Yes	No	N/A	FR 455	500 m	Poor	No	No	ARPA Signage, Monitoring
AR-03-12-05-875	Eligible	No	Poor	Yes	No	N/A	FR 203	Direct FR Access	Good	No	No	ARPA Signage
AR-03-12-06-01	Eligible	Yes	Fair	Yes	No	N/A	FR 203A	600 m	Fair	No	No	ARPA Signage
AR-03-12-06-103	Eligible	Yes	Poor	Yes	No	N/A	FR 1517	400 m	Poor	No	Yes	ARPA Signage
AR-03-12-06-1044	Listed	Yes	Fair	No	No	N/A	FR 409	200 m	Good	No	No	ARPA Signage
AR-03-12-06-106	Eligible	Yes	Poor	Yes	No	N/A	FR 111/ FR 118	400 m	Poor	No	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-06-123	Eligible	Yes	Poor	Yes	No	N/A	FR 1707	1.1 km	Poor	No	No	ARPA Signage
AR-03-12-06-135	Eligible	Yes	Poor	Yes	No	N/A	FR 97C	700 m	Poor	No	No	ARPA Signage
AR-03-12-06-137	Eligible	No	Good	No	No	N/A	FR 97	450 m	Fair	No	No	ARPA Signage
AR-03-12-06-144	Eligible	Yes	Fair	Yes	No	N/A	FR 97C	600 m	Poor	No	No	ARPA Signage
AR-03-12-06-146	Eligible	Yes	Poor	Yes	No	N/A	FR 97C	900 m	Poor	No	No	N/A
AR-03-12-06-1764	Eligible	Yes	Good	Yes	No	N/A	FR 649	700 m	Poor	No	No	ARPA Signage

Site Number	NRHP Status	Priority Heritage Asset	Site Condition	Damage Evident	Recent Damage Evident	Recent Damage Category	Nearest Road	Distance to Nearest Road	Condition of Nearest Road	ARPA Signage Present	Site Steward	Mitigation Recommendation
AR-03-12-06-20	Eligible	No	Fair	Yes	No	N/A	FR 1458	150 m	Fair	No	No	ARPA Signage, Monitoring
AR-03-12-06-2020	Potentially Eligible	No	Poor	Yes	No	N/A	FR 699	Direct FR Access	Impassible	No	No	ARPA Signage, Road Closure
AR-03-12-06-2114	Eligible	No	Fair	Yes	No	N/A	FR 604	550 m	Fair	No	No	ARPA Signage, Monitoring
AR-03-12-06-31	Eligible	Yes	Fair	Yes	No	N/A	FR 243	400 m	Fair	No	Yes	ARPA Signage
AR-03-12-06-32	Eligible	No	Poor	Yes	No	N/A	FR 189	Direct FR Access	Fair	No	No	ARPA Signage
AR-03-12-06-33	Eligible	No	Good	No	No	N/A	FR 189	300 m	Fair	No	No	N/A
AR-03-12-06-357	Potentially Eligible	Yes	Poor	Yes	No	N/A	FR 423	300 m	Good	No	No	ARPA Signage
AR-03-12-06-52	Eligible	Yes	Fair	Yes	No	N/A	FR 425	Direct FR Access	Poor	No	Yes	ARPA Signage, Road Closure
AR-03-12-06-523	Eligible	No	Good	No	No	N/A	SR 87	400 m	Good	No	No	ARPA Signage
AR-03-12-06-54	Listed	Yes	Poor	Yes	Yes	OHV	FR 1555	Direct FR Access	Poor	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-06-549	Eligible	Yes	Poor	Yes	No	N/A	FR 604	Direct FR Access	Fair	No	Yes	ARPA Signage, Road Closure
AR-03-12-06-683	Eligible	Yes	Poor	Yes	No	N/A	FR 236	900 m	Fair	No	No	ARPA Signage
AR-03-12-06-70	Eligible	Yes	Poor	Yes	No	N/A	FR 81	Direct FR Access	Poor	Yes	No	ARPA Signage, Monitoring, Road Closure
AR-03-12-06-705	Eligible	Yes	Fair	Yes	No	N/A	FR 419	Direct FR Access	Good	Yes	Yes	ARPA Signage, Monitoring
AR-03-12-06-733	Eligible	No	Poor	Yes	No	N/A	SR 188	400 m	Good	No	No	ARPA Signage
AR-03-12-06-746	Eligible	Yes	Fair	Yes	No	N/A	FR 421	300 m	Impassible	No	Yes	ARPA Signage, Monitoring, Road Closure
AR-03-12-06-753	Eligible	No	Poor	Yes	No	N/A	SR 188	400 m	Good	No	No	ARPA Signage, Monitoring
AR-03-12-06-799	Eligible	No	Poor	Yes	No	N/A	FR 1456	1 km	Poor	No	No	ARPA Signage
AR-03-12-06-90	Eligible	No	Fair	Yes	No	N/A	FR 448	150 m	Good	No	No	ARPA Signage

Appendix B:

Site Inspection/Maintenance Assessment Form

Tonto National Forest

Site No.AR-03-12-____-_____

SITE INSPECTION/
MAINTENANCE ASSESSMENT

Project No._____

Inspected by:_____

Reason for Inspection: ☐ Routine ☐ Report of Damage ☐ Project ☐ Opportunity_____

Date of Inspection:_____ Date Last Inspected:_____

CONDITION SUMMARY: (Check as appropriate; see Site Inventory Form)

General Condition of Site: ☐ Excellent ☐ Good ☐ Fair ☐ Poor

Types/Damage Present: ☐ Vandalism ☐ Vehicular/OHV ☐ Timber Harvest ☐Facilities Construction
☐ Road Construction ☐ Recreation Use ☐ Livestock ☐ Inundation: ☐ wave action ☐ silting
☐ Erosion ☐ Flooding ☐ Weathering ☐ Other:_____

Data Recovery: ☐ Excavation ☐ Testing ☐ Surface Collection ☐ Other:_____

Project/Report No(s):_____

Changes in site condition since recording/last inspection:_____

_____

_____

_____

_____

_____

_____

_____ ☐ Cont'd_over

(Attach photo documentation/photo log as appropriate or available)

Action Required: (Code: U=Urgent N=Necessary D=Desirable N/A=Not Appropriate)

_____ **SIGNING:** ☐ ARPA ☐ Interp ☐ Other
☐ Install ☐ Repair/Replace

_____ **FENCING:** ☐ Install ☐ Repair/Replace

_____ **ACCESS:** (paths, roads, etc)
☐ Maintain ☐ Close ☐ Develop

_____ **MONITORING**/Site Stewards:

_____ **STUDIES:** ☐ Mapping ☐ Monitoring
☐ Stabilization Plan ☐ Interp Dev Plan
Specify:_____

_____

_____ **EROSION CONTROL:** ☐ Backfill
☐ Install Drainage ☐ Grade
☐ Other (Specify):_____

_____

_____

_____ **WOOD PRESERVATION:**
(rot, insects, weather, etc.)

_____ **STABILIZATION** (Specify areas and types):

_____

_____

_____

_____ **OTHER** (Specify):_____

_____

_____

MANAGEMENT GOALS: (See Site Inventory Form)
☐ Preservation ☐ Interpretive Development ☐ Scientific Use ☐ Experimental Use
☐ Other:_____

Attach site plans, damage assessment report(s), work plan(s), stabilization plan(s), budget(s), etc. as appropriate and/or available.

FS-R3-12-2300-25 (9/03)

Additional Remarks/Recommendations:

(Attach additional sheets as necessary)

COSTS: Field: _____hrs Write-up: _____hrs Admin: _____hrs Mileage: _____miles
Travel: _____ hrs Per Diem:_____ days *JOB CODE:*_____

Appendix C:

Completed Site Inspection/Maintenance Assessment Forms

(Available Upon Request)

Appendix D

Heritage Assets Priority Property Conditions Survey Form

Heritage Assets Priority Property Condition Survey

Region:	**Forest:**	**District:**

Heritage Site No.:	**Site Name:**
NR District(if appl.)	
Date of Condition Survey:	Surveyed by:

Asset Type: Historic Structure Prehistoric Structure Archaeological Site
Site Type (describe):
Date/Time Period:
National Register Status: Listed Eligible Ineligible Unevaluated
National Historic Landmark Status: Yes No
Other Special Designation:
Management Status: Interpreted Stabilized/Preserved Management Plan
Basis for listing on the Priority Heritage Assets List, if other than above:

General Condition of Property

	Good *(property and significant features are intact and stable; need no repair, only routine maintenance)*
	Fair *(some signs of deterioration that need to be addressed, but property and its features are generally sound)*
	Poor *(deterioration or damage affects more than 25% of property)*
	Critical *(potential health & safety risk, or immeninent threat of loss of significant resource values)*

Note: For prehistoric and historic ruined structures and archaeological sites, the assignment of condition should be based on the goal of maintaining the character and stability of the property as a ruin or site or based on a goal identified in an approved management plan.

Deferred Maintenance Needs		**Est. Deferred Maint. Costs**		
Type	Description	H&S	Resource	Mission
	TOTAL			

Types: S = Structural Repair/Stabilization (walls, foundation, etc.); B = Backfilling; E = Erosion Control; R = Rock Art Conservation; C = Compliance (associated Section 106 compliance, including evaluation, SHPO and tribal consultation, mitigation, etc.); O = Other

Annual Maintenance Needs **Est. Annual Cost**

Type	Description	
	TOTAL	

Types: I = Inspection; S = Structural Maintenance (walls, foundation, etc.); B = Backfilling (if needed); E = Erosion Control; R = Rock Art Conservation; 0 = Other

Capital Improvement Needs/Recommendations **Est. Capital Improvement Costs**

Description	H&S	Resource	Mission
Associated Section 106 Compliance			
TOTAL			

Additional Comments:

LS_SDNM_RMP_100129

A SURVEY OF VANDALISM TO ARCHAEOLOGICAL RESOURCES

IN SOUTHWESTERN COLORADO

Paul R. Nickens

Signa L. Larralde

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BUREAU OF
LAND MANAGEMENT
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CULTURAL
RESOURCES
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ABSTRACT

One of the most critical concerns for land managers and professional archaeologists is vandalism or unwarranted destruction of vestiges of the nation's historic and prehistoric cultural resources. Though illegal since 1906, the attrition of archaeological sites and data on public lands has been and continues to be a serious problem. This study undertakes analysis of the factors affecting vandalism to archaeological sites in the Bureau of Land Management's Sacred Mountain Planning Unit, located in southwestern Colorado. The study area has long been known for its many spectacular prehistoric ruins and, as a consequence, relic or artifact collecting has been a common pastime since the 1880s.

In order to define factors associated with vandalism from which recommendations for improved management and conservation of the area's ruins could be made, several phases of inquiry were outlined. These include: 1) a review of activities which are deleterious to cultural resources; 2) an overview of cultural resource destruction in the project area; 3) a compilation of known site data through the use of certain variables thought to be important to the problem; 4) a field implementation phase designed to verify the trends and factors identified in the known site file data; and 5) interviews with known collectors of antiquities living in the area. As a result of these efforts, quantitative data are offered to support previous ideas that in the project area archaeological site density, distribution, and visibility, along with relatively easy access, are the principal factors associated with vandalism to cultural resources. Other factors of secondary importance include the local and family traditions of artifact collecting, and a commercial or profit motive. Recommendations to management center on actions related to the need for demonstrable intent to prosecute violators of extant antiquities laws, expansion of existing preventative programs, and continued and increased emphasis on public education approaches.

IV

DATA PRESENTATION: KNOWN SITE INFORMATION

General

To accomplish the goal of defining and evaluating factors affecting archaeological site vandalism in the Sacred Mountain Planning Unit, several approaches were outlined. In general terms, these lines of inquiry may be listed as follows: 1) compilation of data from existing site files and previous investigations; 2) a brief field check of some previously recorded sites to provide supplementary information; and 3) informant interviews with persons who reside in the project area and are known to be artifact collectors. The results of the known site data compilations and field implementation efforts are discussed below, while a summation of the informant interview phase is presented in the following chapter. Together, these bodies of data form the basis for statements concerning factors important to a better understanding of the vandalism problem and for subsequent recommendations to aid in the prevention of such activities.

Several stages of work were outlined to review data contained in the cultural resource site file and other existing information. First, a set of variables thought to be important to the vandalism problem was derived and the comprehensive site file at the BLM Montrose District office was examined in light of these variables. Following tabulation of these results for sites on BLM lands, they were compared to a similar analysis of nearly 300 prehistoric sites recorded during the recent class II cultural resource inventory of the Sacred Mountain Planning Unit (Chandler, Reed, and Nickens 1980). This survey, completed during 1978-79, was a stratified proportional probability sample of some 8000 acres, or about four percent, of the Planning Unit. Although the primary goal of that work was to provide a statistically reliable projection of the density and types of cultural resources on public lands in the area, site recording techniques also included collection of data relevant to vandalism aspects. The results of the class II inventory, then, comprise a reliable and convenient data base for comparative purposes. Finally, a

sample of previously known sites which had originally been recorded as pristine (i.e. unvandalized) was selected and revisited to assess rates and forms of ongoing vandalism and to verify the data contained in the site files. An ancillary goal of the field implementation phase was to field test a format for more precise recording of vandalism and associated variables. The collection of such data will be critical to future analyses of archaeological site vandalism.

Known Site Data

Methods

A number of variables, measurable at prehistoric sites, were selected for analysis prior to data compilation. These include the following categories: 1) age/cultural period of the site; 2) type of site; 3) distance to nearest road; 4) type of nearest access road; 5) distance to nearest town. As might be expected, placement of known site data into these categories was at times difficult as many previously recorded sites lacked certain information pertaining to one or more variables. Nonetheless, after sites with incomplete or unknown data entries were culled from the total number of known sites, adequate samples for analysis remained in both the BLM site file source and the class II inventory data base. In some cases, the absence of information was minor and the sites were included in analysis of certain variables, causing slight variation in some totals.

Comparisons were made for each variable measured between vandalized and unvandalized sites. The criterion for defining vandalism was the presence of some form of intentional human activity causing destruction of a site and/or data. For example, forms of vandalism noted included illegal excavation (potholes) and defacement of rock art sites. In many instances, site recorders did not adequately document the presence or absence of vandalism; however, if the site photo clearly indicated potholes or other disturbances the site was coded as being vandalized. Surface collecting, a prevalent form of vandalism, was all but impossible to discern from the site forms and, thus, cannot be included in the analysis.

Whenever possible, data on other variables was also collected. One of these was whether or not a site which was formally noted on a U.S.G.S.

quadrangle map as a "ruin" had been vandalized. Another was the area of the site which exhibited vandalism (e.g. midden area versus roomblocks). The results of these compilations are reviewed following presentation of data related to site age, type, and access vis à vis vandalism activities.

Results

Site Age and Type

These two variables are closely linked with few exceptions. Generally speaking, the earlier sites lack the characteristic highly visible rubble mounds denoting ruins of surface masonry structures. There is a decided trend for the later sites with masonry rubble to have been vandalized. Of the prehistoric sites recorded during the class II inventory, 41% of the sites with masonry had been damaged while only 21% of the non-masonry sites had been vandalized. Correspondingly, 48% of the late period Anasazi sites (McElmo and Mesa Verde phases) had been vandalized as compared to 27% of the middle period sites (Ackmen and Mancos phases) and only 11% of early period sites (La Plata and Piedra phases). A total of 54% of late sites with masonry architecture had been vandalized.

Of the previously recorded sites, a similar trend is indicated as shown in the following tabulation.

Cultural period	No. of sites in sample	No. vandalized	% vandalized
Basketmaker II-III	74	9	12%
Pueblo I	158	24	15%
Pueblo II	172	38	22%
Pueblo II-III	239	103	43%
Pueblo III	89	28	31%
TOTALS	732	202	28%

Of the 202 vandalized sites noted above, 4% are Basketmaker II-III, 12% are Pueblo I, 19% are Pueblo II, 51% are Pueblo II-III, and 14% are Pueblo III.

In terms of site type, such designations are highly variable on the BLM site file forms and, consequently, only the data from the class II inventory are presented in full. These are as follows:

Site type	No. unvandalized/	% of total	No. vandalized/	% of total
Surface Pueblo	39	(55%)	27	(68%)
Pithouse	10	(14%)	1	(2.5%)
Tower	4	(6%)	3	(7%)
Granary	1	(1%)	2	(5%)
Cist	1	(1%)	1	(2.5%)
Cliff dwelling	2	(3%)	1	(2.5%)
Rockshelter	11	(16%)	4	(10%)
Field house	1	(1%)	0	0
Kiva	2	(3%)	1	(2.5%)
TOTALS	71	(100%)	40	(100%)

The following percentages of each type were noted as having been vandalized, albeit many types have too few occurrences to be regarded as accurate samples or estimates.

Site type	No.	No. vandalized	% vandalized
Surface pueblo	66	27	41%
Pithouse	11	1	9%
Tower	7	3	42%
Granary	3	2	67%
Cist	2	1	50%
Cliff dwelling	3	1	33%
Rockshelter	15	4	27%
Field house	1	0	0
Kiva	3	1	33%
TOTALS	71	40	

Incidences of vandalism at two special types of sites, cliff dwellings and rock art, were possible to tally from the BLM site files. A total of 37 cliff dwellings dating to the Pueblo II and III period have been previously recorded, of which 26 (70%) had been vandalized. A review of rock art sites of indeterminate age revealed that of 15 recorded instances, seven (47%) had been vandalized, all in the form of having graffiti scratched on their surfaces.

Thus, we see that the later, more visible Anasazi sites have been subjected to heavier vandalism in the past. This distribution is not unexpected.

Access to Sites

This general category is thought to be one of the primary factors affecting vandalism in the Sacred Mountain Planning Unit (Scott 1977).

Three variables were measured to evaluate the association between access and vandalism: 1) distance to nearest road; 2) type of nearest road; and 3) distance to nearest town. Type of road was categorized from U.S.G.S. topographic maps and BLM road update maps in the following manner:

Rank	Type of road
1	Paved, state or county
2	Gravel
3	Dirt with ditch
4	Dirt with berm
5	Track or jeep trail

The results of these measurements and analyses are broken down between the class II inventory sites (those with architecture only) and site data contained in the BLM files.

1. Class II inventory sites

The mean distance to unvandalized sites from the nearest road is 580 m, with a range of 100 m to 1.3 km. The mean distance to vandalized sites from the nearest road is 491 m, with a range of 10 m to 3.0 km. When distances are grouped into five ranges, an x^2 analysis shows the differences between vandalized and unvandalized sites to be significant at .01. Distances were grouped as follows: visible from the road ($\leq$100 m), a short walk from the road (101-400 m), a moderately short walk from the road (401-800 m), a moderately long walk from the road (0.8 - 1.6 km), and a long walk from the road (over 1.6 km).

Distance to Roads

	$\leq$100 m	101-400 m	401-800 m	0.8-1.6 km	over 1.6 km	
Vandalized	12 (86%)	11 (38%)	12 (33%)	4 (27%)	1 (100%)	40 (42%)
Unvandalized	2 (14%)	18 (62%)	24 (67%)	11 (73%)	0 (0)	55 (58%)
	14	29	36	15	1	95

$x^2 = 15.22$ df = 4 $p < .01$

The proximity of a site to town does not appear to increase its probability of being vandalized, as only 38% of sites within 16 km of the nearest town had been vandalized, as compared to 73% of sites over 32 km

from the nearest town. 38% of sites 17-32 km from town had been vandalized. However, an x^2 analysis reveals that the differences between vandalized and unvandalized sites are significant at 0.10. A higher number of vandalized sites than expected are located over 32 km from the nearest town.

Distance to Nearest Town

	Vandalized	Unvandalized	
≤ 16 km	10 (38%)	16 (62%)	26
17-32 km	22 (38%)	36 (62%)	58
over 32 km	8 (73%)	3 (27%)	11
	40	55	95

$x^2 = 4.16$ df = 2 $p < .10$

More sites are located near dirt and two-track roads (ranks 4 and 5) than near improved roads; none of the sites recorded on the Sacred Mountain Project was located near a road with a rank higher than 3. There is a significant difference between vandalized and unvandalized sites with respect to rank of nearest road, with the highest percentage of vandalized sites located near rank 4 roads. The highest percentage of unvandalized sites are located near two-track jeep trails (rank 5 roads).

Rank of Nearest Road

	Vandalized	Unvandalized	
Rank 3	6 (35%)	11 (65%)	17
Rank 4	25 (54%)	21 (46%)	46
Rank 5	9 (28%)	23 (72%)	32
	40	55	95

$x^2 = 5.74$ df = 2 $p < .10$

In summary, late sites with masonry architecture located over 20 miles from the nearest town and within 100 m of a dirt road would appear to be the most vulnerable to vandalism, based on the results of the Sacred Mountain class II survey.

2. Previously recorded sites (BLM site files)

The numerous previously recorded sites exhibit a similar pattern of vandalism with respect to distance to nearest road. There was, however, no significant difference between vandalized or unvandalized sites on the basis of rank of nearest road or distance to nearest town.

Distance to Roads

	≤100 m	101-400 m	401-800 m	0.8-1.6 km	over 1.6 km	
Vandalized	83 (51%)	42 (33%)	27 (26%)	37 (29%)	16 (28%)	205 (35%)
Unvandalized	79 (49%)	85 (67%)	78 (74%)	90 (71%)	41 (72%)	373 (65%)
	162	127	105	127	57	578

$x^2 = 25.72$ df = 4 $p < .001$

Distance to Nearest Town

	0-8 km	9-16 km	17-24 km	25-32 km	over 33 km	
Vandalized	11 (31%)	62 (36%)	47 (43%)	58 (33%)	27 (33%)	205 (35%)
Unvandalized	24 (69%)	112 (64%)	63 (57%)	120 (67%)	56 (67%)	375 (65%)
	35	174	110	178	83	580

$x^2 = 3.73$ df = 4 $p < 0.50$

Rank of Nearest Road

	2	3	4	5	
Vandalized	26 (36%)	37 (47%)	97 (33%)	44 (33%)	204 (35%)
Unvandalized	46 (64%)	42 (53%)	195 (67%)	89 (67%)	372 (65%)
	72	79	292	133	576

$x^2 = 5.43$ df = 3 $p < 0.20$

Other variables

During compilation of the various data categories, certain other variables were measured which were considered to be of importance to the problem of vandalism. In general, these data are not as complete as the other variables and the results should be considered as limited or tentative. Three questions were considered: 1) Is there a tendency for sites marked on U.S.G.S. topographic maps as ruins to be vandalized, in other words, are these maps being used to locate sites?; 2) Are sites exposed by pinyon-juniper chaining activities being potted more heavily than those in other locations?; and 3) Among architectural sites, what areas of the sites are being vandalized?

With regard to the first question, no sites which were formally noted on maps were recorded by the class II inventory. Twenty-eight previously recorded sites are on maps, and 18 (64%) have been vandalized by illegal digging. This percentage is about twice that of vandalized sites in the total sample, but we feel more research should be done on this factor before a relationship is established between sites noted on maps and incidence of vandalism.

It appears that pinyon-juniper chaining, which exposes sites, does not lead to increased vandalism according to the following figures:

Data source	Total sites recorded in chained areas	Total vandalized	Total unvandalized
Class II inventory	17	1 (6%)	16 (94%)
BLM site files	96	26 (27%)	70 (73%)
TOTALS	113	27 (24%)	86 (76%)

This distribution might be anticipated, however, since although chaining exposes sites, it also removes tree cover which serves to hide the illegal activities. In other words, working in open, chained areas also exposes the vandal to detection.

In order to determine the areas within architectural site boundaries being vandalized, counts were made for the class II inventory sites and those in the BLM site file of potting in either the roomblocks (rubble mounds) or the midden areas. No instances of digging in kivas were noted in either case. These results are as follows:

Data source	Total architectural sites	Roomblock vandalized	Midden vandalized	Undetermined (not recorded)
Class II inventory	29	11 (38%)	18 (62%)	0
BLM site files	178	41 (23%)	79 (44%)	58 (33%)
TOTALS	207	52 (25%)	97 (47%)	58 (28%)

Thus, the totals indicate that approximately twice as much digging takes place in the middens as in roomblocks. This is to be expected since relatively easier digging can be found in the trash deposits; furthermore, burials with ceramic accompaniments are commonly located in these areas. At architectural sites, only ten cases were noted to have potting in both the midden and roomblocks. However, it should be observed that these figures do not reflect the whole picture since the middens are frequently more heavily dug in than the rooms. Good data on this subject are not available for the previously recorded sites since rarely were the number of extant potholes reported. At one site recorded during the class II inventory, the midden contained over 43 discernible holes, and two others had more than 15 separate holes in evidence.

Field Implementation

A field check of previously recorded archaeological sites was conducted to provide supplementary data for making objective estimates of the nature and type of vandalism occurring on cultural resource sites within southwestern Colorado. In order to standardize on-site observations and provide a data base adequate for quantification, a preliminary version of a vandalism recording form was drafted prior to the beginning of fieldwork; Appendix A gives a completed example of this preliminary version. Minor changes were found to be necessary in this form and Appendix B exhibits the final recommended version. This vandalism form is intended to accompany the State of Colorado Archaeological Site form.

A sample of 81 archaeological sites was selected from the total population of unvandalized sites in the study area. This sample was chosen so that the major temporal periods of the Pueblo Tradition and the dates of recording would be adequately represented. The results of this selection process are given in Table 1. Temporally indeterminate petroglyph sites were also included in the sample.

Table 1. Selection of sites according to temporal period and date of recording.

Temporal Period	Date of Recording		Total
	Pre-1970	Post-1970	
Basketmaker III	18 (37) (72)	7 (22) (28)	25 (31) (100)
Pueblo I-Pueblo II	12 (24) (67)	6 (19) (33)	18 (22) (100)
Pueblo II-Pueblo III	17 (35) (47)	19 (59) (53)	36 (44) (100)
Petroglyphs	2 (4) (100)	0 --- ---	2 (2) (100)
TOTAL	49 (100) (60)	32 (100) (40)	81

Key: 18 = frequency
(37) = column percentage
(72) = row percentage

The date of site recording was included as a major category in an effort to assess the recency of site vandalism. Originally, three recording periods were formulated: 1965-1970, 1971-1975, and 1976-1980, but that scheme was found to be inoperative due to the limited number of sites recorded in the 1971-1975 time period. These three groupings subsequently were collapsed into the two broader categories of sites recorded prior to 1970 and those recorded after 1970.

It was intended at the outset that at least 60 sites--10 sites for each of the six categories--would need to be located so that an accurate assessment of vandalism could be made. An additional 21 sites were included in the sample to allow for the probability that the fieldworkers might not be able to locate all of the sites.

Selection of the particular sites to fill the six "cells" was done on a somewhat random basis, rejection of many of the sites occurring if a site was located more than a mile from any access, if access was particularly difficult, or if the site description was notably brief. It can be seen in Table 1 that representation within each cell and for each category is uneven, noticeably so in the post-1970 BMIII and PI-PII cells which fall short of the desired 10 sites, and the substantial majority of pre-1970 sites compared to post-1970 sites. A better, but certainly not ideal, sampling of sites for prehistoric temporal periods was attained.

Fieldwork and Relocation Strategy

All of the sites selected in the sample were plotted on U.S.G.S. topographic quadrangles according to their established locations on the map files maintained by the BLM, Montrose District. Aerial photographs obtained from the Colorado Geological Survey that correspond to each of the topographic maps were employed to gain a better understanding of local terrain and to identify access routes. The aerial photos proved to be an invaluable aid, especially in more remote parts of the study area.

Actual relocation of the sites was accomplished by a two-person crew during two successive time periods: June 16 to June 24, 1980, and July 4 to July 14, 1980. A total of 272 person-hours was spent in completing the field check portion of the study.

Using the topographic quadrangles, the aerial photos, and location descriptions recorded on the original site forms, an attempt was made to locate each site. Efforts were made to drive as close to the site as possible so that walking time could be minimized. Use of a four-wheel drive vehicle greatly enhanced the ability of the crew to get within reasonable walking distance of a site. Once the immediate vicinity of the site was reached by vehicle, an intensive reconnaissance of the area was undertaken using prominent topographic features for orientation. In ideal situations, the terrain was distinct or was described accurately enough that the site could be quickly relocated. In many cases, however, more extensive coverage was necessary because a description was vague and/or the site could not be immediately relocated. The maximum amount of time spent in relocating a site was approximately one hour. If, by the end of that hour, the site had not been found, further reconnaissance was suspended and the site was recorded as being "Not Found."

Relocation Results

From the original sample of 81 sites, a total of 61 sites was relocated. Of those 61 sites, 20 were found to have been vandalized; 41 showed no indications of vandalism. A breakdown of the 61 sites according to the two previously established categories of temporal period and recording date is given in Tables 2, 3, and 4.

As Table 2 indicates, a good balance was achieved between the relocation of those sites recorded prior to 1970 and those recorded after 1970, the numbers of pre-1970 sites being only slightly greater. Such a balance, however, was not attained for the temporal periods: approximately equal numbers of PI-PII and PII-PIII sites were relocated (22 and 23, respectively), but a somewhat smaller number of BMIII sites was found (15 sites).

Tables 3 and 4 were constructed to determine whether observable relationships existed between vandalized and unvandalized sites, respectively, and the temporal periods and recording dates. A subjective interpretation of Tables 3 and 4 indicates that greater numbers of BMIII and PI-PII sites recorded prior to 1970 have been vandalized than sites of those periods recorded after 1970; equal numbers of PII-PIII sites have been vandalized

whether they were recorded before or after 1970. For unvandalized sites the situation is reversed, however: as many pre-1970 as post-1970 sites for the BMIII and PI-PII periods have not been disturbed. It is more likely for PII-PIII sites recorded after 1970 not to be disturbed.

Does a statistically significant relationship exist between the categories of temporal period and recording date and the presence of vandalism? Or, to state it somewhat differently: are sites of particular temporal periods more likely to have been vandalized if they were recorded prior to or after 1970? To answer those questions a simple chi-square test was performed on both Tables 3 and 4. In both cases, the results of the chi-square test were not significant. There is a good possibility, however, that the sample size has affected the results of the chi-square and, hence, we should not reject prematurely such a possibility.

Table 2. Breakdown of all located sites according to temporal period and recording date.

Temporal Period	Date of Recording		
	Pre-1970	Post-1970	Total
Basketmaker III	9 (28) (60)	6 (21) (40)	15 (25) (100)
Pueblo I-Pueblo II	13 (41) (59)	9 (31) (41)	22 (36) (100)
Pueblo II-Pueblo III	9 (28) (39)	14 (48) (61)	23 (38) (100)
Petroglyphs	1 (3) (100)	0 --- ---	1 (2) (100)
TOTAL	32 (100) (52)	29 (100) (48)	61

Key: 9 = frequency
(28) = column percentage
(60) = row percentage

Table 3. Breakdown of vandalized sites according to temporal period and recording date.

Temporal Period	Date of Recording		Total
	Pre-1970	Post-1970	
Basketmaker III	4 (29) (80)	1 (17) (20)	5 (25) (100)
Pueblo I-Pueblo II	5 (36) (83)	1 (17) (17)	6 (30) (100)
Pueblo II-Pueblo III	4 (29) (50)	4 (67) (50)	8 (40) (100)
Petroglyphs	1 (7) (100)	0 --- ---	1 (5) (100)
TOTAL	14 (101) (70)	6 (101) (30)	20

Key: 4 = frequency
(29) = column percentage
(80) = row percentage

Table 4. Breakdown of unvandalized sites according to temporal period and recording date.

Temporal Period	Date of Recording		Total
	Pre-1970	Post-1970	
Basketmaker III	5 (28) (50)	5 (22) (50)	10 (24) (100)
Pueblo I-Pueblo II	8 (44) (50)	8 (35) (50)	16 (39) (100)
Pueblo II-Pueblo III	5 (28) (33)	10 (43) (67)	15 (37) (100)
TOTAL	18 (100) (44)	23 (100) (56)	41

Key: 5 = frequency
(28) = column percentage
(50) = row percentage

Data Manipulations

Site and Spatial Characteristics

As was mentioned in the introduction, one of the primary goals of the field check portion of the study was to test a vandalism recording form. This form was designed so that, once the results were compiled, those physical characteristics that significantly influenced the likelihood of site vandalism could be isolated. In this portion of the analysis, attention is focused upon those categories incorporated within Section II (Site Characteristics) and Section IV (Spatial Characteristics) of the form.

Appendix C presents a compilation of specified characteristics for each relocated site. This form tabulates, in addition to site number and presence of vandalism, the type and period of the site (under the general heading of Site Characteristics), the distance to the nearest road and the rank of that road, the distance to the nearest community and the size of that community, and the distance to the nearest intrusion and the type of intrusion (the latter three categories subsumed under the general heading of Spatial Characteristics).

Table 5 presents, in summary fashion, the frequency and percentage of those categories other than presence of vandalism and temporal period (previously summarized in Tables 2, 3, and 4). Figure 21 is a graphic reformulation of Table 5. Table 5 and Figure 21 demonstrate that the typical relocated site possesses architecture, pottery, and lithics; is closer to a jeep road; located nearer to a community of less than 100; and situated in the vicinity of an agricultural field, residence, or chained area.

The question still remains of whether there exists a demonstrable and significant relationship between the occurrence of vandalism and the physical and spatial characteristics of a site. In descriptive fashion, we can first compare the spatial characteristics of all sites with the vandalized sites.

Table 5. Summary statistics for categories site type, road rank, size of nearest community, and type of nearest intrusion.

Category code/label	Frequency	Percentage
Architectural Site		
1 yes	49	81.7
2 no	11	18.3
Lithic Site		
1 yes	51	85.0
2 no	9	15.0
Pottery Site		
1 yes	56	93.3
2 no	4	6.7
Rockshelter Site		
1 yes	5	8.3
2 no	55	91.7
Hearth Site		
1 yes	1	1.7
2 no	59	98.3
Cist Site		
1 yes	6	10.0
2 no	54	90.0
Road Rank		
2 all weather	11	18.3
3 seasonal use	14	23.3
4 jeep road	34	56.7
5 trail	1	1.7
Size of Community		
1 less than 100	35	58.3
3 501-1000	9	15.0
5 greater than 5000	16	26.7
Type of Intrusion		
0 NA	14	23.3
1 field	13	21.7
2 well	1	1.7
3 reservoir	2	3.3
4 residence	10	16.7
6 chained area	7	11.7
7 other	13	21.7

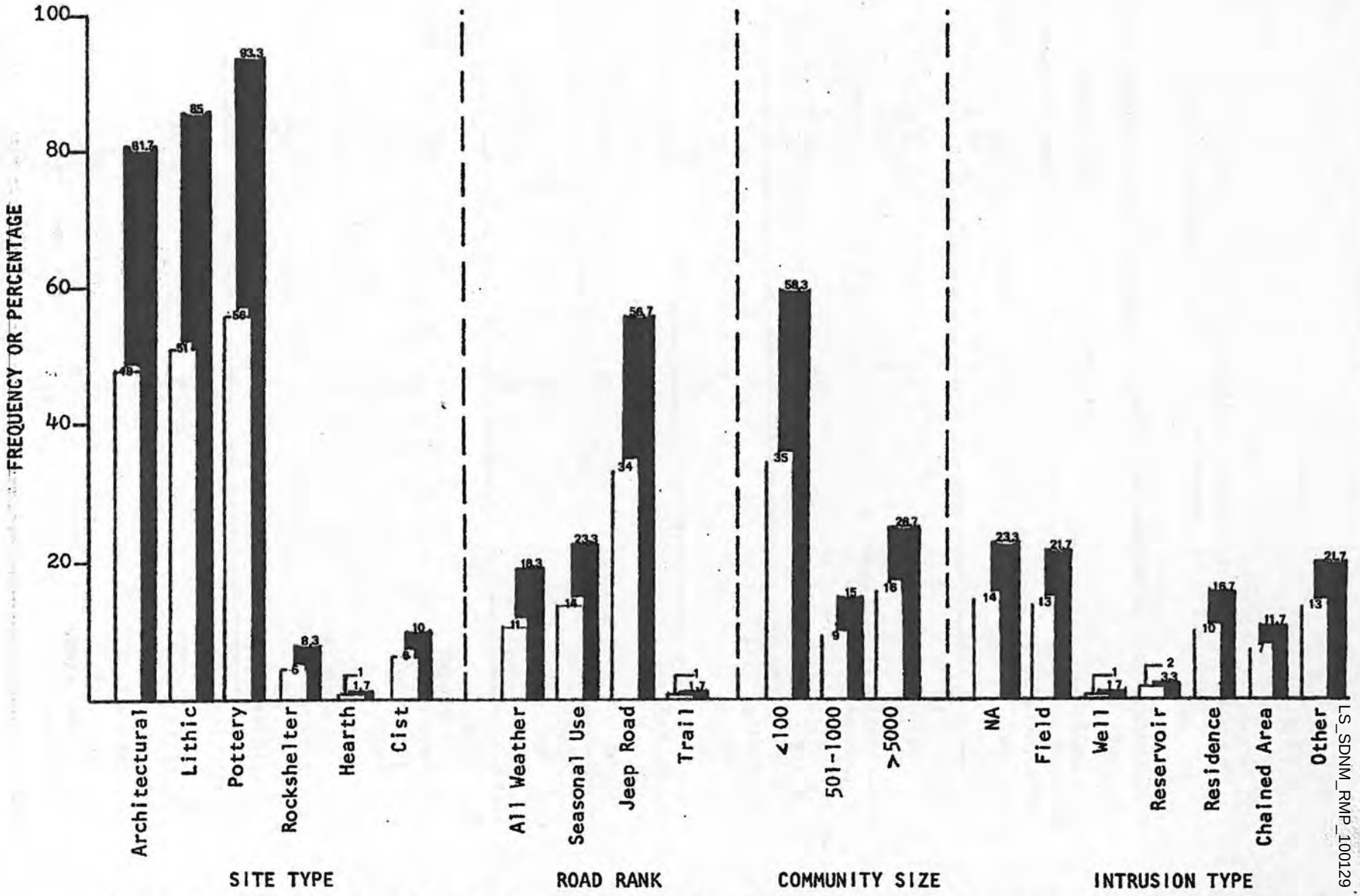

Figure 21. Frequency (white) and percentage (black) of Site and Spatial Characteristics of relocated sites. Actual values of sub-categories indicated.

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Table 6. Spatial characteristics of all sites compared to vandalized sites.

Variable	All Sites (N=61) Range Min	Max	Mean	Vandalized Sites (N=20) Range Min	Max	Mean
Distance to nearest road	0	1613	338.1	0	645	145.6
Distance to nearest community	2.7	51.3	20.4	4.2	34.0	18.8
Distance to nearest intrusion	0	5160	869.7	0	800	160.5

Table 6 suggests that vandalized sites are located, on the average, closer to roads, communities, and intrusions. A Student's t test was performed to ascertain whether the observed measurements on the three variables for the vandalized sites differed significantly from those of the entire sample. T-values of 2.18, 0.62, and 1.64 were obtained for the distance to nearest road, community, and intrusion variables, respectively. Only one of those t-values--distance to nearest road--was found to be significant ($.05 \geq p \geq .02$).

Patterns in the data are beginning to emerge. Continuing in an exploratory fashion, the statistical technique of multiple regression was employed to determine if the presence of vandalism on a site could be explained or predicted by that site's physical or spatial characteristics. In other words, to what degree can the variation in the dependent variable (Presence of Vandalism) be explained by the variation in the independent variables (Site Characteristics and Spatial Characteristics) considered individually or combinatorially?

The SPSS subprogram REGRESSION was utilized to discover possible relationships between the dependent variable and the independent variables. In the first procedure, the dependent variable Presence of Vandalism was regressed against the independent variables, the six categories of Spatial Characteristics. Results of this first procedure are displayed in Table 7. At the top, the table lists the independent variables in the order of their ability to explain the variation in the

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Table 7. Multiple regression on variables of vandalism study 1.

DEPENDENT VARIABLE.. VAR02 PRESENCE OF VANDALISM

VARIABLE(S) ENTERED ON STEP NUMBER 1..

VAR13	DISTANCE TO NEAREST ROAD, IN METERS
VAR18	TYPE OF NEAREST INTRUSION
VAR16	SIZE OF NEAREST COMMUNITY
VAR14	RANK OF NEAREST ROAD
VAR17	DISTANCE TO NEAREST INTRUSION, IN METERS
VAR15	DISTANCE TO NEAREST COMMUNITY, IN KILOME

		SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
MULTIPLE R	.41874				
R SQUARE	.17535	2.33796	.38966	1.87824	.102
ADJUSTED R SQUARE	.08199	10.99537	.20746		
STD DEVIATION	.45548				

S U M M A R Y T A B L E

VARIABLE INTERED	F TO ENTER	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
VAR13	3.98635	.051	.36076	.13015	.13015	.36076	1.87824	.102
VAR18	.18684	.667	.36899	.13616	.00601	-.08116		
VAR16	.35233	.555	.37955	.14406	.00790	-.08671		
VAR14	.87740	.353	.38470	.14799	.00394	-.07348		
VAR17	1.45933	.232	.41333	.17084	.02285	.26506		
VAR15	.28953	.593	.41874	.17535	.00450	.11040		

dependent variable; the R Square value below that indicates the strength of the relationship. The test of significance of this relationship is reflected in the F ratio and the corresponding probability of that F ratio. This F ratio is referred to as an "overall" test for goodness of fit of the regression equation: it indicates "whether the (assumed random) sample of observations being analyzed has been drawn from a population in which the multiple correlation is equal to zero" (Kim and Kohout 1975:335). In this example, variables of all six Spatial Characteristics combine to explain 17.5% of the variation in the dependent variable, Presence of Vandalism. The F ratio is 1.88, and the probability of getting a ratio equal to or greater than 1.88 is slightly greater than 10%.

At the bottom of Table 7 is a Summary Table which clarifies the contributions of the individual independent variables. In this particular case only one variable, distance to nearest road, is consequential: it contributes approximately 13% of the variation in the dependent variable and has an F ratio of 3.99 which is significant at slightly more than .05. The other five variables make significantly weaker contributions. It is interesting to note, however, that once the effects of the preceding variables have been removed, distance to nearest intrusion has a greater, although not statistically significant, effect on the dependent variable.

Table 8 shows the effects of the eight independent variables of Site Characteristics upon the dependent variable. The results of this procedure are substantially poorer than those obtained from the Spatial Characteristics, but may be examined for heuristic purposes. Considered together, the eight independent variables contribute only 10.9% of the variation in the dependent variable. The F ratio is .782 with a probability of .621, thus making it more likely that the observed multiple correlation is due to sampling fluctuation or measurement error. It is provocative that the presence of architecture on a site makes a greater contribution, in terms of the other independent variables, to the variation in the dependent variable. This is certainly not a surprising revelation and it does make intuitive sense. It is reassuring, however, that such

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Table 8. Multiple regression on variables of vandalism study II.

DEPENDENT VARIABLE.. VAR02 PRESENCE OF VANDALISM

VARIABLE(S) ENTERED ON STEP NUMBER 1..

VAR03	ARCHITECTURAL SITE
VAR05	POTTERY SITE
VAR11	PUEBLO 1-PUEBLO 2
VAR07	HEARTH SITE
VAR06	ROCKSHELTER SITE
VAR08	CIST SITE
VAR04	LITHIC SITE
VAR10	BASKETMAKER 3

		SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
MULTIPLE R	.33047				
R SQUARE	.10921	1.45617	.18202	.78159	.621
ADJUSTED R SQUARE	0	11.87716	.23289		
STD DEVIATION	.48258				

S U M M A R Y T A B L E

VARIABLE ENTERED	F TO ENTER	SIGNIFICANCE	MULTIPLE R	R SQUARE	R SQUARE CHANGE	SIMPLE R	OVERALL F	SIGNIFICANCE
VAR03	2.54213	.117	.24366	.05937	.05937	.24366	.78159	.621
VAR05	.15671	.694	.24631	.06067	.00130	.04725		
VAR11	.10413	.748	.27885	.07775	.01708	-.09782		
VAR07	.17467	.678	.28165	.07933	.00157	-.09206		
VAR06	1.02790	.315	.30582	.09352	.01419	.17056		
VAR08	.33648	.564	.31065	.09650	.00298	-.11785		
VAR04	.00062	.977	.31070	.09653	.00003	0		
VAR10	.72591	.398	.33047	.10921	.01268	0		

intuitively recognized relationships are supported by the more objective, statistical methods. Here again, it can be seen that a second variable, rockshelter site, is elevated to a significance slightly greater than its counterparts when the preceding variables are removed from the equation.

Nature of Vandalism

The Vandalism Recording Form (see Appendix B) is constructed so as to record for each vandalized site the nature of vandalism in addition to the physical and spatial characteristics. This section is included in order to obtain a more comprehensive, standardized, and objective evaluation of the how, where, and extensiveness of site vandalism. Table 9 summarizes succinctly for each vandalized site the location of disturbance, method of disturbance, and intensity of disturbance, as well as making recommendations for ameliorating the effects of the vandalism. Table 10 is a synthesis of values recorded in two of the categories in Table 9. For the category intensity of disturbance, the recorded values ranged from a minimum of 1 percent to a maximum of 75 percent, with a mean of 24.7 percent.

It would appear that when a site is disturbed, vandals typically explore the roomblock and midden of a site, a shovel being their preferred instrument of disturbance, and succeed, on the average, in disturbing approximately one-quarter of the site.

As mentioned earlier, specific recommendations to rectify damage have been formulated for each damaged site. More general recommendations for counteracting vandalistic activities, utilizing the data gathered in this study, are proposed in the final chapter. Before proceeding, however, it might be instructive to compare the results of this study with a more informal one conducted in the same general area.

Comparisons

Between August 19 and October 11, 1975, an evaluation of the necessity of stabilization of archaeological ruins in the (then) proposed Sand Canyon Archaeological Lands was conducted at the request of the BLM by the University of Colorado Mesa Verde Research Center, under the

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Table 9. Nature and extent of vandalism on all vandalized sites.

SITE NO.	LOCATION OF[1] DISTURBANCE	METHOD OF[2] DISTURBANCE	INTENSITY OF[3] DISTURBANCE	RECOMMENDATIONS
5MT137	1, 2, 3	3, 4	50	Excavate & stabilize disturbed area; reroute road
5MT275	2, 5	1	1	Excavate trash midden to recover remainder of burial
5MT1580	2, 4	1	75	Excavate potholes; stabilize slab cists
5MT1595	1, 2, 3, 6, 7	1, 8	10	Excavate potholes; stabilize walls; backfill midden
5MT1602	2	3, 4	5	Reroute or close road
5MT1643	1, 2	3	10	Excavate entire site
5MT1667	1, 2	4	10	Excavate disturbed area; reroute road
5MT1841	1	1	25	Excavate pothole; remove initials from lintel
5MT1850	1	1	40	Excavate pothole
5MT1852	1	1	5	Excavate potholes; remove trash
5MT1960	1	1	25	Excavate pothole & stabilize tower walls
5MT2021	1, 2	4	10	Excavate disturbed area; reroute road
5MT2107	1, 3	1, 2	50	Backfill excavated areas; close road; remove trash
5MT2123	1	4	70	Excavate site; determine nature of historic component
5MT2137	1, 2	1	1	Excavate potholes; remove fence
5MT2636	1	1, 8	1	Excavate pothole
5MT4044	2	3	50	Excavate midden area
5MT4085	1, 3	1	10	Excavate site and stabilize walls
5MT4352	1, 2	1	20	Excavate potholes
5MT4575	1	4	1	Close roads; remove garbage
5MT303	7	8	50	Remove recent graffiti if possible; construct protective fence around site

[1]Location: 1=roomblock, 2=midden, 3=pit structure, 4=cist, 5=burial, 6=rockshelter, 7=rock wall

[2]Method: 1=shovel, 2=screen, 3=chain, 4=blade, 5=backhoe, 6=dynamite, 7=bullets, 8=graffiti

[3]Percentage of total site extent

Table 10. Synthesis of factors of disturbance.

Category	Frequency[1]	Percentage of Vandalized Sites
LOCATION OF DISTURBANCE		
Roomblock	16	76
Midden	11	52
Pit Structure	4	19
Cist	1	5
Burial	1	5
Rockshelter	1	5
Rock Wall	1	5
METHOD OF DISTURBANCE		
Shovel	12	57
Screen	1	5
Chain	4	19
Blade	6	29
Backhoe	0	0
Dynamite	0	0
Bullets	0	0
Graffiti	3	14

[1]Total for each of the two categories should exceed 20 since some of the sites had more than one location or method of disturbance.

direction of Dr. David A. Breternitz. Fieldwork supervision and completion of the final report were conducted by Curtis W. Martin. As described by Martin (1976:2),

> The field work consisted of visiting each previously recorded site in the project area. Detailed descriptions of each visible structure and its stabilization requirements were made, the area of the site requiring stabilization work was photographed, and a map of each site was constructed.

Stabilization forms were completed on 42 previously recorded sites. In addition, 7 previously unrecorded sites were encountered during the course of the fieldwork and were subsequently recorded on archaeological inventory, as well as stabilization, forms.

In addition to detailed recommendations concerning stabilization requirements, comments on the present site condition (including descriptions of both natural disturbance and vandalism), amount of disturbance recognized since the original recording, and distance to roads/trails were made. On a general level, Martin (1976:3) describes the occurrence of site vandalism for this group of sites:

> A significant amount of vandalism and natural weathering has occurred at almost all of the sites, and, as evidenced by the amount of each which has occurred since the sites were recorded in the latter half of the 1960's, is continuing to take place.

He goes on to recount particularly noticeable incidences of site vandalism.

Of the 49 sites that were evaluated, Martin found that 35 (71%) of those sites had been vandalized in some way. This vandalism consisted generally of digging in roomblocks or pit structures, destruction of walls, carving of names, initials, or dates into walls, and even dynamiting. In terms of the recency of the vandalism, disturbance had occurred since the original surveys (1965 and 1968) on 13 (33%) of the 33 vandalized sites. On the new sites that Martin recorded, 2 (29%) of those 7 had been vandalized.

Appendix D contains a compilation of all the previously recorded sites that Martin evaluated and for which quantitative information comparable to the present study is available. Summary statistics for all

of the sites and the vandalized sites considered alone are presented along with the Appendix. These results indicate that a large percentage of the sites are vandalized, PII-PIII in age, and located at an average of 305 meters from the nearest road, 31.1 kilometers from the nearest community, and 1557 meters from the nearest intrusion. Although site type was not incorporated into this compilation since the Sand Canyon data is not as complete as that of the present study, Martin (1976) did record the general site type and the number of visible rooms/features. Out of the 49 sites, 31 (63%) of them were recorded as cliff dwellings; the remainder were masonry structures under rockshelters or surface rubble. The number of rooms/features on a cliff dwelling site ranged from 1-10, the average being 3.7 rooms/features per site; the other sites averaged 2.2 rooms/features per site.

The summary statistics at the bottom in Appendix D can be compared to those compiled in Table 6. In contrast to the present study, the mean distances for the Sand Canyon sites are approximately equivalent between all sites and the vandalized sites; in fact, the distance to the nearest intrusion for the vandalized sites is greater than that for all sites. The mean distances to roads, communities, and intrusions for the Sand Canyon sites are substantially larger than those recorded in the present study.

The most likely explanation of the discrepancies between these two data sets lies, we believe, in the nature of the surrounding terrain and that of the sites themselves. The sites relocated during the present study tend for the most part to be located in pinyon-juniper woodlands and do not possess overly distinctive architectural features. These two factors combine to decrease the visibility--and, hence, the potential destruction--of these sites. The majority of the Sand Canyon sites, on the other hand, are highly visible cliff dwellings with multiple architectural features located usually under overhangs in steep-walled sandstone canyons where vegetation is sparser. Martin (1976) observes, in fact, that many of these sites are visible from roads. Thus, despite their greater distances from modern intrusions, the Sand Canyon sites are more readily visible to even the most amateur of vandals and offer greater possibilities for obtaining artifacts.

Summary

The data presented in this chapter confirm what has been generally believed regarding characteristics of archaeological sites and incidences of vandalism. There can be no doubt that variables such as the type and age of a prehistoric site, along with relatively easy access routes, are critical to the vandal's activities. On the other hand, the figures given for the various data categories are also important in and of themselves since they represent quantitative definition of the overall problem. Although there is considerable room for future refinement of the data, it may be observed that the foregoing figures are the first to be tabulated which serve to reflect the overall seriousness of the problem and how widespread it has become over the years. There is one extremely important factor associated with the vandalism problem which cannot be accurately judged by reviewing the known site data or collecting additional field information. This is, of course, the human aspect of the problem, a topic which is examined in the next chapter.

(quoted in Williams 1977:52-53) observes, however, commercial diggers may work during the week while casual artifact hunters go out on weekends and holidays.

Concerning characteristics of artifact hunters and diggers Williams' (1977:55) data conforms with interview data in most respects. 48% of cultural resource managers believe that the over-30 age group is responsible, compared with 85% of interview informants; 31% of the managers named the 14-21 age group as responsible, compared with 0% of the interview informants; 19% of the managers named the 22-29 age group, compared to 10% of the interview informants. Interview data supports Williams' (1977:58) view that older age groups not acting through "youthful exuberance or spontaneity" constitute the ranks of artifact hunters and diggers.

Williams' (1977:59) findings on whether artifact hunters act alone or in groups seem inconclusive, but 2 managers write that small groups (2 to 3) or lone individuals seem to be the norm. This concurs with interview results, with 72% of the informants reporting going alone or with 1-2 others. Results for sex of artifact hunters and diggers are also comparable: 55% of interview responses indicate that these people are male, and 0% are female, with 40% indicating that both men and women are involved (5% no answer). Williams (1977:61) reports that 77.2% of managers believe men are involved, 1.8% believe women are involved, and 21% believe that both are responsible.

Site preference: access and knowledge of site locations

The question of which sites are preferred by artifact hunters is at the center of the problem of how to manage and protect all sites. The sample indicates that people often return to the same site again and again, and that it is accessible by two-wheel drive car or pickup, in an area that is a traditional place to look and that has artifacts on the ground surface or not deeply buried so that finds encourage further investigation. People range over an area at least 20 miles in diameter. One farmer says, "Time and distance are the most important factors in deciding where to go." Another farmer says, "Friends and family recommend places to go. We used to go to likely places--there

had been no digging in the canyon sites. Now there's no such thing as a remote untouched site. People feel that small places have been dug out (exhausted)." A long-time area resident says, "Families go to easily accessible places, where they can drive in with the kids and have the conveniences of home. Families also often return to the same general areas for years." Local people who dig are apt to be quite familiar with the land and they know where the ruins are located. It is consequently a matter of deciding which site to go to rather than discovering a place to go. Our data concur with Williams' (1977:66) evaluation that most artifact hunters and diggers do not drive long distances to get to sites, and are local people familiar with site locations.

One tendency worth noting is the universally expressed attitude that all the sites have already been destroyed and there is little worth preserving now. One man says, "All the ruins have been dug up for 70 years." Another says, "One place is as good as another, they've all been so badly picked over."

As described in Table 28, it seems that families and individuals prefer general areas close to where they live, but driving long distances to dig or surface collect is not unheard of. Fourteen of 20 have sites on their own property.

Table 28. Driving and walking distance to sites.

question	# informants (n-20)				
What is the usual distance you drive to get to a site?	0-5 miles	6-10 miles	11-20 miles	over 20 miles	n/a
	5 25%	4 20%	4 20%	6 30%	1 5%

mean farthest distance ever driven to a site: 60.93 miles (5 "no answers")

What is the usual distance you walk to get to a site?	0-100 yds.	101 yds.-¼ mile	¼-½ mile	½-1 mile	over 1 mile	n/a
	6 30%	8 40%	3 15%	0 0%	2 10%	1 5%

mean farthest distance ever walked to a site: 3.3 miles (2 "no answers")

Walking more than a few hundred yards to get to a site is apparently unusual. The norm was expressed by one man: "We usually park right where we dig."

Table 29 deals with types of roads and vehicles used in access to sites. Maintained dirt roads account for 25% of access. "It's usually a maintained county road within a mile of places we go." Agricultural roads and oil and gas drilling access roads account for another 48% of access, although the breakdown in road types is somewhat misleading. On-the-ground inspection of the area leads to the conclusion that "agricultural access" and "oil and gas drilling access" may describe growth of the road network, but do not describe road conditions. Some of the above are in better condition than county-maintained dirt roads and some are jeep trails. When these two categories are combined with the "4-wheel drive" road category, 65% of access is accounted for. Importance of roads, especially jeep roads, as a factor in site vandalism in southwestern Colorado has been noted by Curtis Martin for the Sand Canyon area, and by Douglas Scott (1977). Lightfoot and Francis (1978:89) have also observed a tendency for severely vandalized sites in BLM's Little Colorado Planning Unit in northeastern Arizona to be located close to jeep roads or trails. In fact, "in several instances, unimproved jeep trails appeared to have no other purpose than to provide access directly to archaeological sites in the more remote regions of the Little Colorado Planning Unit." One informant expresses an identical viewpoint: "If a site is located off a road, people will drive off roads to get to it." A local archaeologist further observes that roads all over the Pleasant View area lead only to sites. The extensive existing road network makes walking long distances unnecessary, and this road network is rapidly expanding as oil and gas exploration accelerates.

People expressed divergent opinions that commercial pothunters would choose easily accessible sites so they could make a hasty escape, or would choose remote sites so they would be less likely to be spotted by patrols. Distance was not considered to be an obstacle for either truly interested people or commercial diggers.

Two-wheel drive truck is the usual vehicle driven to sites. Four-wheel drive vehicles are used only slightly more frequently than two-wheel

drive cars. Use of motorcycles is uncommon (15% report having used motorcycles). Williams (1977:72-74) also reports that access by two-wheel drive vehicle is prevalent, although means of access varies by agency from walking to two-wheel drive to four-wheel drive. BLM managers reported nearly equal access percentages by two-wheel drive as by four-wheel drive vehicle.

Table 29. Road and vehicle use patterns.

question — # informants (n-20) (percentages shown are of total # responses)

What type of roads do you drive on most frequently to get to a site? (more than 1 answer possible) (n = 52 answers)

paved	maintained dirt	4-wheel drive	oil/gas drilling access	agricultural access	drive off roads
3 6%	13 25%	4 8%	8 15%	17 33%	7 14%

What vehicle do you usually use to get there? (more than 1 answer possible)

2-wheel drive car	2-wheel drive truck	4-wheel drive vehicle	n/a
4 19%	10 48%	5 24%	2 10%

Have you ever used motorcycles in these activities?

yes	%	no	%	n/a	%
3	15%	16	80%	1	5%

Site preference: chained lands

Table 30 summarizes factors in site preference. The BLM fared badly on criticisms having to do with chained land. Clearly, people prefer sites in agricultural areas over sites on chained land for a number of reasons. Agricultural land is private, therefore a legal place to dig. Vegetation and ground cover have often already been removed. Sites in chained areas have frequently been partially destroyed by chaining and even if they are in good condition, chained areas are viewed as unpleasant ugly places. Sites in chained areas are easy to pick out, especially because of the thick vegetation or isolated stand of trees left on the site when the surrounding area was chained. Other

that the government's next step in controlling pothunting is the confiscation of private collections. The origin of this thought is unknown, but it drew strong negative reactions from all those who repeated it.

Table 40. Preservation attitudes.

question	# informants (n-20)	%
Please check the attitude closest to your own:		
all these sites should be protected in some way	4	14.2%
most of these sites should be protected in some way	1	3.3%
a few significant sites should be protected in some way	17	56.1%
there are so many sites that the ones already protected are sufficient	8	26.4%

Summary

Twenty interviews were conducted in the Montelores area of southwestern Colorado, using as a guideline a seven-page questionnaire developed to record feelings and habits concerning archaeologists, archaeological sites, artifact hunting and digging, and cultural resource management. A non-random sample of people known to have an interest in archaeology, digging, or collecting was chosen for the interviews. Responses were either tallied and have been presented in tables, or recorded verbatim and are presented in the text and in Appendix F.

To briefly summarize topics covered during the interviews:

1. The sample consists of people who show three levels of interest: 1) casual surface collectors; 2) those with collections who are mostly interested in digging for the sake of artifacts; 3) those who have an interest akin to archaeologists', not specifically tied to artifacts.

2. Collections are felt to be important family heirlooms. Sale of collections would not increase interest in artifact hunting. No local museum is available for display of collections, and museums are distrusted for not displaying collections and for alleged poor care of objects.

artifact hunting appears to be decreasing in recent years, and people report knowing few others who dig and collect.

11. Most diggers are over 30 and male, and most go alone or with 1 or 2 others. Weekends and holidays are preferred times, and spring is the traditional season to dig. Little planning precedes trips.

12. Sites are chosen by familiarity with a local area and ease in access. Most do not walk over a few hundred yards to get to a site. High visibility and private land status were other factors in site preference.

13. Most people drive two-wheel drive trucks on maintained dirt, agricultural, and oil and gas drilling access roads to get to sites.

14. People are looking for burials for the artifacts they contain and prefer to dig in trash areas at sites. Few if any sites are felt to be in pristine condition, and people do not seek out undisturbed sites. Natural erosion also seems to make little difference in choice of a site to dig. Many date sites using the Pecos classification. The antiquities market may influence choice of sites to dig by establishing high monetary value for certain artifacts.

15. People interviewed know that digging and collecting on public lands is illegal, and they feel that everyone else in the area also knows. Further interpretation or knowledge of the Antiquities Act is vague, however. The law was not taken seriously until recent government enforcement and prosecution efforts.

16. Closing roads is considered to be the most effective preventative measure for controlling pothunting. BLM patrol does not appear to be highly visible. Signs promote public awareness of the law and discourage those who are not serious diggers.

17. Awareness of Antiquities Act convictions seems to be growing. Many people have seen or heard local news presentations with an anti-vandalism message.

18. Most feel that at least a few significant sites should be protected in some way, and they offer a variety of opinions and ideas for how this should be done.

As a final note to this section, we would reiterate the fact that only those informants who consented to be interviewed and to complete the questionnaire are included in the sample and subsequent analysis. As a result, it is likely that a segment of the artifact hunting population is not accurately represented in the results of the study. It is probably indicative that the more serious or commercial pothunter is in the minority, however, since, of the potential interviewees contacted, only three out of 23 refused to meet with the interviewer. The three refusals were emphatic denials and unquestionably related to a strong belief in not discussing their collecting activities. If we project these figures for the sample, keeping in mind that it is a limited one, it may be posited that about 13 percent of the collectors are involved in such activities to the point they feel their actions should not be made public.

It should also be stressed that this small sample is non-random and was chosen on the basis of specific interests and activities. It cannot be said to represent the views or the behavior of the people of Montezuma County or of southwestern Colorado at large.

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AN ANALYTICAL APPROACH TO CULTURAL RESOURCE MANAGEMENT:

THE LITTLE COLORADO PLANNING UNIT

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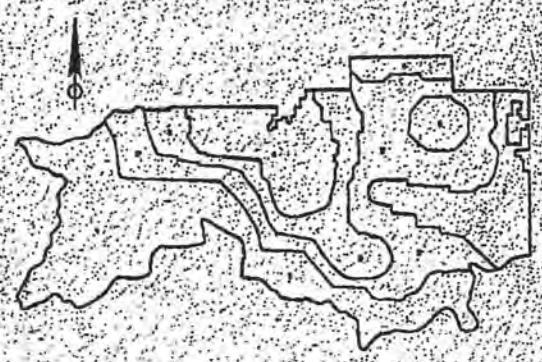

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arboreal vegetation within a 100 m radius of the site. The association of vegetation density and degree of impact due to pothunting was also tested with the Chi-square statistic and was found to have no significance.

The degree of casual collection of a site is an unobserved phenomenon. It can only really be measured by the actual amount of disturbance due to pothunting on any given site. In this study, site accessibility is shown to lead to a greater amount of impact as indicated by the severity of pothunting of any given site and generally lower artifact densities, lower frequencies of decorated ceramics, smaller sherd size, and a paucity of formalized chipped stone tool types on these sites. This impact on sites leads to an unknown amount of disturbance of site collections that must be controlled when reconstructing, for example, prehistoric subsistence activities from the basis of surface collections alone.

Prior to isolating unsystematic collection as a potential source of variation in accounting for differences and similarities between sites, functional and temporal variation of sites must also be evaluated. In evaluating these other sources of variation within the archaeological record, the following assumptions must be made:

1. It is assumed that sites within the Little Colorado Planning Unit are functionally heterogeneous. In particular, activities carried out at larger sites are different from those carried out at smaller sites.

2. It is assumed that architectural sites are habitation sites, while surficial artifact scatters are limited activity sites (Plog and Hill, in Gumerman 1971).

3. It is assumed that a wider variety of activities were carried out prehistorically on habitation sites with more than 3 rooms, than on habitations with 1 or 2 rooms.

These assumptions lead to the following site typology:

1. Pueblos with 3 or more rooms,

2. One or 2-room structures.

3. Artifact scatters.

The following papers present individual analyses and testing of the hypotheses outlined here. Lightfoot utilizes the ceramic inventory of sites in order to determine the effects of unsystematic collection of sites. Francis tests the hypotheses outlined here using chipped stone artifacts collected from sites located during the Little Colorado Planning Unit survey.

THE IMPACT OF CASUAL COLLECTING ON ARCHAEOLOGICAL INTERPRETATION THROUGH REGIONAL SURFACE SURVEYS

by

Kent G. Lightfoot

It has been stated (Schiffer 1976 and other works) that natural and human disturbances of the archaeological record must be recognized and evaluated before realistic behavioral interpretations can be made. Particularly, the impact of casual collecting on the surface material of a site must be understood before the behavior of the prehistoric inhabitants can be known through surface surveys. Since the current study of the Little Colorado Planning Unit consisted of the surface reconnaissance of sites and systematic collection of artifacts, it is essential to determine the impact of collecting before behavioral correlates are deduced from the patterning of surface material.

The purpose of this paper is to examine the impact of non-systematic excavation and collections on the ceramic inventory of sites located through the Little Colorado Planning Unit. Specifically, I shall discuss, (1) the effects of collecting on the ceramic inventory of sites, and (2) the variables on the basis of which one can predict whether a site will be severely collected or not. The breakdown of sites by degree of impact, as defined by Francis and Lightfoot (this volume) are presented in Table 21.

Table 21. Degree of impact as defined by Francis and Lightfoot.

Group	Degree of Disturbance	Cases
1	No apparent impact.	9
2	Minor impact--grazing or minimal disturbance by pothunters.	10
3	Major vandalism--on-site construction, major vandalism.	4

For the purpose of this analysis, the ceramics were sorted into 3 groups, (1) plainware (Alma Plain, Forestdale Smudged, and San Francisco Red), (2) corrugated, and (3) painted ware (almost exclusively Reserve and Tularosa Black-on-white). For each site the number of sherds was counted and the surface area of the sherds (in sq in) was calculated. Surface area was computed by laying out all the sherds of a group and placing an area graph counter (chart #4849) over the sherds. For each site, the total number of sherds and the surface area of sherds for each group is known, along with the total sherd number and surface area for all 3 groups. The surface area and the number of sherds for each site is presented in Table 22.

As stated earlier, it is assumed that pothunters do not collect a site randomly, but instead select certain types of ceramics over others. It is also recognized that the degree of impact can affect the cultural

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Table 22. Surface area and number of sherds for plainware, corrugated and black-on-white ceramics.

	Plainware		Corrugated		Black-on-white		Total	
Site Number	Number	Area	Number	Area	Number	Area	Number	Area
4:03	84	49.5	67	34.00	6	41.0	157	87.6
4:04	93	91.7	24	20.00	11	5.7	128	117.4
4:07	60	47.3	26	28.60	5	2.5	91	78.4
15:02	9	3.7	10	5.50	1	0.9	20	10.2
15:04	154	113.4	60	50.60	46	29.2	260	193.2
15:07	134	45.7	200	87.00	22	24.9	356	157.6
15:10	4	2.7	12	8.40	4	1.8	20	12.9
15:11	5	1.4	2	0.73	0	0.6	7	2.1
15:13	174	80.1	22	8.00	11	4.3	207	92.4
15:14	30	23.3	12	12.20	18	14.6	241	50.1
15:15	354	169.8	70	34.10	58	27.4	482	231.3
15:17	63	53.6	157	117.20	21	18.8	241	189.6
15:18	12	10.4	34	63.50	7	11.9	53	85.8
15:19	119	69.5	120	80.10	52	52.5	291	202.1
15:20	25	10.9	35	17.50	7	4.4	67	32.8
15:21	73	66.5	117	66.50	10	7.2	200	140.2
15:22	19	17.3	75	62.00	5	7.4	99	86.7
16:08	67	112.3	32	70.50	24	44.7	123	227.5
16:10	117	118.4	33	34.10	7	8.6	157	161.1
16:12	11	14.1	49	55.60	65	75.1	125	144.8
16:13	127	79.4	40	29.30	52	61.8	219	170.5
16:15	53	38.8	94	59.40	15	6.6	162	104.8
16:17	30	37.0	8	8.10	28	42.9	66	88.0

inventory of a site. During the survey of the Planning Unit, differential concentrations of artifacts resulting from major and minor vandalism were observed.

Major vandalism (including the use of a backhoe, in several instances) churns up large sections of a site, depositing large quantities of cultural material on the surface. Often dense concentrations of broken and discarded ceramics are left on the site surface. On the other hand, sites which are surface collected and only minimally disturbed through unsystematic excavations would have sparser concentrations of surface material. In these cases, material collected from the surface would not be replaced as quickly as in situations where major vandalism occurred. It is therefore postulated that the concentration of material on sites disturbed through major vandalism would be significantly greater than on sites with minor impact.

General hypotheses that were set up for testing were: (1) that certain artifacts will be selected over others, and (2) that the degree of impact will affect cultural inventories differentially. The Wilcoxon Two-Sample statistic was used to test each hypothesis. By utilizing this statistic one can judge whether 2 samples have the same or different population medians. The p value for each statistic was used to evaluate the validity of each hypothesis. Due to the small sample, I decided to use a significance level of .1 or less to reject the null hypothesis. For a more detailed discussion on sample size and appropriate levels of significance see Thomas (1976:459).

The following are the specific hypotheses that were tested in this manner.

Hypotheses:

1. Black-on-white (B/W) sherds are preferred over plainware sherds.

    a. Sites with minor impact should have smaller percentages of B/W sherds than sites which have had little or no impact.

    b. Sites with minor impact should have smaller percentages of B/W sherds than sites which have been disturbed through major vandalism.

2. Corrugated sherds are preferred over plainware sherds.

    a. Sites with minor impact should have smaller percentages of corrugated sherds than sites which have had little or no impact.

    b. Sites with minor impact should have smaller percentages of corrugated sherds than sites which have been disturbed through major vandalism.

3. Larger sherds (in total surface area) are preferred over smaller ones.

a. Sites with minor impact should have smaller sherds than sites which have had little or no impact.

b. Sites with minor impact should have smaller sherds than sites which have been disturbed through major vandalism.

4. Since the collection of sherds from a site will reduce the total number of ceramics found at that site, the density of sherds per square meter will vary with the degree of impact,

a. Sites with minor impact should have lower ceramic densities than sites which have had little or no impact.

b. Sites with minor impact should have lower ceramic densities than sites which have been disturbed through major vandalism.

The First Hypothesis--The percentage of B/W sherds was computed by dividing the surface area of the B/W sherds found at a site by the combined surface area of all ceramics and multiplying by 100. The results of the Wilcoxon statistics done on B/W sherds by the degree of impact are in Tables 23 and 24.

Table 23. Wilcoxon statistics; black-on-white percentages by sites with minor or no impact.

n_1 = 9.0	μw = 90.000	p = .02
n_2 = 10.0	σw = 12.200	
w_1 = 114.5	z = 2.008	

Table 24. Wilcoxon statistics; black-on-white percentages by sites with minor or major impact.

n_1 = 4	μw = 30.00	p = .2843
n_2 = 10	σw = 6.98	
n_3 = 34	z = 0.57	

1a. The p value (p = .02) computed for this test was low enough to reject the null hypothesis. There is evidence that sites with minor impact have significantly smaller percentages of B/W sherds than non-impacted sites.

LS_SDNM_RMP_I00129

1b. The p value (p = .284) calculated for this test was not low enough to reject the null hypothesis, thus there is not a significant difference between the percentages of B/W sherds found on sites with major and minor impact. Thus, the quantity of B/W sherds (in relation to plainware ceramics) will be small on sites with both major and minor impact.

The Second Hypothesis--The percentage of corrugated sherds was calculated by taking the surface area of corrugated sherds and dividing this figure by the combined surface area of all sherds found at a site and multiplying by 100. The outcome of the Wilcoxon statistics are presented in Tables 25 and 26.

Table 25. Wilcoxon statistics; corrugated percentages by sites with minor or no impact.

n_1 = 9.0	μw = 90.000	p = .298
n_2 = 10.0	σw = 12.240	
w_1 = 83.5	z = -.531	

Table 26. Wilcoxon statistics; corrugated percentages by sites with minor or major impact.

n_1 = 4	μw = 30.000	p = .239
n_2 = 10	σw = 7.060	
w_1 = 25	z = 0.708	

2a. The p value (p = .298) for this test was not low enough to reject the null hypothesis. There does not seem to be any significant differences between the percentages of corrugated sherds found at sites with minor and no impact.

2b. The p value (p = .239) calculated for this test was not low enough to reject the null hypothesis. There does not seem to be any significant differences between the percentages of corrugated sherds found at sites with minor and major impact.

The Third Hypothesis--The average size sherd for each site was calculated by taking the total surface area of sherds collected from a site and dividing this by the total number of sherds found at that site. This calculation gives the average size sherd for each site in square inches. Tables 27 and 28 show the results of the Wilcoxon test done on the average sherd size.

Table 27. Wilcoxon statistics; size of sherds by sites with minor or no impact.

n_1 = 9	μw = 90.00	p = .06
n_2 = 10	σw = 12.20	
w_1 = 109	z = 1.55	

Table 28. Wilcoxon statistics; size of sherds by sites with minor or major impact.

n_1 = 4	μw = 30.00	p = .024
n_2 = 10	σw = 7.06	
w_1 = 44	z = 1.98	

3a. The p value (p = .06) for this test was low enough to reject the null hypothesis. There is evidence that sites with minor impact have significantly smaller sherds than non-impacted ones.

3b. The p value (p = .024) computed for this test was low enough to reject the null hypothesis. There is evidence that sites with minor impact have significantly smaller sherds than ones with major impacts.

Another possible factor associated with the size of sherds found on the surface of sites is the amount of grazing done in the vicinity. Since cattle ranching is a major concern within the Springerville region, I postulated that sites located within grazing lands would be impacted differently from sites outside of such lands. Evidence of grazing was taken into account when sites were recorded and surface collected. The on-site evaluation of whether a site was grazed or not was used in testing this hypothesis.

Test Implication--It is logical to assume that materials on sites which have been continuously grazed would be crushed.

The results of the Wilcoxon test done on the size of sherds by grazed and non-grazed sites is presented in Table 29. The outcome of the test indicates that the size of sherds for non-grazed sites is not significantly higher (p = .145) than sites which were not grazed. However, while the hypothesis has not been supported, it should be noted that the mean size of sherds for grazed sites ($\bar{X}$ = .61 sq in) was smaller than for non-grazed sites ($\bar{X}$ = .88 sq in).

Table 29. Wilcoxon statistics; size of sherds by grazed and non-grazed sites.

n_1 = 8.0	μw = 96.000	p = .145
n_2 = 15.0	σw = 15.460	
w_1 = 79.5	z = -1.066	

The Fourth Hypothesis--The density of ceramics per square meter was calculated by taking the total number of sherds collected at a site and dividing this number by the total area (in square meters) covered by collection transects utilized in picking up artifacts. The results of the Wilcoxon test are presented in Tables 30 and 31.

Table 30. Wilcoxon statistics; ceramic density by sites with minor or no impact.

n_1 = 9.0	μw = 90.00	p = .046
n_2 = 10.0	σw = 12.20	
w_1 = 110.5	z = 1.68	

Table 31. Wilcoxon statistics; ceramic density by sites with minor or major impact.

n_1 = 4	μw = 30.000	p = .008
n_2 = 10	σw = 7.070	
w_1 = 47	z = 2.404	

4a. The results of this test indicate that sites with minor impact have significantly smaller (p = .046) ceramic densities than non-impacted ones.

4b. The outcome of this test indicates that sites with minor impact have significantly smaller (p = .008) ceramic densities than sites with major impact.

The above tests have empirically demonstrated that pothunters prefer certain artifacts over others. While this may seem implicit to many investigators, it is an important step towards evaluating the effects of pothunting upon sites. It has also been demonstrated that the degree of impact will affect the amount of surface material on a site. Overall, in sites with major and no impact there will be larger quantities of surface material than on sites with minor impact. However, the density of specific ceramic types will vary in sites with major impact, depending upon what was being selected.

Predicting the Impact of a Site

The second section of this paper examines several variables which might be meaningful in predicting the degree of impact at sites. Two major variables, the accessibility and visibility of sites outlined by Francis and Lightfoot (this volume), are discussed. It is postulated that sites which are the most accessible to modern man will be more severely collected than sites located in more isolated regions. It is felt that the accessibility of a site can be measured by the distance a site is located from a road. Furthermore, it is posited that the proximity of sites to heavily traveled roads will be a very significant variable in determining the impact of a site. The 3 types of roads defined earlier (primary, improved and primitive) will be used to test whether an association exists between the degree of impact and the accessibility of a site. Since the amount of travel varies for each type of road, they should be excellent indicators of whether an increase in the accessibility to an area affects the pilfering of sites located there.

Accessibility was measured in 2 ways. The first measure is the distance between a site and type of road. The second, an ease of access index measure, includes elevation above or below the road as well as distance. The ease of access index was developed by measuring the elevation difference between sites and roads, and reducing this figure to an ordinal scale of vertical distance. The vertical distance scale is as follows:

Elevation difference (in feet)	Scale of vertical distance
0	1
1 to 50	2
51 to 100	3
101 to 150	4
151 and above	5

Once the vertical distance index was computed for a particular type of road, it was then multiplied by the distance from the site to the road. This computation was used as a measure for the ease of access to a site from each type of road.

The visibility of a site is the second major variable examined for its potential in predicting the impact of a site. This variable has been

discussed in some detail by Francis and Lightfoot (this volume). It is postulated that the lower the on-site vegetation density, the easier it is for pothunters to spot sites. Therefore, sites with low on-site vegetation densities should be more severely collected than sites with higher vegetation densities.

The accessibility and visibility of sites will be tested for their potential in predicting the impact of a site by utilizing the B/W percentages, the size of sherds, and the ceramic densities of sites. Since it has already been demonstrated that fluctuations within these variables from site to site can in part be attributed to casual collecting, it can be assumed that they will give a representative estimate of the amount of pothunting done on sites.

The following hypotheses were developed to test whether the accessibility and visibility of sites affects the degree of casual collecting.

The Fifth Hypothesis--The nearer a site is located to any road, the more severely collected that site should be.

> Test Implication--Sites located close to any type of road should have smaller percentages of B/W sherds, smaller size sherds, and lower ceramic densities than sites located at a distance from roads.

The Sixth Hypothesis--The nearer a site to a heavily traveled road (primary highways), the more severely collected that site should be.

> Test Implication--Sites located close to primary highways should have smaller percentages of B/W sherds, smaller size sherds, and lower ceramic densities than sites located at a distance from heavily traveled roads.

The Seventh Hypothesis--Sites which have low ease of access indexes in relation to any type of road, should be more extensively collected than sites with high ease of access indexes.

> Test Implication--The lower the ease of access index for a site from any road, the smaller the B/W percentages, the size of the sherd, and the ceramic density for that site should be.

The Eighth Hypothesis--The lower the on-site vegetation density, the more severely collected a site should be.

> Test Implication--Sites with low vegetation densities should have smaller percentages of B/W sherds, smaller size sherds, and lower ceramic densities than sites with high ones.

Both correlation and analysis of variance statistical packages, produced through the SPSS program (Nie et al.), were used to test the strength of the above hypotheses. The p value for both the analysis of variance and scattergram tests were used to evaluate the validity of each hypothesis.

The Fifth Hypothesis--A histogram was used to rank the distances sites are located from all roads into 3 groups. The distribution of these groups is as follows:

0 to .25 of a mile	(11 cases)
.26 to .50 of a mile	(7 cases)
.51 to 1.00 of a mile	(5 cases)

Table 32 presents the results of the analysis of variance test done on B/W percentages, the size of sherds, and the ceramic densities by the above groups.

Table 32. Analysis of variance statistics; black-on-white percentages, size of sherds and ceramic density by the distance from sites to all roads.

Ceramic Category	Source of Variation	Sum of Squares	F value	p value
B/W Percentages	Between Groups	41.2106	.095	.514
	Within Groups	4,322.4417		
Size of Sherds	Between Groups	1.6624	8.966	.002
	Within Groups	1.8541		
Ceramic Density	Between Groups	30.6998	2.860	.079
	Within Groups	107.3326		

The test indicates significant differences in the mean size of sherds and ceramic densities on sites located 0 to .25, .26 to .50 and .51 and further from roads. This result supports the hypothesis that the ceramic inventories of sites situated near roads will vary from those located at a distance. Correlation statistics were done on the size of sherds and the ceramic density to determine how much of the variation within these variables can be attributed to a site's proximity to any road. These tests are presented in Table 33.

Table 33. Correlation statistics; size of sherds and ceramic density by the distance from sites to all roads.

Size of sherds by distance to all roads

r square = .071
p = .108

Ceramic density by distance to all roads

r square = .155
p = .031

These tests indicate that at a fairly significant level (p = .108), the proximity of roads to sites accounts for about 7% of the variation in the size of sherds. At a more significant level (p = .031), this same variable accounts for approximately 16% (r = .155) of the variation in the ceramic densities.

The Sixth Hypothesis--The hypothesis that sites located closest to primary highways will be the most severely collected was tested by analysis of variance. If the proximity to primary roads is the major factor in determining the impact of a site, then the p values for primary roads should be the most significant in comparison to improved and primitive roads. A histogram was used to rank the distance of sites from all 3 road types. This is presented below:

Primary Roads:	0.0 to 2.0 miles
	2.1 to 3.0 miles
	3.1 to 5.0 miles
Improved Roads:	0.00 to 0.25 of a mile
	0.26 to 1.25 miles
	1.26 to 4.00 miles
Primitive Roads:	0.00 to 0.25 of a mile
	0.26 to 0.50 of a mile
	0.51 to 2.00 miles

The results of the analysis of variance done on B/W percentages, the size of sherds and the ceramic densities by the distances sites are located from primary, improved and primitive roads are presented in Table 34.

The outcome of the analysis of variance test indicates that differences in the mean size of sherds and B/W percentages for sites located less than 2 and more than 3 miles from primary roads is equal or less than the .1 level of confidence. The only other analysis of variance statistic that was less than or equal to the .1 level of significance was the relationship between the size of sherds and primitive roads. It can be concluded that the proximity of primary roads to sites is fairly important in predicting the impact of sites.

As indicated above, the analysis of variance test conducted on primary roads did not result in very significant p values. It was decided to reevaluate the Sixth Hypothesis to determine what road types were the most important in predicting the impact of a site. It was felt that an impressive amount of travel done within the Springerville region is accomplished on hard surface, all-weather roads. If primary or improved roads are the most traveled routes, then sites located closest to these thoroughfares would be more accessible than sites situated near primitive or no roads at all. Based on this logic a new hypothesis was formulated:

> Sites situated closest to roads with hard or improved surfaces would be the most severely collected sites.

Table 34. Analysis of variance statistics; black-on-white percentages, size of sherds, and ceramic density by the distance from sites to primary, improved and primitive roads.

Ceramic Category	Source of Variation	Sum of Squares	F value	p value
Distance from Sites to Primary Roads				
B/W Percentages	Between Groups	.0079	.006	.098
	Within Groups	13.8182		
Size of Sherds	Between Groups	.0023	.006	.104
	Within Groups	3.5143		
Ceramic Density	Between Groups	.3580	.026	.234
	Within Groups	137.6743		
Distance from Sites to Improved Roads				
B/W Percentages	Between Groups	.8261	.635	.543
	Within Groups	13.0000		
Size of Sherds	Between Groups	.6594	2.308	.124
	Within Groups	2.8571		
Ceramic Density	Between Groups	.1444	.010	.135
	Within Groups	137.8879		
Distance from Sites to Primitive Roads				
B/W Percentages	Between Groups	183.0807	.434	.641
	Within Groups	4,180.5715		
Size of Sherds	Between Groups	1.4377	6.916	.005
	Within Groups	2.0788		
Ceramic Density	Between Groups	19.0226	1.598	.226
	Within Groups	119.0097		

A histogram divided the distances to either primary or improved roads into 2 groups:

0.0 to 1.0 mile (15 cases)
1.1 to 5.0 miles (8 cases)

The outcome of analysis of variance statistics done on B/W percentages, size of sherds, and ceramic densities for these 2 groups is presented in Table 35.

Table 35. Analysis of variance statistic; black-on-white percentages, size of sherds and ceramic density by the distance from sites to either primary or improved roads.

Ceramic Category	Source of Variation	Sum of Squares	F value	p value
B/W Percentages	Between Groups	488.3772	2.647	.115
	Within Groups	3,875.2750		
Size of Sherds	Between Groups	.6544	4.802	.038
	Within Groups	2.8621		
Ceramic Density	Between Groups	22.0600	3.995	.056
	Within Groups	115.9724		

The results of the test indicate the size of sherds and the ceramic densities of sites located less than 1 mi and further than 1 mi from primary or improved roads are significantly different at the .05 level (p = .038 and .056 respectively). For B/W sherds the significance level is close to .1 (p = .115). Thus, of the variables tested so far, the distance to primary or improved roads is the most significant in predicting the impact of sites.

In order to determine the amount of variation in B/W percentages, the size of sherds and ceramic densities explained by a site's proximity to improved or primary roads, correlation statistics were calculated. The results of this test are presented in Table 36.

Table 36. Correlation statistics; black-on-white percentages, size of sherds and ceramic density by the distance from sites to either primary or improved roads.

B/W percentages by distance to primary or improved roads

r square = .1843 p = .020

Size of sherds by distance to primary or improved roads

r square = .3055 p = .003

Ceramic densities by distance to primary or improved roads

r square = .1860 p = .019

The outcome of this test indicates that the proximity of sites to primary or improved roads explains approximately 18% of the variation in

B/W percentages, 30% of the variation in the size of sherds and 19% of the variation in ceramic densities at a level of significance below .02.

The Seventh Hypothesis--Histogram statistics were used to divide the ease of access indexes for all roads into the following 3 groups:

0.00 to 0.25	(11 cases)
0.26 to 1.25	(5 cases)
1.26 to 4.50	(7 cases)

Analysis of variance statistics done on B/W percentages, the size of sherds and ceramic densities for these groups are presented in Table 37.

Table 37. Analysis of variance; black-on-white percentages, size of sherds, and ceramic density by the ease of access indexes to all roads.

Ceramic Category	Source of Variation	Sum of Squares	F value	p value
B/W Percentages	Between Groups	584.2963	1.546	.237
	Within Groups	3,779.3560		
Size of Sherds	Between Groups	1.0816	5.552	.025
	Within Groups	2.4349		
Ceramic Density	Between Groups	67.0456	9.445	.002
	Within Groups	70.9868		

The results of this test indicate that the mean size of sherds and ceramic densities for sites with an ease of access index of less than .26 and more than 1.25 are significantly different at the .03 level.

Correlation statistics were generated to determine the amount of variation in the size of sherds and ceramic densities explained through the ease of access to a site. This test is presented in Table 38. Ease of access accounts for approximately 14% (r^2 = .1429) of the variation in the ceramic densities at a .037 level of significance.

Table 38. Correlation statistics; size of sherds and ceramic density by the ease of access indices to all roads.

Size of sherds by the ease of access to all roads

r square = .0510 p = .2100

Ceramic densities by the ease of access to all roads

r square = .1429 p = .0376

The Eighth Hypothesis--Histogram statistics were used to divide vegetation densities into the following 2 groups:

Group 1: 0 to 55% (14 cases)
Group 2: 56 to 99% (9 cases)

The analysis of variance statistics done on the B/W percentages, size of sherds and ceramic densities for these groups are presented in Table 39. This test demonstrates that the mean size of sherds and B/W percentages for sites with low (less than or equal to 55%) and high (more than 55%) vegetation densities are significantly different at less than the .1 level. This supports the hypothesis that fluctuations in the vegetation densities will affect the impact on sites.

Table 39. Analysis of variance statistics, black-on-white percentages, size of sherds, and ceramic density by vegetation densities of sites.

Ceramic Category	Source of Variation	Sum of Squares	F value	p value
B/W Percentages	Between Groups	745.6522	4.328	.047
	Within Groups	3,618.0001		
Size of Sherds	Between Groups	.5408	3.817	.061
	Within Groups	2.9757		
Ceramic Density	Between Groups	8.9778	1.461	.239
	Within Groups	129.0546		

Correlation statistics were calculated to determine the amount of variation within B/W percentages and size of sherds accounted for by the vegetation densities of sites. These tests are presented in Table 40. The results of these tests indicate that approximately 7% (r^2 = .07424) of the fluctuation in B/W percentages are explained by on-site vegetation at about the .1 level of significance. About 10% (r^2 = .10350) of the variation in the size of sherds is accounted for by vegetation density at about the .06 level of confidence.

Table 40. Correlation statistics; black-on-white percentages, and size of sherds by vegetation densities, of sites.

B/W percentages by vegetation densities

r square = .07424 p = .10425

Size of sherds by vegetation densities

r square = .10350 p = .06725

Another variable associated with the visibility of sites is the number of discernible rooms on the surface of a site. It is postulated that the larger the room count of a site, the easier it is for pothunters to detect. Therefore, the larger the number of rooms visible on the surface of a site, the more severely collected that site should be. In order to test this hypothesis, on-site vegetation density and room counts were combined. It is felt that this is a more reliable indicator of the visibility of a site than room counts alone. Correlation coefficients were calculated for B/W percentages, size of sherds and ceramic densities with site size, 0, 1 to 2, and 3 to 8 rooms. The results of this test are presented in Table 41.

This test indicates that sites with the largest room counts are not necessarily the most severely impacted. In sites with only 1 to 2 rooms visible, vegetation density accounted for approximately 60% (r^2 = .60717) of the fluctuation in the size of sherds at a .06 level of confidence. On these same sites, about 48% (r^2 = .48438) of the variation in ceramic densities was explained by vegetation density at a level of significance below .1. Within 3- to 8-room sites, about 37% (r^2 = .37390) of the variation in B/W percentages was accounted for by vegetation density at a .04 level of confidence. Forty-two percent (r^2 = .41799) of the fluctuation in the size of sherds in 0-room sites was explained by vegetation density at a significance level of .03. It is clear from the above test that all 3 site types defined by Francis and Lightfoot are being casually collected. Of these types, 1- to 2-room sites seem to be the most severely collected.

Since it has been demonstrated that the accessibility and visibility of sites account for some variation in ceramic inventories, it was decided to examine the combined effects of these 2 variables. Analysis of variance was used to test the power of these 2 variables in explaining variations in B/W percentages, size of sherds and ceramic densities from site to site. The groups developed for the 1-way analysis of variance statistics earlier in this paper were used for the Anova tests. The results of these tests are presented in Tables 42, 43 and 44. Approximately 60% (r^2 = .588) of the variation in sherd size can be explained through the combination of vegetation density and distance to all roads at a .001 level of confidence. About 45% (r^2 = .455) of the fluctuation in sherd size can be explained by the combined effects of vegetation density and ease of access to all roads at a .011 level of confidence. Vegetation density and distance to all roads explained about 24% (r^2 = .242) of the variation in ceramic densities at a .083 level of confidence, while vegetation density and ease of access to all roads accounted for approximately 49% (r^2 = .489) of the fluctuation in ceramic densities at the .028 level of significance. It is apparent that the accessibility and visibility of sites will determine a very large proportion of the variation in sherd size from site to site at a very significant level.

Table 41. Correlation statistics; B/W percentages, size of sherds and ceramic densities by sites with 0, 1 to 2 and 3 to 8 rooms.

0 room

B/W by vegetation densities

r square = .05449 p = .2727

Size of sherds by vegetation densities

r square = .41799 p = .02994

Ceramic density by vegetation density

r square = .00905 p = .40383

1 to 2 rooms

B/W by vegetation densities

r square = .15320 p = .25734

Size of sherds by vegetation densities

r square = .60717 p = .0617

Ceramic density by vegetation density

r square = .48438 p = .09589

3 to 8 rooms

B/W by vegetation densities

r square = .37390 p = .04008

Size of sherds by vegetation densities

r square = .03721 p = .30952

Ceramic density by vegetation density

r square = .03411 p = .31713

Table 42. Anova statistics; black-on-white percentages, size of sherds and ceramic density by vegetation density and distance from sites to all roads.

B/W percentages by vegetation density and distance to all roads

Source of Variation	Sum of Squares	F value	p value
Main effect	749.469	1.466	.259
Vegetation	708.258	4.157	.055
Distance all roads	3.817	.011	.999
2-way interaction	717.683	2.106	.151
Vegetation by distance all	717.683	2.106	.151
Explained	1,467.152	1.722	.183
Residual	2,896.500		

r^2 = .172 eta = .41, .10 Beta = .42, .03
r = .414

Size of sherds by vegetation density and distance to all roads

Main effect	2.069	11.523	.001
Vegetation	.406	6.789	.018
Distance all roads	1.528	12.766	.001
2-way interaction	.430	3.597	.049
Vegetation by distance all	.430	3.597	.049
Explained	2.499	8.353	.001
Residual	1.017		

r^2 = .588 eta = .39, .69 Beta = .35, .66
r = .767

Ceramic density by vegetation density and distance all roads

Main effect	33.356	2.323	.111
Vegetation	2.656	.555	.999
Distance all roads	24.378	2.546	.106
2-way interaction	23.291	2.433	.116
Vegetation by distance all	23.291	2.433	.116
Explained	56.647	2.367	.083
Residual	81.385		

r^2 = .242 eta = .26, .47 Beta = .14, .43
r = .492

Table 43. Anova statistics; black-on-white percentages, size of sherds, and ceramic density by vegetation density and distance from sites to primary or improved roads.

B/W by vegetation density and distance to improved or primary roads

Source of Variation	Sum of Squares	F value	p value
Main effects	823.460	2.297	.126
Vegetation	335.083	1.870	.185
Distance improved, primary	77.808	.434	.999
2-way interaction	134.776	.752	.999
Veg. by dist. improv., prim.	134.776	.752	.999
Explained	958.235	1.782	.184
Residual	3,405.417		

r^2 = .189 eta = .41, .33 Beta = .33, .16
r = .434

Size of sherds by vegetation density and distance to improved or primary roads

Main effects	.782	2.719	.090
Vegetation	.127	.886	.999
Distance improved, primary	.241	1.676	.209
2-way interaction	.002	.016	.999
Veg. by dist. improv., prim.	.002	.016	.999
Explained	.784	1.818	.177
Residual	2.732		

r^2 = .222 eta = .29, .43 Beta = .23, .31
r = .472

Ceramic density by vegetation and distance to primary or improved roads

Main effects	22.377	2.023	.158
Vegetation	.317	.057	.999
Distance improved, primary	13.400	2.423	.133
2-way interaction	10.582	1.914	.180
Veg. by dist. improv., prim.	10.582	1.914	.180
Explained	32.959	1.987	.149
Residual	105.073		

r^2 = .162 eta = .26, .40 Beta = .06, .37
r = .403

Table 44. Anova statistics; black-on-white percentages, size of sherds, and ceramic density by vegetation density and the ease of access index to all roads.

B/W by vegetation density and ease of access to all roads

Source of Variation	Sum of squares	F value	p value
Main effects	956.847	1.701	.204
Vegetation	372.550	1.987	.174
Access all roads	211.194	.563	.999
2-way interaction	219.639	.586	.999
Veg. by ease of access	219.639	.586	.999
Explained	1,176.485	1.255	.999
Residual	3,187.167		

r^2 = .219 eta = .41, .37 Beta = .33, .24
r = .468

Size of sherds by vegetation density and ease of access to all roads

Main effects	1.601	5.780	.007
Vegetation	.519	5.624	.028
Access all roads	1.060	5.741	.012
2-way interaction	.346	1.876	.182
Veg. by ease of access	.346	1.876	.182
Explained	1.947	4.218	.011
Residual	1.569		

r^2 = .455 eta = .39, .55 Beta = .33, .24
r = .675

Ceramic density by vegetation and ease of access to all roads

Main effects	66.520	5.493	.008
Vegetation	.474	.116	.999
Ease of access	58.542	7.144	.006
2-way interaction	.859	.105	.999
Veg. by ease of access	.859	.105	.999
Explained	68.379	3.338	.028
Residual	69.654		

r^2 = .489 eta = .26, .70 Beta = .07, .73
r = .699

Conclusion

It has been stressed (Francis and Lightfoot, this volume) that a understanding of pothunting's impact on sites is necessary before realistic behavioral correlates can be deduced from surface surveys. However, the evaluation of pothunting's impact on the dispersal of surface material is a complex procedure. The multiple processes which affect the patterning of material on a site surface preclude a simple causal relationship between pothunting and the dispersal of surface material. Too often archaeologists have either ignored the pilfering of surface material from sites or they have used it as a catchall explanation for problematic sites. It has been assumed that a very low density of artifacts found on the surface of a site reflected a severely collected site. While this might explain the low density of surface material, other processes could just as easily account for this phenomenon. A sparse amount of surface material might yield important behavioral information on the prehistoric occupants. If the dispersal of material found on a site is simply assumed to have been caused by pothunting, important behavioral correlates might be missed by the investigator. It is therefore important that the effects of casual collecting be tested on the cultural inventory of a site.

In order to facilitate the testing of casual collecting, variables can be developed which predict the impact of pothunting on sites. Two major predictive variables tested in this paper are the accessibility and visibility of sites. By examining the location of sites in respect to the nearest roads and also their on-site vegetation density, hypotheses can be developed which will estimate the amount of collecting done on sites. By testing these proposed hypotheses using the cultural inventory of a site, the amount of variation in the surface materials explained by the hypotheses can be determined. Variation not explained by the hypotheses can be attributed to other processes. Behavioral hypotheses can then be formulated to explain this variation.

The correlation that exists between the amount of collecting and the distance a site is located from a road is of significance to the Forest Service. The full impact of building roads in the vicinity of archaeological sites should be understood before major construction projects are carried out. It should be recognized that the effects of building roads will go much beyond those sites modified through road construction and maintenance. The construction of roads will increase the flow of people into an area, making the sites located in the immediate vicinity more accessible to pothunters. It is suggested that road clearance surveys should go beyond the right-of-way strip of the proposed road. Within this paper there was some evidence presented which indicated that sites situated approximately 0 to .25 and .26 to .50 of a mile to roads will probably be more substantially collected than sites located further from roads. It is proposed that road clearance surveys should cover at least .25 of a mile (approximately 1350 ft) on either side of the right-of-way.

It should be noted that several of the sites surveyed for the proposed Highway 180/666 realignment in the Apache-Sitgreaves National Forests are in danger of being severely collected. Although site numbers AR 03-01-01-10, AR 03-01-01-11, and AR 03-01-01-14 are not located in the road right-of-way

proper, they are situated close enough to be adversely impacted through pothunting. The results of my work support Wood and Hantman's (1976) recommendations that these sites should be thoroughly mitigated before major vandalism occurs.

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AN ANALYTICAL APPROACH TO CULTURAL RESOURCE MANAGEMENT:

THE LITTLE COLORADO PLANNING UNIT

FRED PLOG, EDITOR

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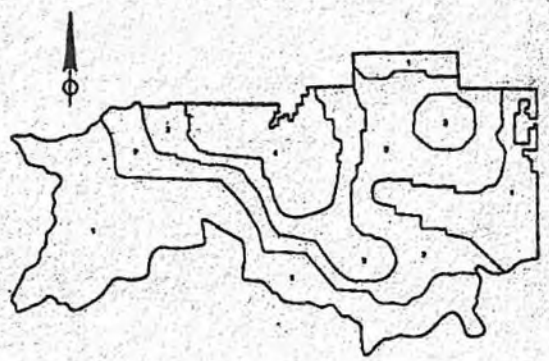

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Introduction

The problem of identifying and assessing the effects of casual surface collection on variability in archaeological remains is one that must be dealt with prior to developing behavioral interpretations of archaeological materials through the use of surface collections alone. This paper will attempt to identify and assess the effects of casual and unsystematic surface collection on the chipped stone assemblages from sites located during the 1976 survey of the Little Colorado Planning Unit.

It is assumed that artifacts are not collected randomly, but that certain artifacts will be collected before others. In the case of chipped stone assemblages:

1. Projectile points and other formalized tools are preferred over debitage.

2. Artifacts manufactured from raw materials such as cherts are preferred over those made of basalts.

3. Collection of lithics reduces the total number of lithics found on a site.

These assumptions lead to the following hypotheses and test implications:

1. Relatively lower ratios of tools and utilized flakes to debitage will be found on heavily collected sites.

2. Relatively fewer categories of tools will be found on heavily collected sites.

3. Fewer varieties of cherts will be found on heavily collected sites.

4. Higher proportions of basalts to cherts will be found on heavily collected sites.

5. Lower lithic densities per square meter will be found on heavily collected sites.

Several variables are meaningful in predicting the amount of casual surface collection that has occurred on a site. Among these are its accessibility and its visibility. In this paper the accessibility of a site will be measured in 2 ways: distance to the nearest road and distance to private land. Much of the private land located within the Little Colorado Planning Unit consists of small enclaves of private holdings surrounding old homestead and ranch houses. In many cases these enclaves are completely surrounded by United States Forest Service lands. In addition, much of the Forests lands adjacent to these ranches is leased for cattle grazing and is heavily traveled by private land owners. Site visibility should be indicative of the amount of casual collecting of sites. This phenomenon is measured by the vegetation density of the land surrounding the site.

Methodology

Chipped stone artifacts from a total of 22 of 42 sites located in the Little Colorado Planning Unit were used in the present analysis. Only sites on which surficial lithics were present and either a random or total collection made were included. Of these 22 sites, 8 are architectural sites with 3 or more rooms and 5 sites are 1- or 2-room structures. There are 2 lithic scatters and 6 lithic/sherd scatters, and 1 isolated pithouse.

In Table 45 the lithic typology and definitions used in this study are described. This typology, which employs artifact types defined by Plog (1974:182-184) for the Hay Hollow Valley, and Decker (1976) and Green (1976) for the Chevelon Archaeological Research Project, is based primarily on morphological criteria of flakes and functional criteria such as edge angle, orientation of use edge, shape of the use edge, length of the use edge, and wear patterns. It also includes a series of technological variables. As such, this typology is designed to measure the variability in the distribution of activities among sites as manifested by the chipped stone assemblages. Both a 10x hand lens and a 40x binocular microscope were used to determine utilization on flakes. Care was taken to control for "bag retouch;" cases where edge damage consisted of only 1 or 2 flakes detached from the edge or where flake scars appeared to be recent and clean were considered as debitage. In Table 45 the raw material classification used in this study is also identified.

Table 46 defines variables pertaining to sites and their surroundings: site type, size, number of rooms, on-site vegetation zone, and lithic density. Surface artifact scatters are broken down into 2 categories--lithic scatters only, and lithic/sherd scatters. Table 46 also contains the variable of site slope which will be used to control for erosional and depositional factors that will influence the surficial lithic densities of sites.

The remaining variables in Table 46 are those that are hypothesized to be predictive of artificial impact due to casual collection and digging on sites (distance to nearest road, type of road, distance to private land, vegetation density, and the extent of pothunting as assessed in the field). Definitions of distance to roads and the types of roads, as well as vegetation density and distance to private land have been discussed earlier. All variables were measured using USGS 7.5' and 15' quad maps and "resource" photographs of the Little Colorado Planning Unit provided by the Apache-Sitgreaves National Forests. The extent of pothunting was obtained from field assessments of artificial impact noted on Arizona State University site survey forms.

Behavioral Analysis--Little Colorado Planning Unit

Following completion of laboratory analysis, various descriptive statistics were computed for all variables using Version 6 of the Statistical Package for the Social Sciences (Nie, et al., 1975). This task was intended to generate a description of the variability within the data

Table 45. Lithic typology.

1. Tools--any object deliberately retouched for function or modified due to use.

   A. Flake Tools

      Projectile Point--symmetrical pointed biface.

      Biface--flake that has been bifacially retouched after removal from a core. Function: cutting and sawing.

      Scraper/Knife--flake showing evidence of utilization or modified unifacially. Function: scraping and cutting.

      Bec--flake retouched after detachment from a core to form a single projection. Function: perforating tool for hides.

      Notch--flake with distinct concavity produced by retouch. Function: bone and wood working, shaft straightening.

      Point Wear--Unmodified flake with pointed edge showing evidence of utilization. Function: perforating tool.

      Burin--flake that has had burin spalls removed to form a chisel edge. Function: engraving or grooving.

      Denticulate--flake retouched to form a toothed or serrated edge. Function: shredding.

   B. Core Tools

      Chopper--stone with flakes removed from either face to make a high-angled cutting tool with evidence of battering on the edge.

      Hammerstone--shows evidence of battering on 1 or both ends.

2. Manufacturing Debris

   A. Core--piece of stone from which flakes have been detached.

   B. Unutilized Flakes

      Primary Reduction--flake having dorsal face with 100% cortex and no dorsal scars.

      Secondary Reduction--flake with at least 1 dorsal scar, and some cortex present on the dorsal surface.

      Trimming and Shaping Flakes--bifacial reduction flakes, thinning flakes, pressure flakes and resharpening flakes.

Table 45 (Concluded).

C. Amorphous Shatter--fragments of flakes with striking platform and termination absent.

Raw Material Types

Basalt
Obsidian
Metamorphosed Shale or Siltstone
White Siliceous Chert
Tan Chert
Grey Chert
Chalky Chert
Quartzite

Table 46. Site Variables.

Site Type--

A. Pueblo with 3 or more contiguous surface rooms.

B. Isolated rooms.

C. Lithic scatter.

D. Lithic scatter/sherd scatter.

E. Isolated pithouse.

Site Size--measured in square meters.

Number of Rooms--Subsurface or surface rooms.

On-site Vegetation Zone--

A. Juniper-pinyon woodland.

B. Ponderosa pine forest.

Site Slope--measured in percent.

Lithic Density--number of lithics per square meter.

Distance to Nearest Road--measured in meters.

Road Rank--

A. Paved highway.

B. Improved dirt or gravel road.

C. Unimproved jeep trail.

Table 46 (Concluded).

Distance to Private Land--measured in miles.

Vegetation Density--percentage of area 100 m radius around site covered by arboreal vegetation.

Degree of Pothunting--as assessed on field forms.

A. No apparent impact.

B. Minor impact--grazing and minimal disturbance by pothunters.

C. Major impact--trails through sites or heavy disturbance by pothunters.

base. Summary tables of these descriptive statistics and additional statistics not included in this paper are on file in the Department of Anthropology, Arizona State University.

Several statistical tests available in SPSS Version 6 (Nie et al., 1975) were used to examine the relationships between the chipped stone assemblages and variables describing erosional and depositional factors, behavioral differences between sites, and the degree of casual surface collection.

Slope

A difference of means test was used to evaluate the effect of slope on lithic densities of sites (see Table 47). The slope of the site had only a minimal effect on the mean lithic density. As expected, densities of lithics on sites located on steeper slopes are lower than on sites located on relatively flat surfaces. However, this difference is not statistically significant.

It should be noted that the SPSS sub-routine T-TEST, used in this paper, calculates a value for the statistic T and a p-value for the pooled variance estimate and an approximation to T and the p-value for a separate variance estimate (Nie et al., 1975). Values reported in this paper for the statistic T are those for separate variance estimates, and all p-values that are reported for both difference of means and analysis of variance are for 2-tailed tests.

Vegetation Type

Difference of means tests were also used to determine differences in lithic densities and tool/non-tool ratios in relation to the predominant on-site vegetation type. Meaningful differences in these 2 variables would be related to (a) differences in activities carried out within these major vegetation zones, or (b) visibility and casual surface collecting. However, as can be seen from Table 47, differences in the means of both variables between vegetation zones were minimal and statistically insignificant,

Table 47. Difference of means test of on-site vegetation zone and slope for the Little Colorado Planning Unit.

Variable	Groups	Mean	T	p-value
	Vegetation Zones			
Lithic Density	Juniper-Pinyon	0.8056	0.47	0.656
	Ponderosa	0.6500		
Tool/Non-Tool Ratio	Juniper-Pinyon	0.1788	-0.04	0.971
	Ponderosa	0.1841		
	Slope			
Lithic Density	1% - 6%	0.9333	0.92	0.372
	10% - 40%	0.6083		

indicating that it would not be necessary to control for vegetation type when examining the artificial impact of sites.

Site Function and Type

Results of differences of means tests between site types for the variables of lithic density and tool/non-tool ratios are reported in Table 48. It was expected that lithic densities would reflect behavioral differences between site types--higher densities on larger architectural sites (due to longer periods of occupation and/or more varied activities) as opposed to surface scatters. These expectations were not confirmed, as no statistically significant differences in the mean lithic density between site type occurred. The overall uniformity of densities is felt to be related to the degree of unsystematic collection and excavation. If all site types were subjected to equal amounts of casual collection any differences in densities between site types due to prehistoric behavior would be preserved. In fact, densities on sites with 3 or more rooms were lower than densities on lithic/sherd scatters and equal to densities of lithic scatters. This variation suggests that the larger architectural sites are more subject to amateur collection than surficial scatters. In order to test this hypothesis, the Chi-square test for independence (Blalock 1972) was performed. This test utilized a 6-cell contingency table cross-tabulating architectural sites and surface artifact scatters against the degree of pothunting. Computation of the test statistic yielded $X^2 = 7.76$ (df = 2), and $P = 0.0517$. Apparently, architectural sites tend to be more severely pothunted than do non-architectural sites.

Results of similar differences of means test for the variable of tool/non-tool ratio between site types indicate that tool/non-tool ratios do appear to reflect variation in site types (see Table 48). In general, architectural sites had higher mean tool/non-tool ratios than lithic

Table 48. Difference of means test between site types, Little Colorado Planning Unit.

Site Types	Mean	T	p-value
Artifact Density			
3-room Pueblos	0.6500	-0.29	0.782
Isolated Rooms	0.8000		
3-room Pueblos	0.6500	0.00	1.000
Lithic Scatters	0.6500		
3-room Pueblos	0.6500	-0.39	0.701
Lithic/Sherd Scatters	0.8167		
Isolated Rooms	0.8000	0.33	0.756
Lithic Scatters	0.6500		
Isolated rooms	0.8000	-0.03	0.976
Lithic/Sherd Scatters	0.8167		
Lithic Scatters	0.6500	-0.49	0.640
Lithic/Sherd Scatters	0.8167		
Tool/Non-Tool Ratios			
3-room Pueblos	0.2132	-0.26	0.801
Isolated Rooms	0.2519		
3-room Pueblos	0.2132	2.31	0.054
Lithic Scatters	0.0278		
3-room Pueblos	0.2132	0.85	0.413
Lithic/Sherd Scatters	0.1378		
Isolated Rooms	0.2519	1.80	0.147
Lithic Scatters	0.0278		
Isolated Rooms	0.2519	0.88	0.421
Lithic/Sherd Scatters	0.1378		
Lithic Scatters	0.0278	-2.96	0.031
Lithic/Sherd Scatters	0.1378		

scatters (p-values of 0.054 and 0.147) indicating a greater range of activities involving tool use, rather than manufacture, on architectural sites. Lithic/sherd scatters also had significantly higher mean tool/non-tool ratios than lithic scatters (p-value of 0.031), indicating more intense tool use as opposed to tool manufacture. This suggests that architectural sites are habitation sites, lithic-sherd scatters are special-use processing loci, and lithic scatters are special-use manufacturing loci or chipping stations.

Analysis of Artificial Impact Due to Casual Surface Collection: Analysis of Variance

One-way and 2-way analyses of variance (Nie et al., 1975) were used to test for differences of lithic densities and tool/non-tool ratios between groupings of sites suggested by the distributions of variables of vegetation density, distance to the nearest road, and the distance to private land. Correlation coefficients are also reported in order to summarize the relationship between the 2 variables and to indicate the degree to which variation in 1 variable is related to variation in the other.

Table 49 reports the results of these tests for the variable of lithic density. In the 1-way analysis of variance tests, the only variable that significantly affected lithic density was that of distance to the nearest road (p-value 0.043). The chances are approximately 4 out of 100 that the mean densities of lithics from sites within 150 m of roads and densities of sites at a greater distance are samples drawn from the same populations. The correlation coefficient of these 2 variables obtained using the SPSS sub-routine SCATTERGRAM (Nie et al., 1975) illustrates the nature of the effect of distance to the nearest road. As the distance to the nearest road increases, lithic density also increases ($r = 0.51502$); this accounts for approximately 26% of the variability in lithic density ($r^2 = 0.26524$) at a significance level of 0.01418. Although the effects of the other variables were not statistically significant, the general trend of lithic density over these variables followed the hypothesized pattern, i.e., lower densities on sites near private land and in areas of sparse vegetation.

The results of these tests strongly support the original hypotheses outlined earlier in this paper. In the case of lithic assemblages, significantly lower lithic densities are found on sites within 150 m of the nearest road, as compared with sites that are more distant. This pattern is taken to be strongly indicative of the degree to which sites within 150 m of roads are subjected to a greater amount of casual collection and excavation.

Two-way analysis of variance (Nie et al., 1975) using lithic density as the dependent variable and distance to nearest road and to private land as independent variables, was used to measure the overall interaction effect between the 2 independent variables. Similar results to the 1-way analysis of variance were obtained with this test. Distance to the nearest road

Table 49. Analyses of variance of lithic densities.

Variable	Groups	Source of Variation	Sum of Squares	F-Ratio	p-value
Vegetation Density	0% - 7% 21% - 33% 45% - 66% 85% - 99%	Between Within	1.1193	0.564	0.638
	r_2 = 0.23482 r^2 = 0.05514				
	Significance = 0.30555				
Distance to Nearest Road in Meters	0 - 150 m 325 - 550 m 840 - 1500 m	Between Within	3.4804 8.9583	3.691	0.043
	r_2 = 0.51502 r^2 = 0.26524				
	Significance = 0.01418				
Distance to Private Land in Miles	0.0 - 0.5 mi 0.6 - 1.5 mi	Between Within	0.9139 11.5248	1.586	0.220
	r_2 = 0.26357 r^2 = 0.06947				
	Significance = 0.24833				

Variable	Source of Variation	F	Significance of F	Eta	Beta
Distance to Nearest Road and Distance to Private Land	Main Effects	2.890	0.067	0.53	0.49
	Distance to Road	3.245	0.064	0.27	0.12
	Distance to Private Land	0.369	0.999		
	2-way Interactions	2.499	0.112		
	Road - Land	2.499	0.112		
	Explained	2.734	0.057		
	Residual				
	Multiple r_2 = 0.541 Multiple r^2 = 0.292				

road had the strongest effect on lithic densities. The value of multiple r^2, indicating the cumulative proportion of variation in densities explained by the distance that sites are located from both roads and private land is about 30% (r^2 = 0.292). This result again strongly supports the original hypotheses outlined earlier. Although the distance between a site and a road is the primary variable affecting the degree to which that site is likely to be collected or excavated unsystematically, the addition of nearness to private land slightly increases that likelihood.

An analysis of variance was done in order to demonstrate the effects of distance to road on lithic densities, controlling for site type. However, this approach so severely reduced the sample size in each category that the results were spurious.

Similar tests (1-way and 2-way analysis of variance, correlation) were done to evaluate the relationships between tool/non-tool ratios and the independent variables of vegetation density, distance to the nearest road, and the distance to private land. Somewhat varied results were obtained here. Neither vegetation density, nor distance to the nearest road had a statistically significant effect upon the tool/non-tool ratios (see Table 50). Although the effect of vegetation density was insignificant, the overall pattern of variation in tool/non-tool ratios followed the expectations of the hypotheses. This can be seen in the value of the correlation coefficient r; fewer tools and utilized flakes in relation to debitage are found on sites located in areas of sparse vegetation. The value of r for the test of the effects of the distance to the nearest road indicates that almost no relationship exists between the 2 variables of tool/non-tool ratios and the distance to the nearest road.

The 2-way analysis of variance (Table 50) illustrates the counteracting effects of distance to the nearest road and the distance to private land. The distance to private land had a statistically significant effect (p-value = 0.031), while the effect of distance to the nearest road was insignificant (p-value = 0.999) in explaining the variation in tool/non-tool ratios. When the effect of distance to nearest road is added to that of distance to private land, the overall significance of the test is severely reduced (p-value = 0.374). This result is even more clearly illustrated when the significance of the interaction effects is examined. In the case of tool/non-tool ratios, the interaction effect (Table 50) of distance to roads and to private land was statistically insignificant (p-value = 0.999), while in the case of lithic density, the interaction effects (see Table 49) were stronger (p-value = 0.112).

An Approach Based on Discriminant Function Analysis

The strong correlation of tool/non-tool ratios with groupings of sites based on the distance to private land suggested the possibility that these groupings represented groups of functionally similar site types. Discriminant function analysis (Nie *et al.*, 1975) was used to test this hypothesis. A similar discriminant function analysis was done

Table 50. Analysis of variance of tool/non-tool ratios.

Variable	Groups	Source of Variation	Sum of Squares	F-Ratio	p-value
Vegetation Density	0% - 7% 21% - 33% 45% - 66% 85% - 99%	Between Within	1.1193 11.2387	0.564	0.635
		$r = 0.17732$ $r^2 = 0.03144$			
		Significance = 0.44193			
Distance to Nearest Road in Meters	0 - 150 m 325 - 550 m 840 - 1500 m	Between Within	0.0078 0.8005	0.092	0.505
		$r = -0.03198$ $r^2 = 0.00102$			
		Significance = 0.88765			
Distance to Private Land in Miles	0.0 - 0.5 mi 0.6 - 1.5 mi	Between Within	0.2029 0.6054	6.702	0.017
		$r = -0.50637$ $r^2 = 0.25641$			
		Significance = 0.01916			

Variable	Source of Variation	F	Significance of F	Eta	Beta
Distance to Nearest Road and Distance to Private Land	Main Effects	1.904	0.169	0.10	0.11
	Distance to Road	0.125	0.999	0.50	0.54
	Distance to Private Land	5.504	0.031		
	2-way Interactions	0.026	0.999		
	Road - Land	0.026	0.999		
	Explained	1.153	0.374		
	Residual				

Multiple $r = 0.512$
Multiple $r^2 = 0.262$

to test this same hypothesis for groupings of sites based on distance to nearest roads. The results of these analyses are presented in Table 51.

In this study discriminant function analysis was used as a classificatory device. Discriminant analysis begins with a distinction between 2 or more groups of cases. In order to distinguish the groups, a set of discriminating variables that measure characteristics on which the groups are expected to differ is selected. In this case, 2 groups of sites based on distance to private land, and 3 groups of sites based on distance to nearest road, were hypothesized to be distinguished by variables pertaining to site function (number of rooms, site size, lithic densities, tool/non-tool ratios, and number of lithics in all typological categories). After the computation of several discriminant functions which serve to identify the variables which contribute the most to the differentiation of the groups, a series of functions are derived which permit the classification of new cases with unknown membership.

In order to check the adequacy of the derived functions, the original set of cases is classified in order to determine how many are correctly classified by the variables being used. This is done by computing a probability of membership in the respective group for each case, and the case is assigned to the group with the highest probability. In this particular analysis, if the discriminant analysis showed high percentages of correct classifications for each group, the groups would most likely represent functionally similar site types. If the percentage of correct classification was poor, the groups would cross-cut functional site types and would thus suggest that sites were being grouped on the basis of artificial impact, rather than site function. All sites were used in this analysis in order to keep the total sample size as large as possible.

In the case of distance to private land, the percentage of correct classification of 2 groups of sites was 100% (Table 51). Checks as to which site types as defined earlier were classified into each group showed that the majority of architectural sites fell into the group of sites located within 0.5 mi of private land, while 1/2 of the non-architectural sites fell into each group. The distribution of private land closely coincides with the distribution of arable land and permanent streams within the Little Colorado Planning Unit. Thus, it is felt that the groups of sites based on the distance to private land highly reflect the distribution of functionally similar site types in relation to the availability of arable land and permanent water sources.

Table 51 also shows that for distance to nearest road, the percentage of correct classification of 3 groups was only 77%. Group 1 (0-150 m) did appear to maintain some integrity; however, Group 2 (325-550 m) merged with Group 1. Group 2 and Group 3 (840-1500 m) appeared to be quite similar. All types of sites as defined earlier were evenly distributed between the 3 groups. This suggests that groups initially defined by their distance to the nearest road cross-cut functional variability between site types and are based on the degree of casual surface collecting and excavation. This is further reinforced by the results of difference of means tests between lithic density and the 3 categories of extent of pothunting (Table 52). The results of these tests show that significantly lower mean lithic

Table 51. Result of discriminant function analysis.

Groups Defined by Distance to Private Land

Summary Table Step Number	Variable Entered	F to Enter	Wilk's Lambda	Sig.
1	TR	6.70154	0.74902	0.017
2	Trimming Flakes	2.48691	0.66233	0.020
3	Artifact Density	6.36878	0.48923	0.004
4	Bifaces	6.51879	0.35363	0.001
5	Becs	2.37688	0.30789	0.001
6	Shatter	2.52384	0.26355	0.001
7	Point Wear	3.21773	0.21429	0.001

Prediction of Classification Results

Groups	Cases	Predicted Group 1	Predicted Group 2
Group 1 (0.0 - 0.5 mi)	13	13 (100%)	0
Group 2 (0.6 - 1.5 mi)	9	0	9 (100%)

Percent of "grouped" cases classified correctly: 100%.

Groups Defined by Distance to Nearest Road

Summary Table Step Number	Variable Entered	F to Enter	Wilk's Lambda	Sig.
1	Artifact Density	3.69074	0.72020	0.043
2	Shatter	3.03911	0.53840	0.022
3	Choppers	3.49131	0.38164	0.008
4	Notches	1.71433	0.31429	0.010
5	Becs	1.15584	0.27232	0.016

Prediction of Classification Results

Groups	Cases	Predicted Group 1	Predicted Group 2	Predicted Group 3
Group 1 (0 - 150 m)	12	11 (91.7%)	1 (8.3%)	0 (0%)
Group 2 (325 - 550 m)	6	2 (33.3%)	3 (50.0%)	1 (16.7%)
Group 3 (840 - 1500 m)	4	0 (0%)	1 (25.0%)	3 (75.0%)

Percent of "grouped" cases classified correctly: 77.27%.

densities are found on sites where major vandalism had occurred, as opposed to sites which were only minimally disturbed by pothunters or exhibited no apparent impact.

Table 52. Difference of means tests of lithic density and extent of pothunting.

Groups	Mean	T-value	p-value
1-No Apparent Impact	0.8778	-0.8952	0.2000
2-Minor Disturbance	1.3400		
2-Minor Disturbance	1.3400	2.2523	0.0295
3-Major Vandalism	0.3125		
1-No Apparent Impact	0.8778	2.0829	0.0650
3-Major Vandalism	0.3125		

Chi-Squared Analyses

The X^2 test was used in order to evaluate the hypothesis that fewer categories of tools are found on more severely impacted sites. This test yielded a value for the X^2 statistic of 0.822 with 1° of freedom ($p = 0.381$). The results of this test indicate that there is no strong association between the 2 variables. Sites that are within 150 m of the nearest road had similar numbers of categories of tool types as did sites located further from roads. This test does not strongly support the hypothesis, however, it only takes into account the number of tool type categories, rather than the type of tool itself. For example, the test may have been more meaninfgul had the number of projectile points found on sites within 150 m of a road been compared with the number of projectile points found on sites located farther from roads. However, as no projectile points were in the sample of lithics used in this study, this test could not be performed.

Raw Material

In dealing with raw material types, it was argued that severely impacted sites would show higher quantities of basalt as compared to cherts. Preliminary to testing this hypothesis, a difference of means test between raw material categories was done. The results of this test (Table 53) show that the amount of a locally-occurring siliceous chert is significantly higher than all other categories of raw material types. This test indicates that basalt was used to only a minor extent throughout the Little Colorado Planning Unit, and further testing of this hypothesis would be meaningless. Only 1 site [AZ Q:15:4 (ASU)] showed higher percentages of basalt over siliceous material. Basalt was probably not widely available over the entire area. Other types of cherts (tan chert and

grey chert) do not appear to occur locally and their occurrence was confined to only 1 or 2 sites, indicating that their usage by prehistoric populations in the Little Colorado Planning Unit was limited.

Table 53. Difference of means tests of raw material types.

Raw Material	Mean	T	p-value
Basalt	6.8636	-2.60	0.017
Siliceous	15.5909		
Basalt	6.8386	1.35	0.191
Quartzite	4.2727		
Basalt	6.8636	2.40	0.026
Metamorphosed	2.4091		
Siliceous	15.5900	4.37	0.000
Quartzite	4.2727		
Siliceous	15.5909	4.91	0.000
Metamorphosed	2.4091		
Quartzite	4.2890	1.73	0.099
Metamorphosed	3.8750		

Non-Parametric Alternatives

Due to small sample sizes in many of the groups used in the statistical procedures of the analysis, selected non-parametric tests were run in addition to parametric versions reported here, as a check on the reliability of the parametric procedures. Non-parametric tests do not require the assumption of normally-distributed underlying populations, as do their counterparts (Hollander and Wolfe 1973). Test statistics are calculated from the ranks of the observations, rather than their actual magnitudes, as are the parametric tests, and are not subject to deviation from normality.

The Mann-Whitney U statistic was calculated as an alternative to the T-test; the Kruskal-Wallis test was used in lieu of 1-way analysis of variance; and Kendall's Tau was calculated in place of the correlation coefficient r. Although results of these tests are not reported here, results are on file at the Department of Anthropology, Arizona State University. Briefly, results of the non-parametric tests compared very favorably with the parametric versions, and their results strengthened inferences and conclusions drawn from the parametric procedures.

The Mann-Whitney U statistic was used to test for differences in lithic density and tool/non-tool ratios between site types. Lithic

density tests yielded exactly the same results as the T-tests. Using tool/non-tool ratios, functional differences were less marked.

Kruskal-Wallis 1-way analysis of variance and Kendall's Tau rank order correlation coefficient were used to test hypotheses related to the impact of casual surface collection. Results of these tests more strongly confirmed the hypotheses. In the case of lithic densities, all results were substantially the same as the parametric results: only distance to the nearest road affected lithic densities using the Kruskal-Wallis test. Using Kendall's Tau, both distance to nearest road and distance to private land were directly correlated with lithic density.

Using the Kruskal-Wallis test, again only distance to private land significantly affected tool/non-tool ratios. The Kendall's Tau statistic again showed their inverse correlation. The only difference between results obtained with parametric procedures was that vegetation density and tool/non-tool ratios were directly correlated using Kendall's Tau. Using the parametric correlation coefficient r, they showed no relationship.

In summary, functional variation in chipped stone assemblages between site types was not as apparent using non-parametric tests, and non-parametric tests yielded stronger confirmation of hypotheses pertaining to casual collection. Both distance to private land and distance to nearest road strongly affected lithic densities and vegetation density strongly affected tool/non-tool ratios. Results of non-parametric tests agreed substantially with parametric tests, speaking well for the robusticity of normal theory tests using small samples.

Conclusions and Recommendations

In summary, densities and tool/non-tool ratios of chipped stone artifacts from sites within the Little Colorado Planning Unit exhibit variation that can be explained by reference to differences between sites and to similarities and differences in the amount and degree of casual collection and excavation post-dating their original deposition. Lithic densities were quite uniform between site types. This uniformity appears to be due to greater amounts of casual surface collection of large architectural sites as opposed to surficial artifact scatters. Functional differences between site types were still apparent when examined in light of tool/non-tool ratios.

In terms of the hypotheses and test implications outlined in Lightfoot and Francis (this volume) and in the initial part of this paper, only the distance to the nearest road had any statistically significant effect on lithic densities. Variation in lithic densities appears to be highly related to the degree of casual surface collection and excavation, and the direct correlation of density and distance to the nearest road appears to cross-cut functionally defined site types. The degree of casual collection appears to be the most severe on sites that are located within 150 m of unimproved roads such as 4-wheel drive jeep trails.

The only variable that significantly affected the tool/non-tool ratios was that of distance to private land. This effect was an indirect correlation--the opposite of what was expected. This correlation appears to be related to functional site types in that larger sites with higher tool/non-tool ratios are consistently located within 0.5 mi of private land reflecting the distribution of arable land and permanent streams within the Little Colorado Planning Unit.

Hypotheses and test implications pertaining to the number of tool categories per site and the raw material composition of lithic assemblages were not confirmed.

Lithic density, rather than tool/non-tool ratios and tool type categories, was the most strongly affected by variables relating to the degree of casual surface collection. The variables of distance to the nearest road and to private land accounted for a substantial amount of the variation within lithic densities--30%. The results of this study suggest that variables strongly related to the degree of casual collecting may be of use to the archaeologist in attempting to explain intersite variation, in addition to variables relating to temporal, spatial, and behavioral diversity. Unsystematic surface collection and excavation of sites occurs after the original deposition of cultural materials and becomes relevant to the archaeologist in that it is an additional source of variation producing diversity among archaeological remains above and beyond depositional and behavioral factors (Schiffer 1976). Although such variables as distance to the nearest road cannot be considered relevant to prehistoric behavior, such variables may bias behavioral interpretations of prehistoric data in areas that have been well known archaeologically for long periods of time. This bias should be identified and controlled for by the archaeologist when dealing with the reconstruction of prehistoric behavior. In the case of the Little Colorado Planning Unit, distance to the nearest road certainly does not explain all variation seen within the chipped stone collections; however, it does act to obscure behavioral diversity among sites.

In the context of planning unit studies the accessibility of any given site as measured by the nearness of roads will have a very significant effect on the degree of unsystematic surface collection and excavation that a site will be subjected to. This effect will more likely be observed not only in reference to roads, but in reference to planned camping areas, picnic grounds, and other recreational areas intended for public use on the Apache-Sitgreaves National Forests. The increased accessibility of more remote regions of the Forests due to greater use of off-road vehicles is already affecting the cultural resources within the Forests. In the event that new areas of the Forests are opened to off-road vehicle traffic, the degree of impact to sites in such areas will only be increased. Regular monitoring of currently used campgrounds and well-traveled roads within the Forests may be of use in keeping impact due to unauthorized collection and excavation to a minimum. Awareness of Forest Service personnel in areas of high site density and cultural resources near current campgrounds may also aid in reducing such impact. If at all possible, future recreational areas should be planned so that the number of sites impacted, as well as the degree of impact, can be

kept to a minimum. Finally, although not strongly suggested in this study, the greatest degree of actual potting may be going on on Forest Service lands that are adjacent to parcels of private land within the Forests. Monitoring of these areas may aid in keeping major impact to cultural resources to a minimum.

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Archaeology Southwest™

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The Great Bend of the Gila

William H. Doelle and Andy Laurenzi, Center for Desert Archaeology
Ella Pierpoint, Arizona Site Steward

FROM ITS SOURCE in the highlands of western New Mexico, the Gila River flows for nearly 650 miles in a westerly direction to join the Colorado River at Yuma. Just forty miles southwest of downtown Phoenix, the Gila River makes a very sharp bend to the south. After twenty-two miles, it turns abruptly to the west-northwest. This "Great Bend of the Gila" was carved as the river's waters were pushed left and right by the unique geology of this area. Several ancient volcanoes and extensive lava flows flank much older sedimentary layers that are exposed in the Gila Bend Mountains (see map on pages 6–7).

Henry D. Wallace

This distinctive pair of petroglyphs is extraordinarily large. Together, they convey a dynamic scene of a hunter with bow and arrow (right) aimed at a prey animal (left). The hunter image has had a second, very bold design of interlocking scrolls pecked over it.

Since ancient times, countless travelers have passed through the Great Bend. The river was essential to a prehistoric trail network linking the California deserts, lower Colorado River, and Gulf of California with the verdant Salt and middle Gila river valleys. European explorers and Euro-American travelers crossed this arid landscape in close proximity to the river. Remnants of their passage are still visible today.

The Gila River sustained many communities for hundreds of years: Mimbres villages in its upper reaches, Hohokam irrigation farmers between Safford and Gila Bend, and Patayan groups from Gila Bend to Yuma (see map on page 2). In the Great Bend, the two desert cultures met. Substantial Hohokam ballcourt villages were established along the margins of the floodplain here, and an early Hohokam platform mound was built at the Gatlin site, north of Gila Bend. These settlements thrived from the 800s to the 1100s. By the 1100s, Patayan groups had also moved into the region. Areas of culture contact such as this are dynamic places—sometimes creative and peaceful, at other times socially tense, and, in extreme cases, torn by conflict.

Much of this story is—literally—written upon the rocks. Taking advantage of the lava flows and volcanic features along the river, native peoples transformed long stretches of the Great Bend of the Gila into an extraordinary gallery over the past two millennia. These fragile traces of the past have yet to be fully explored.

This issue of *Archaeology Southwest* presents several thousand years of human history along the Great Bend of the Gila. We tap the records of early travelers and archaeologists to reveal some of the hidden history of a unique, sometimes overlooked, cultural landscape.

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Hohokam and Patayan

ONE OF THE MOST COMPELLING aspects of archaeology in the Great Bend of the Gila is the growing body of evidence that people from two distinct cultural traditions, Hohokam and Patayan, lived there, concurrently, for several centuries.

Archaeological surveys of the lower Gila region in the 1950s and 1960s identified a pattern: Patayan pottery was more abundant west of the Painted Rock Mountains, and Hohokam pottery was more common to the east of this range. Likewise, large sites with Hohokam ballcourts were found east of the Painted Rock Mountains. These ballcourt villages were settled around A.D. 800 and inhabited until about 1150. At least four major canal systems served these settlements, and some canals may have served as many as three villages.

Archaeological work conducted in anticipation of the Painted Rock Dam and Reservoir, which was completed in 1965 (see map on pages 6–7), found smaller sites containing mostly Patayan ceramics in areas closer to the Gila River. Albert Schroeder, a National Park Service archaeologist who performed an initial survey for the project, thought that these sites represented the movement of Yuman speakers from the lower Colorado River into the area by 1100.

Two recent excavations near Gila Bend provided intriguing glimpses into Hohokam-Patayan interaction in the centuries between 1000 and 1200. Excavations by Rio Salado Archaeology at a site southeast of the Gillespie Dam (see map on pages 6–7) revealed two contemporaneous burial areas that were very different from each other: based on the associated ceramics, one was clearly Hohokam, and the other was distinctly Patayan. Rio Salado archaeologist Glen Rice thinks both groups lived in the community at the same time. The presence of Patayan households within Hohokam communities is also seen at the ballcourt village of Las Colinas, on the western side of Phoenix.

At the same Gillespie Dam site, a few hundred yards to the north, archaeologists from Desert Archaeology, Inc., discovered a series of exceptionally large Hohokam pithouses—one more than 1,000 square feet in floor area, five times the usual square footage (see *Archaeology Southwest* 21[4]). Built and used in sequence, these structures may have been formal meeting places for heads of household who provided leadership for the community.

It is striking that leadership and ritual in this apparently multicultural community did not employ a ballcourt or a platform mound, as we see at other Hohokam sites in this time period. The nearby and roughly contemporaneous Gatlin site (see page 4), for example, had a platform mound as a community focus. The mound was excavated by Arizona State Museum archaeologists William Wasley and Albert Johnson in the winter of 1958–1959. Although they interpreted the site as a vacant ceremonial center, we now think it was a thriving community of some 500 residents. Clearly, there is much to learn about how Hohokam and Patayan people were living and working together within and among villages, and how community-level decisions might have been made.

Catherine Gilman

Three major cultural traditions were found along the Gila River around A.D. 1000 to 1150. Archaeologists use the term Patayan to describe a prehistoric culture associated with the lower Colorado and lower Gila rivers. These people produced pottery collectively known as Lower Colorado Buff Wares, and they are believed to be ancestral Yuman.

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Henry D. Wallace

Henry D. Wallace

Top: Aerial view of very large Hohokam pithouses at the Gillespie Dam site. Left: Many of the region's ballcourt villages have been destroyed by agricultural development and flooding from the Painted Rock Dam. This aerial image shows two of six known remaining courts; at least twelve were originally documented. One court is in the center of the photo; the other, subtler depression is in the upper right.

There is linguistic, historical, and oral history evidence of close, long-term contact between Hohokam and Patayan people, as well. Archaeologist John Andresen and linguist David Shaul examined words shared by Yuman speakers of the lower Colorado River area and Piman, or O'odham, speakers. Their conclusion, reported almost twenty years ago, was that Yuman and O'odham speakers probably interacted very closely for at least several centuries around A.D. 1000.

When Father Kino passed through Gila Bend in 1699, he observed settlements of Yuman speakers to the west, O'odham speakers to the east, and bilingual people in the middle. By the mid-1800s, warfare with lower Colorado River groups had forced the abandonment of the Gila Bend area. People resettled farther upstream with allies and relatives living on the stretch of the Gila between Coolidge and the junction of the Gila and Salt rivers. The Salt River Pima-Maricopa Indian Community and the Pee Posh (Maricopa) and Akimel O'odham (Pima) of the Gila River Indian Community continue to recognize the languages and cultural traditions of this earlier time.

The Gatlin Site, a National Historic Landmark

THE GATLIN SITE National Historic Landmark (NHL) and Archaeological Park preserves and interprets a major Hohokam village that was inhabited from A.D. 800 to 1200. The Gatlin site—also known as the Gila Bend site—had two ballcourts, a unique platform mound, a large plaza, and more than thirty trash mounds. The platform mound dates to the 1100s, which makes it earlier than other mounds outside the lower Salt and middle Gila river areas. Furthermore, it seems to be the only platform mound ever built in the Great Bend area.

Thirty acres of the site were designated as a NHL in 1964, following William Wasley and Albert Johnson's excavations; this represents only a portion of the site. The Town of Gila Bend purchased the NHL property in 1986 and an adjoining eighty acres to the south in 1987. Although the twelfth century settlement covered nearly twice this preserved area, the Town of Gila Bend's Gatlin Site Archaeological Park contains a substantial portion of the original core of the community.

The Gatlin Steering Committee was established in 1990. Consulting archaeologist David Doyel has led development, interpretive, and preservation efforts at the site, and a diverse group of volunteers has devoted time to these projects. Funding has come from local, state, and federal sources.

As a result of these efforts, the site is now fenced; sixteen trash mounds have been stabilized; a road and a power line through the site have been formally abandoned; portions of the site are landscaped with native plants; and entry and exit roads, as well as a parking area, have been developed. Interpretive elements include walking-tour trails, ramadas, signage, and replica pithouses. At present, the park is open for walking tours and special events by prior arrangement with the Town of Gila Bend (928-683-2255).

Ella Pierpoint

Reconstructed pithouse at the Gatlin Site Archaeological Park.

Ancient Rock and the Great Bend Gallery

Jim Mathews

Desert Archaeology, Inc., archaeologist Henry Wallace discusses a Gila Bend petroglyph panel.

THE GREAT BEND OF THE GILA is a dramatic landscape, bounded by a volcanic field, cleaved by the Gila River, and studded with mountains and buttes. These geologic features provided centuries of residents and travelers with ideal surfaces for imparting information and artistry.

Formed three to four million years ago, the Sentinel-Arlington Volcanic Field is comprised of basaltic lava flows and two shield volcanoes, one west and one north of Gillespie Dam (see map on pages 6–7). As the Gila River cut through this volcanic field, cliff faces and boulders formed. The surfaces of these rocks developed a dark patina, which, when pecked away by humans, revealed lighter rock beneath and enabled communication of bold signs and symbols.

Older geologic features, such as the Gila Bend Mountains and the iconic Powers and Robbins buttes of the Buckeye Hills, are embedded in and adjacent to the volcanic field. Striking reddish sandstone outcrops in the Gila Bend Mountains host petroglyphs dating from early prehistoric through protohistoric times.

Three major styles of petroglyphs are found across the region. The Archaic style, which dates before A.D.

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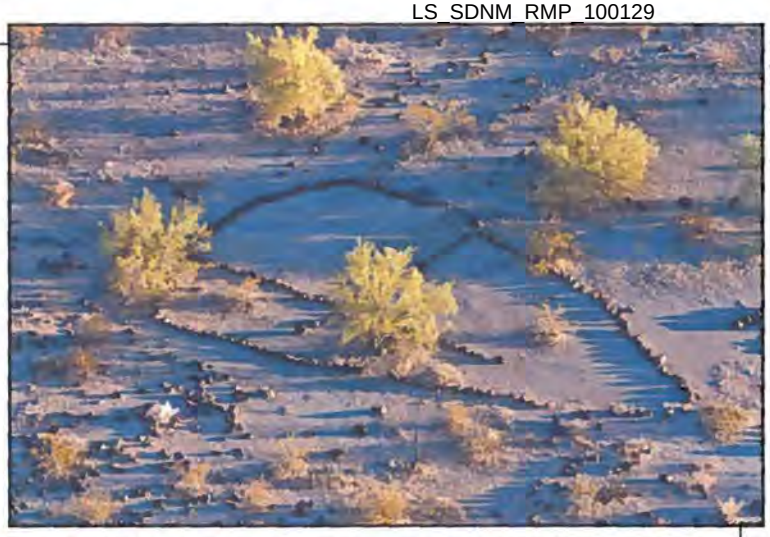
100, features geometric elements rather than human or animal forms. Because of their greater age, Archaic petroglyphs often exhibit a dark patina. During the ceramic period, both Hohokam and Patayan styles are evident. Circular images that may represent shields became more common in Patayan glyphs over time, and may indicate increased conflict between Patayan and Hohokam people in this boundary zone after 1100.

The ground surface of this arid, sparsely vegetated volcanic landscape is itself a messenger. Geoglyphs—arrangements of rocks or boulders on the ground surface—are often found on the terraces overlooking the Gila River. Archaeologists have also documented trails and the patterned removal of desert pavement, which is comprised of closely packed rocks or gravels that have weathered to a dark patina.

All of these expressions in or on the rock landscape are extremely fragile—and greatly endangered. When a vehicle drives over intact desert pavement, it leaves an indelible scar. Geoglyphs are under constant threat from vehicles and vandals. Petroglyphs are especially vulnerable to vandalism, and spray paint is their worst modern enemy.



Henry D. Wallace

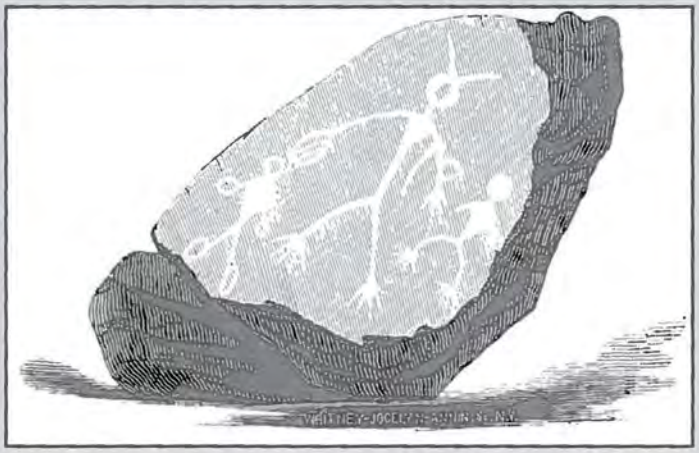
Henry D. Wallace

Top: A geoglyph—an arrangement of large volcanic cobbles on the ground surface—presents a striking view in this aerial image taken just after sunrise. Right: A very complex panel with many distinctive Patayan elements is found at Sears Point.

First Recording in 1852

JOHN RUSSELL BARTLETT (1805–1886) headed the United States–Mexico Boundary Commission, which surveyed the boundary imposed by the 1848 Treaty of Guadalupe Hidalgo at the close of the Mexican-American War. At that time, the Gila River constituted the boundary with Mexico across what is now Arizona. In his published account, Bartlett describes the June 1852 journey from Fort Yuma to Gila Bend: the oppressive heat, meals of fish, "sculptured rocks," stands of willows, trailside graves, U.S. Army camp remains, abandoned canal systems, a river crossing, the tragic fate of the Oatmans a year earlier. He sketched a number of these "sculptured rocks"—petroglyphs—at two locations along the way.

Henry D. Wallace



Bartlett recorded this Patayan image (left) near Antelope Hill, some twenty-eight miles west of the Great Bend region. It bears a close resemblance to a petroglyph (far left) at Sears Point.

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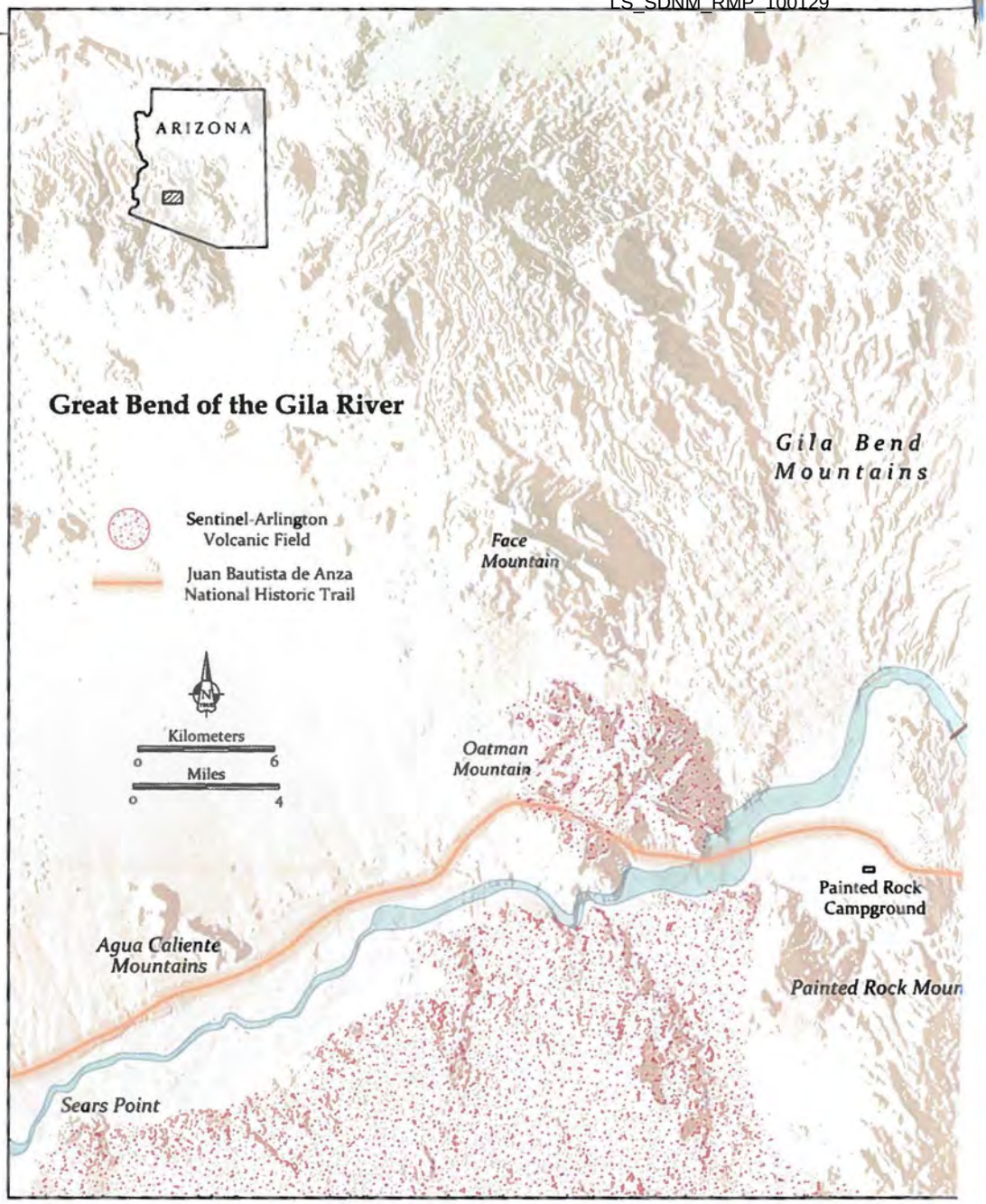
Andy Laurenzi

Henry D. Wallace



Henry D. Wallace

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Counterclockwise from above: anthropomorph along the Gila River; Patayan shield petroglyph along the Gila River; geoglyph on Sentinel Plain; Patayan wa image of a deer on a sandstone outcrop in Red Rock Canyon in the Gila Bend Mountains.

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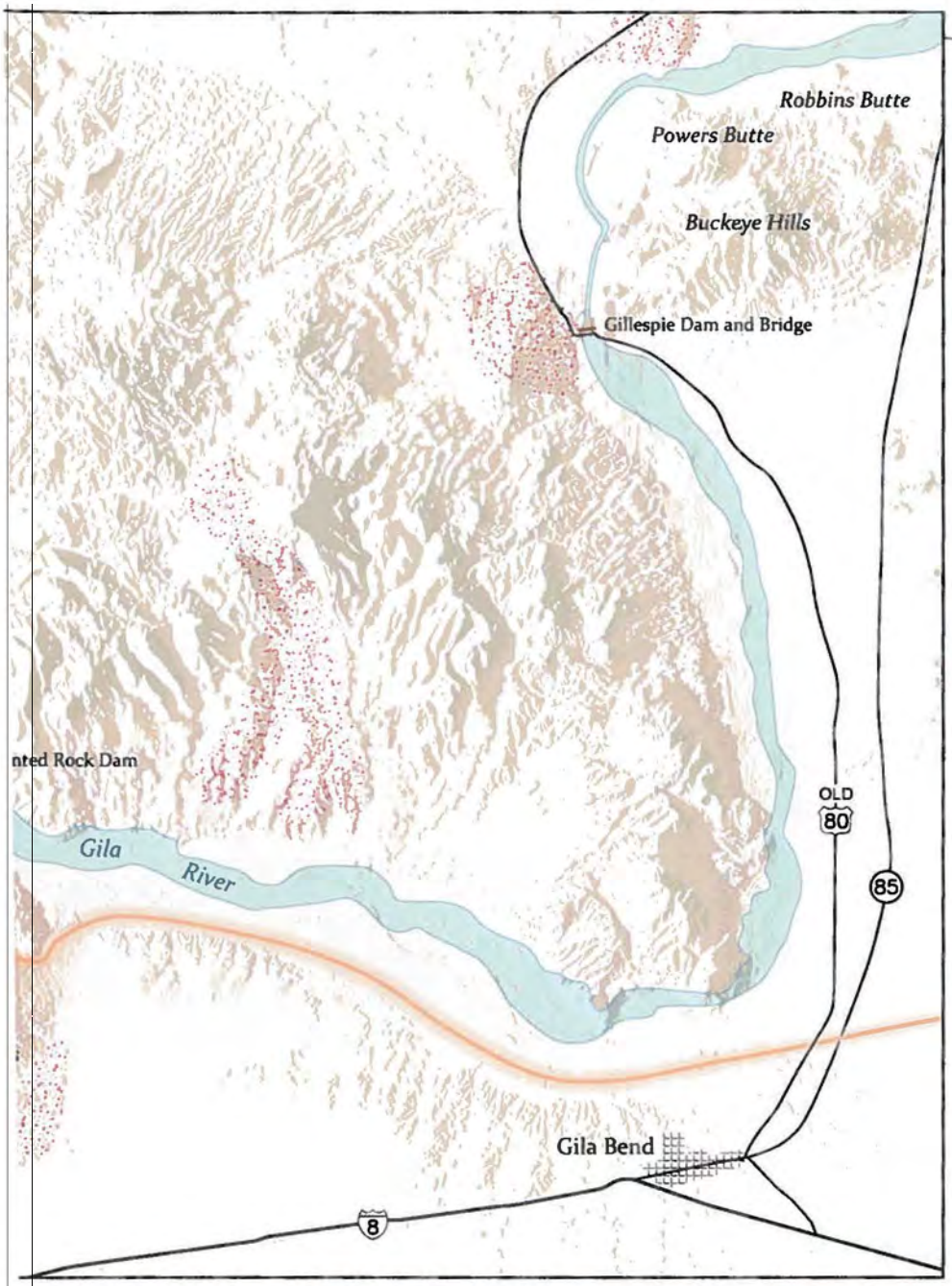

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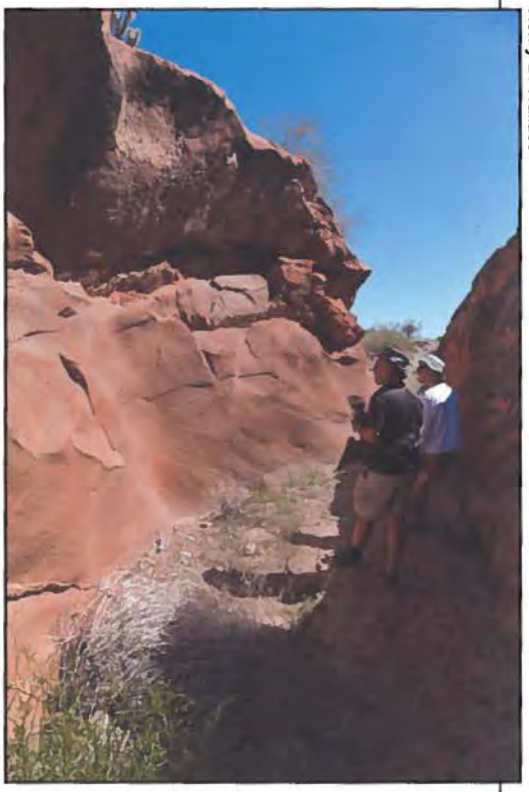
Henry D. Wallace

Henry D. Wallace

Henry D. Wallace

it Hummingbird Point; Robbins Butte; view north of Gillespie Dam Bridge and Dam; a small group examines a large petroglyph panel at Red Rock Canyon;

Use of Hillsides and Hilltops

WHEN ARCHAEOLOGISTS encounter residential sites on high ground surrounded by steep slopes, they generally interpret this positioning as a defensive strategy on the part of the site's inhabitants. Several hilltop sites in the Great Bend region seem to be such fortresses, including the Fortaleza and Pierpoint Canyon sites. Other uses of local hilltops and hillsides are evident, but harder to interpret.

The Fortaleza, or Fortified Hill, site was investigated by William Wasley and Albert Johnson in the early 1960s as part of the salvage work done in anticipation of the Painted Rock Dam and Reservoir. Funded by the National Science Foundation, Wasley and Johnson excavated forty-three of the fifty-seven rooms they identified. The rooms were built of dry-laid rocks with a rubble core, resulting in walls that were almost three feet thick. Although archaeologists did not find much decorated pottery, what they did recover was almost exclusively Tanque Verde Red-on-brown. This pottery, which helps date the site between A.D. 1150 and 1300, is most common in the Tucson Basin.

Thus, the site seems to have been inhabited while Patayan presence in the region was growing stronger—yet there was almost no Patayan pottery at Fortaleza. Some archaeologists have suggested that a group of migrants from the Tucson area lived at the site. Collections and field notes from the project should be reexamined in order to assess this intriguing idea.

The Pierpoint Canyon site is located in the Gila Bend Mountains. The Agua Fria Chapter of the Arizona Archaeological Society intensively surveyed and mapped the site, which is distinguished by two massive stone walls oriented north-south across the mouth of the canyon. More than 140 rock rings averaging ten to twelve feet in diameter are located near these walls. Composed of roughly stacked, friable granite, the rings probably represent rooms. The team identified 120 other features, including partial rock rings, rockshelters, cleared areas, water diversion features, and an extensive foot trail system. Petroglyphs are found at twenty-nine locations around the site, and both Patayan and Hohokam pottery are present.

Craig Weaver

Henry D. Wallace

Top: Large, fortress-like wall atop a volcanic butte overlooking the Gila River. Bottom: Aerial view of Fortaleza. The site was stabilized and restored through a National Science Foundation project under William Wasley's direction.

Many isolated volcanic hills in the Gila Bend area bear features that may have been defensive, but probably served other, special purposes. We know of one hilltop site that likely had a ceremonial function, as there is limited usable space at its peak. Some hills are marked by very steep, straight trails, called summit trails. Archaeologists' examination of multiple summit trails indicates they were intentionally constructed. They are unlike trails known from hilltop residential sites, and, in some cases, they show strong relationships with petroglyphs and other rock features. Their striking physical appearance further supports the idea that they served a ritual function.

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Community-based Preservation Archaeology

Ella Pierpoint

Henry D. Wallace

Top: Dave Doyel (left) and Roy Pierpoint discussing the next project at the Gatlin Site Archaeological Park. Bottom: Ella Pierpoint surveys the road damage related to an ill-conceived mining project.

DR. DAVID DOYEL AND ROY AND ELLA PIERPOINT must be recognized for their dedication to the preservation of special places in the Great Bend of the Gila. Active in Hohokam archaeology since the early 1970s, Dave has spent more than two decades working with the Town of Gila Bend and local volunteer groups to create a public preserve and interpretive program at the Gatlin Site National Historic Landmark and Archaeological Park (see page 4).

Dave found outstanding partners in the Pierpoints, local farmers with deep roots in the community who spearheaded efforts to establish the Gatlin Site Archaeological Park. For more than fifteen years, Ella served as the liaison between the park's Steering Committee and the town. As the project's grants administrator, she secured nearly $200,000 in funding. Roy directed on-the-ground efforts to protect the site and donated the use of heavy equipment from Pierpoint Farms.

As long-time Arizona site stewards, Roy and Ella advocated for a complete survey of the Pierpoint Canyon site (see page 8). With Dave Doyel's guidance, the Glendale-based Agua Fria Chapter of the Arizona Archaeological Society recently completed inventory and mapping of the site. A report is forthcoming.

In November 2004, rancher Earl Rayner alerted the Pierpoints that he had observed petroglyphs on some boulders dislodged by road blading. In time, it was learned that the owner of the property (a third party) planned to remove the volcanic rocks and gravel for processing and sale as commercial landscaping material. Ella and Roy convened a group of archaeologists and other specialists, including the Bureau of Land Management (BLM).

The BLM determined that the federal government owned the underlying mineral rights. The landowner was notified that removing and selling the rocks would constitute mining activity, which would in turn require submission of a formal plan of operation to the BLM, as well as consultation with the State Historic Preservation Office and Native American tribes.

The mining project did not go forward; the petroglyphs were saved. Roy and Ella's involvement in protecting the rock art was formally recognized in 2008, when they received the Arizona Archaeological Council's award for "Avocational Archaeologist of the Year."

Arizona State Museum, University of Arizona/ Ken Matesich, Photographer

Norton Allen

ANY DISCUSSION of the archaeology of the Great Bend of the Gila must pay tribute to Norton Allen (1909–1997). A well-respected avocational archaeologist and commercial artist, Norton spent forty field seasons and many more years discovering, documenting, and doing what he could to protect Hohokam archaeological sites in the region. Allen maintained correspondence with Dr. Emil Haury of the University of Arizona and a host of other professional archaeologists, sharing information and advocating on behalf of threatened sites such as the Gatlin site. He lovingly preserved a stunning collection of artifacts and field notes that he and his wife, Ethel, donated to the Arizona State Museum. Significantly, the Allens stipulated that the Tohono O'odham Nation should be able to use any objects it wished at Himdag Ki, its cultural center in Topawa, Arizona.

To find out more about a recent publication celebrating Norton Allen's remarkable life and contributions to archaeology, visit www.cdarc.org/asw-25-1.

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Trails Across the Millennia

THE DARKENED, CLOSELY PACKED GRAVELS known as "desert pavement" have recorded at least two thousand years of journeys. Feet, hooves, and wagon wheels displaced the thin layer of dark rock and exposed the lighter-colored soils beneath. Trails through the Great Bend of the Gila can be traced continuously for tens of miles—or even longer—in many areas. Despite the apparent longevity of these traces, their durability is under constant threat; desert pavement is extremely fragile, and particularly vulnerable to off-road vehicle damage (see *Archaeology Southwest* 21[4]).

Later travelers followed in the footsteps of the native peoples. In addition to grooves and ruts worn by wagon wheels, occasional inscriptions and camp remains provide a physical record of the Bartlett survey (see page 5), the Butterfield Overland Stage, and the rush of "Forty-niners," among others. The Juan Bautista de Anza National Historic Trail (see map on pages 6–7) now marks the route taken by the Spanish Expedition of 1775–1776 on its way to the San Francisco Bay area.

In the Sentinel Plain, south of the Gila River, little has changed since prehistoric times. Remarkably, this plain preserves portions of ancient and historical routes, as well as the landscapes experienced by those who traversed them.

Rose Ann Tompkins
Oregon-California Trail Association

Inscription by "O W Randall," a Texas rancher who made two trips to California, at least one in 1849, at the time of the Gold Rush.

Henry D Wallace

A remnant of the Butterfield Overland Stage (and probably earlier wagon roads and prehistoric trails) that was improved by William Fourr (1843–1935), owner of the Oatman Flat Stage Station. Between 1869 and 1877, Fourr managed this as a toll road, but was ultimately driven from the area by Apache and Yavapai raids. After a time in California, he and his family settled in the Dragoon Mountains of Arizona.

U.S. Route 80, Broadway of America

IN 1925, the U.S. Department of Agriculture submitted a proposal to the American Association of State Highway Officials (the "Association"). In it, they created a numbered system of U.S. highways that was stitched together with formally designated state highways. In 1926, the Association adopted these recommendations for U.S. Route 80, and the Arizona segment of a federal highway system was officially born.

Prior to designation as U.S. 80, the Arizona route was part of the Dixie Overland Highway. The latter was promoted as a southern, all-weather transcontinental highway beginning in 1914. After 1916, the Arizona segment was also listed as part of the Bankhead Highway, a second transcontinental highway comprised of regional auto trails. This network of auto trails, which shared portions of other named routes such as the Dixie, was complex and confusing. For a time, the Bankhead was touted as the "Broadway of America."

Lack of consistent standards for these long-distance auto trails led states to petition the federal government to establish a formal system of interstate highways. The Department of Agriculture's proposal followed. The first official description of the federally approved U.S. 80 appeared in April 1927. In Arizona, the route came through Douglas, Bisbee, Tombstone, Benson, Tucson, Florence, Mesa, Phoenix, Buckeye, Gila Bend, Sentinel, and Yuma. It crossed the Gila River at the Gillespie Dam Bridge (see page 11).

In 1956, the section of U.S. 80 between Buckeye and Gila Bend was realigned to the current State Route 85. The former alignment was decommissioned, and that segment of U.S. 80 came under the control of Maricopa County. Today, the section of U.S. 80 between Buckeye and Gila Bend, including the Gillespie Dam Bridge, retains much of the historical character present when it first became a part of the federal highway system.

Gillespie Dam Bridge

Hugh Davidson, Maricopa County Department of Transportation

IN 1926, in anticipation of the federal highway system, the Arizona State Highway Department commissioned the construction of a steel truss bridge just downstream from Gillespie Dam (see map on pages 6–7). Prior to the bridge's construction, the concrete apron fronting the 1921 dam provided the only vehicular crossing in the area. Heavy runoff over the diversion dam required trucks to pull cars through the flow. During major floods, automobiles could not cross at all. The bridge was completed and opened to traffic on August 1, 1927, at a cost of $320,000 ($3,950,000 in 2009 dollars).

A ride across the Gillespie Dam Bridge evokes that earlier era of road travel. The striking steel thru-truss spans, the concrete piers and road deck, the substantial length, and the dramatic physical setting all contributed to a successful nomination to the National Register of Historic Places in 1980.

Henry D. Wallace

Looking east along the Gillespie Dam Bridge.

In 2010, Maricopa County proposed bridge rehabilitation according to federal preservation standards. The project cost is estimated at $6.8 million, three-quarters of which will be borne by Maricopa County. The remainder of the funds comes from the Federal Highway Administration's Bridge Rehabilitation and Transportation Enhancement programs. Significant effort has been invested in retaining the historical character of the bridge through the rehabilitation process, which is scheduled to begin in 2011, after five years of planning. Concrete abutment and pier footings will be reinforced and refurbished; broken, bent, and rusted steel elements will be treated and reintegrated into place; and compromised steel roller bearings crucial to stability will be replaced by new elastic bearings that will better absorb the forces that have threatened the bridge's survival. This important historic resource will be preserved, safe, and efficient for the foreseeable future.

See the Center for Desert Archaeology website for more information: <http://www.cdarc.org>

AT THE CENTER FOR DESERT ARCHAEOLOGY, we envision a society in which the places of the past are valued as the foundations for a vibrant future. As such, it is our mission to preserve the places of our shared past. A private 501(c)(3) organization, the Center is supported through donations, memberships, and grants from individuals, foundations, and corporations. Center members receive an annual subscription to *Archaeology Southwest* and a host of other benefits. For more information or to join, contact Membership Coordinator Kate Sarther Gann at 520.882.6946, ext. 16, or kate@cdarc.org.

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Back Sight

THE GREAT BEND OF THE GILA is a unique and fragile place. Its most visually spectacular resources are the geoglyphs and petroglyph panels that border the Gila River floodplain, sometimes continuously for more than a mile. The volcanic hills that tower above parts of this area also show special uses—some probably defensive, others more likely ceremonial. Many Hohokam and Patayan sites have been degraded or destroyed by agricultural and flood control activities, but several significant villages have survived. This is fortunate.

Petroglyph sites along the Great Bend of the Gila are among the largest concentrations of rock art in the desert west. Some designs are thousands of years old, and some inscriptions date from the mid-1800s. In the short stretch from Painted Rock Dam to Sears Point, a very distinctive variety of Patayan rock art occurs that has not been found elsewhere.

Threats to this area are numerous. The Painted Rock Dam was constructed to slow and briefly retain floodwaters in order to protect downstream agricultural areas. As a result, archaeological resources over a very large area are exposed to intermittent inundation and the destructive wave action of rising and falling water levels. As recreational use of the area grows in tandem with Arizona's metropolitan areas, other deleterious impacts occur.

Much less archaeological work has been accomplished in the Great Bend than upstream on the Salt and middle Gila rivers—yet nearly every study has yielded unexpected results. In an area where so much more could be learned, loss of or damage to archaeological sites is particularly tragic. The Center for Desert Archaeology is working with diverse groups who are also concerned about this area. We continue to work with private landowners, but protection of this vast, valuable landscape also urgently requires significant safeguards on public lands.

Henry D. Wallace

Spray paint and recent pecking deface these ancient petroglyphs. Irrevocable vandalism to petroglyphs is on the rise.

back sight (băk sīt) n. **1.** a reading used by surveyors to check the accuracy of their work. **2.** an opportunity to reflect on and evaluate the Center for Desert Archaeology's mission.

William H. Doelle, President & CEO
Center for Desert Archaeology

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