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CHALLENGE COST SHARE AGREEMENT
between
USDA FOREST SERVICE, SHOSHONE NATIONAL FOREST
and
BOARD OF GOVERNORS OF THE COLORADO STATE UNIVERSITY SYSTEM
BY AND THROUGH COLORADO STATE UNIVERSITY
ON BEHALF OF THE DEPARTMENT OF ANTHROPOLOGY

APPENDIX A: 2006 Modification

FIELD SESSION 1: 48PA2874 AREA INVESTIGATIONS

NON-COLLECTION SURFACE SURVEY

Investigations at site 48PA2874 (Figure 1) in 2006 will include additional multiscale non-collection survey of the site area and slightly over 100 ha (102) surrounding the documented site area. The survey will include in-field coding of artifacts and the only items to be collected will be obsidian artifacts and debitage of suitable size to submit for geochemical source analysis. The second phase of site evaluation will include limited subsurface testing (a 0.04% sample of the site area) to assess the potential for buried cultural materials. Fieldwork at the site is planned to take place between June 14th and June 30, 2006 by the Colorado State University archaeological field school under the direction of Professor Lawrence C. Todd. During this part of the project, the crew will be staying at a field camp near Jack Creek.

Of the sites recorded by CSU since 2002, only five have more than 2000 pieces of chipped stone tabulated from the surface documentation. Site 48PA2874 (Figure 1) is one of these larger assemblages with a total of 2471 piece having been recorded in July, 2005. These include 23 projectile points ranging from Late Paleoindian to Late Prehistoric in age and 21 other bifacial performs as well as cores, scrapers, and a series of other formal and expedient tools. At an elevation of 3100 m and covering over 6 ha, this site is spatially one of the largest encountered in our four year's survey, is one of the highest elevation sites recorded in the project, and contains one of the most diverse lithic assemblages (in terms of both chronological indicators and artifact categories). Raw materials include over 70% non-local sources (e.g., not from the local Absaroka Eocene volcano-clastics; Breckenridge 1974; Dunrud 1962; Love 1939). Most recorded items are fairly small (average 15.6 mm, maximum 115 mm) and unmodified debitage accounts for fully 73% of the documented assemblage. Nearly 5% of the chipped stone exhibits crazing or potlidding indicative of burning, The site is currently above timber line, but given fluctuations in the past (Meyer et al. 1995; Meyer and Wells 1997; Romme 1982; Romme and Despain 1989; Whitlock and Bartlein 2004), it is possible that this burning may be the result of past forest fires. However, spatial patterning of the burned pieces of chipped stone exhibits a tendency toward clustering within a few areas rather than uniform scatter across the site surface, which is suggestive of potential hearth locations.

The site is on a rolling surface dotted with a series of alpine ponds fed by seasonal snow melt. Several of the larger ponds appear to hold water through out the summer. The east facing slope is somewhat sheltered from the high winds that often scour the ridge tops and more exposed settings and fine-grained sediments seem to have accumulated and soil development is indicated by exposures in several erosional cuts. The alpine ponds (sag ponds resulting from slope instability) form in the bottoms of depressions that can be as much as 2-5 m below the surrounding surfaces and seem to provide excellent sediment traps. Spring melt waters coupled with abundant loose sediments from pocket gopher burrows both on the ground surface and within snow drifts provide a ready source of annual deposition into these lower lying areas. One of the reasons we've selected 48PA2874 for additional investigation is this potential for greater regular depositional inputs than most other sites in the area. This depositional potential, coupled with the projectile point evidence of nearly 8 millennia of repeated use suggests that this is a good candidate for yielding datable materials from a range of time periods.

However, the site's depositional history is no doubt complex. First, pocket gophers as well as badgers seem to be very active in areas of the site with appropriate sediment depths and soil moisture properties. The potential for bioturbation from this burrowing as well as from trampling by grazing animals around the muddy pond margins is high. Second, some of the higher portions of the site exhibit some patterned ground and cryoturbation has no doubt played a role in the soil mantle formation. Small-scale sediment slumping and soil creep are suggested on some of the steeper slopes and the entire surface on which the site is situated may be in part the result of multi-scale mass wasting earthflow events (e.g., Parise 2003), which may be the origin of the hummocky terrain with lobate structure in which the ponds form.

The artifact assemblage from 48PA2874 is suggestive of a diverse set of activities including tool manufacture (based on the number of early stage bifaces recorded) and rejuvenation (many of the flakes seem to be from tool resharphening with over 700 of those observed on the surface being under 10 mm in maximum length). Projectile points include Paleoindian points that appear to be more similar to classic Plains forms than to Mountain/Foothills forms as a well as a suite of both named and unnamed Archaic and Late Prehistoric variants. It is one of the highest elevation sites documented in the GRSLE project (3100 m) and has one of the highest surface artifact densities in the project area. Possible clustering of burned lithics suggests hearth areas, and there is the possibility of stratigraphic separation of occupational episodes in some of the sediment pockets dispersed across the site area. In all, the site has a high potential for contributing a better understanding of the little known mountain archaeology of the region and providing insights into a wider range of montane landuse questions.

However, in order to meet such potential and before any large scale excavation would be warranted, further information on the site's context and formational complexity is required. It is toward these ends that much of the 2006 field work is directed.

1. Initial Block Survey – Red Flag[1] Survey (2 days)

The 48PA2874 Red Flag Survey (FRS) will examine a 1700 m (EW) by 600 m (NS) block area (102 ha) encompassing the site will be surveyed by 15 person survey lines with crew members spaced 5 m apart. At 5 m spacing, a 15 person crew covers an 80 m wide swath in each transect. Transects will be oriented E-W in order to cross the grain of the general slope contours of the survey block. A rate of travel of approximately 2 km/hour will be maintained by monitoring GSP travel speed readings. As artifacts are observed, they will be marked with red pin flag, and a GPS waypoint marked while crew maintains constant movement. A total of 7.5, 15 person transects will be required to cover the 102 ha block. At a coverage rate of 2 km/hr, each 1700 NS transect should require approximately 51 minutes to complete.

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[1] *Different colors of pin flags are used to mark items found with different survey techniques, and pin flag color is recorded during analysis of each artifact so that we can investigate relationships between survey type and artifact discovery rates.*

Although the entire area will be covered at 5 m spacing, this is not considered to be a 100% survey. Our experience is that each crew member has a “visibility focus lane” (VFL) of approximately 1.5 m as they walk a transect line. The means that with 15 person teams walking 7.5 transects, with each of the 115.5 VFL’s covering about a 1.5 m wide strip, upon completion of this survey we’ll have actively survey 101250 m^2 of the 102 ha block and therefore our estimated coverage percentage for this phase of the project will be 10% coverage of our block area. We anticipate completing 4 transects per day, and estimate that it will require 2 field days (30 person days) to complete the initial survey.

2. Sample Plot Resurvey – 70cm Modified-Whittaker Survey/Green Flag Survey (1/2 day)

Based on plot of GPS waypoints recorded on the RFS, the block survey area will be stratified into 3 artifact density zones (High, moderate, low/absent – the absolute values of these will be determined based on counts of artifacts from the RFS survey in 50X50 m areas). One 20 X 50 m Modified-Whittaker sample plot (Burger et al. 2004) will be placed in the high artifact density strata and two plots will be positioned in each of the remaining artifact density zones. A total of 5000 m^2 will be resurveyed in these five plots with survey crew members spaced at ~70 cm. A rate of travel of approximately 2 km/hour will be maintained using GSP travel speed readings. Artifacts encountered in this survey will have their locations marked with green pin flags. Given our VFL value of 1.5 m, this spacing provides as close to 100% coverage as possible in pedestrian survey. This will give us 100% pedestrian survey coverage of 0.5% of our 102 ha survey block. We anticipate that this phase of the survey can be completed in about half a field day (15 person days).

3. Adaptive Sampling – White Flag Survey (4 days)

At the conclusion on the 70cm Modified-Whittaker survey, all red flag marked items outside the Modified-Whittaker plots will be revisited and a single person, 5 m radius “dog leash” survey will be undertaken around each artifact. A minimum of 2 minutes will be spent searching for additional items in the vicinity of each red-flagged object and any new artifacts discovered will be marked with white pin flags. If additional items are located, another band from the 5 m radius to a 10 m radius will be surveyed. This pattern of concentric expansion of survey around an initial find spot will be continued until no artifacts are encountered. Since this adaptive design is based on number of artifacts encountered rather than specific transect numbers and coverage rates, time estimates for completion of this phase of the survey are more difficult. However, given that over 2000 artifacts were documented in the 48PA2874 site area, and search time around each of these would be at least 2 minutes, we can give a rough approximation of approximately 67 person hours will be required for this phase of the project. With a 15 person crew, this is roughly 4 field days.

4. Non-systematic discovery – Blue Flag Survey (on-going)

During the day-to-day fieldwork it is common to find occasional artifacts that had not been located during any of the systematic survey operations. As found, such non-systematically discovered items will be marked with blue pin flags. If blue flag items are found outside of existing artifact clusters, the area around each find spot will be evaluated using the adaptive sampling, dog-leash approach.

5. Crawl Resurvey

After artifacts from the red flag and green flag surveys (5 m and 70 cm spacing respectively) have been coded (see artifact coding schedule), a segment of the field crew that had not participated in coding artifacts in a particular Modified-Whittaker plot will conduct a third level of survey intensity coverage. For this phase, 130 m^2 of each five Modified-Whittaker plot will be resurveyed by crews crawling on hands-and-knees with shoulders touching. This represents a 0.06% resurvey sample of the 102 ha block area. In past survey experiments, we’ve found that this survey technique often discovers significantly more artifacts than the 70cm pedestrian survey and provides the most reliable metric we’ve found for estimating surface artifact frequencies.

SUBSURFACE TESTING

Initial surface documentation of site 48PA2874 during 2005 recorded a scatter of chipped stone covering an area of roughly 44,132 m^2. During the 2006 field season, we proposed limited subsurface testing of no more than 0.05% of this site area (20 m^2). In addition, we'd like to place a series of much smaller (100X50 cm and 50X50 cm) test excavation plots and auger probes to assess the potential for buried materials both in the site area and it other in portions of the 102 ha survey plot that exhibit low densities or no surface artifacts. All excavations will be conducted by hand and sediments will be passed though screens with mesh size of 1/8" or less. Locations of each excavation plot, as well as all point-provenienced artifacts and samples will be recorded using total station EDM based on permanent site datum marker system.

1. Block test areas (10m^2 or less)

Testing of 48PA2874 will be initiated in a 1X2 m area. Depending on the results of this initial test, which will be excavated in 50X50 cm quadrants, taken out in 5 cm levels, this first test unit will either be expanded to a larger block area (not to exceed a maximum size of 2X5m), or a second 1X2 or 1X1 m unit will be positioned in another portion of the site judged likely to yield buried cultural materials. The total of these "block excavations," regardless of whether they are contiguous or dispersed will not exceed 10 m^2. If the full 10 m^2 is completed, this represents approximately 0.02% of the site area as indicated by the surface artifact scatter. Depths of these test units will not exceed 1.5 m. Materials from the excavation plots will be collected and the excavation areas completely backfilled at the end of the fieldwork.

2. Small on-site test areas (10m^2 or less)

A series of small, dispersed test units will be arrayed across the site area to provide information of subsurface artifact density variation. These will consist of no more than 10 100X50 cm slit trenches, and 20 50X50 tests. None of these will exceed 50 cm in depth and all will be completely backfilled at the end of the fieldwork. If all 30 of these dispersed units are excavated, this amounts to another 10 m2 of on-site excavation, and brings the site area total test percentage to approximately 0.04%.

3. Soil probes and Auger tests

In addition to the hand-excavated test units, series of Oakfield soil probes (20.6 mm dia.) will be used to estimate sediment depths across the site area. These probes give an indication of sediment depth and general textural and color properties that will be used to help evaluate variation of depositional characteristics across the site area. Soil probes will be arrayed along linear transects, and each probe location will be mapped using an EDM.

Finally, a series of 95.25 mm diameter[2] soil auger tests will be positioned based on both surface artifact density and sediment depth estimates based on Oakfield probes. Each run of the auger yields slightly more than a liter of sediment from a roughly 20 cm deep cylinder. Unlike the soil probes, the auger test units are more likely to provide evidence of buried cultural materials. Successive runs can provide a continuously sampled sediment column to a total depth of about 1 m. Sediments from each consecutive run will be screen through mesh no larger than 1/8". After each auger hole is recorded and mapped using the EDM, it will be backfilled with the screened sediment removed during its excavation.

4. Off-site testing (15m^2 or less)

If time allows, a group of no more than 30 small test plots (ten, 100X50 cm and twenty, 50X50 cm tests), may be positioned within the 102 ha survey plot to 1) assess subsurface potential in areas with no surface artifacts, 2) to provide a clearer picture of local geomorphology, and 3) to evaluate

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[2] The auger bucket removes discrete sediment samples ~190 mm deep in each run; given the diameter of 95.25 mm, each auger bucket contains approximately 1220 cc of sediment.

relationships between artifact content in surface pocket gopher mounds and buried deposits. Placement of these plots will be determined by results of both the area survey and preliminary results of on-site test pitting.

FIELD SESSION 2: WILDERNESS TRAIL SURVEY

During the last four field seasons, reconnaissance along one of the region's larger drainage systems (Greybull River) has provided glimpses of the rich and complex archaeological record in the higher elevation settings. This project (Greybull River Sustainable Landscape Ecology or GRSLE project) has focused on developing a better understanding of "landscape taphonomy" in which interactions and legacies of past cultural, biological, and physical processes are studied. This approach is similar to that described by Barton et al. who note that "human society is constantly reshaping the intertwined cultural and natural components of the socioecological landscape on which its members and their descendents must operate" (2004:254; see also Binnema 2001; Butzer 1982; Grayson 2001; Lyman 2004; van der Leeuw and Redman 2002). Survey, including several small blocks and trail corridor transects, indicates prehistoric human use of these mountain landscapes began with the onset of the Holocene (Breckenridge 1974) and included a diverse set of site types including raw material quarries (Reitze 2004), stone drivelines/structures, small resource procurement sites, and large habitation sites (Burnett 2004). Although the number of artifacts (>40,000) and sites (nearly 200 locations with 163 having had full in-field analysis completed) recorded so far provides a more secure picture of the region's past, we request funding for an additional season's fieldwork to complete our inventory of major trail corridors into the upper reaches of the Greybull drainage. The average site assemblage recorded during the last four summers has over 200 pieces of chipped stone but some may have 4000-5000. Over 300 projectile points have been recorded, 219 of which are complete enough or stylistically distinctive enough to serve as temporal indicators. The most common time period represented is the Late Archaic (45% of the points), followed by the Late Prehistoric (33%). Early phases of the region's occupational history (Paleoindian and Early Archaic) are present, but each represented by only about 4% of the documented points. Previous investigations have documented segments of the upper Greybull that are relatively easily accessible.

During July, 2006, one of two possible remote field camps will be established in areas so far not surveyed intensively and used a base for the second 16-day field session of the CSU archaeological field class. Depending on weather conditions and logistical arrangements, the trail survey will be based out of a main field camp either at the confluence of Cow Creek and the Greybull River, or along Eleanor Creek (Figure 2). This survey will take place between July 13-28.

OBJECTIVES

Objectives include both basic and applied archaeological research. At the basic level, documentation of prehistoric sites will add considerably to our understanding of montane adaptations in general (Aldenderfer 1998), as well as contribute to questions on: 1) interactions betweens Plains/Foothills/Mountain groups on the northwestern Plains (e.g., Bender and Wright 1988; Black 1991; Frison 1976, 1992; Frison et al. 1986; Frison and Gray 1980; Husted 1969, 1995, 2002; Husted and Edgar 2002; Johnson 2002; Kornfeld and Frison 2000; Kornfeld et al. 2000; McCracken et al. 1978; Pitblado 2004; Stiger 2001; Wedel et al. 1968); 2) interactions among prehistoric groups inhabiting the Plains, Plateau, Great Basins (Frison 1991; Janetski 2002); 3) interactions of human groups and western montane landscapes during the Holocene (Bender 1983; Benedict 1978, 1981, 1992a, 1992b; Benedict and Olson 1978; Canon 1996; Frison 1976, 1991; Frison and Walker 1984; Hughes 1988, 1998, 2003; Reeves 1973, 1974; Sanders 2002; Shortt 2002; Wright 1982, 1984); 4) investigation of the interplay between humans and other components of multi-scale adaptive cycles (Gunderson and Holling 2002; Holling 2001, 2002; Holling and Gunderson 2002) and 5) researching how the ecological legacies (Barton et al. 2004; Odling-Smee et al. 2003; Phillips 1997, 2001; Redman 1999a, 1999b, 2002) of past human/landscape interactions provide a framework for understanding contemporary ecological pattern, process, and adaptive management strategies (Berkes and Folke 1998a, 1998b, 2004; Holling, Gunderson, and Ludwig 2002; Redman and Kinzig 2003; Wesley et al. 2002). On the applied side, the project will operate at two levels. First, it will contribute baseline data and field methodologies for monitoring archaeological site condition (particularly in terms of anthropogenic impacts) in an area that has yet to suffer extensive damage from artifact collection or other impacts related to recreational or commercial use. This component of the projects seeks to develop a series of indicators (Bamberger et al 2004; Niemi and McDonald 2003; Noon 2004) to evaluate changes in archaeological site condition. Second, the project will apply archaeological techniques to expand the conceptual and methodological toolkit of recreational ecology (e.g., Cole 1978, 1981a, 1981b, 1988, 1989, 1992, 1993, 1994, 1995a, 1995b, 1995c, 2001; Cole and Bayfield 1993;Cole and Landres 1996; Cole and Marion 1988; Cole and Monz 2002, 2003, 2004; Cole et al. 1997; Font 2000; Gaines et al. 2003; Hall and Farrell 2001; Liddle 1997; Reid and Marion 2005; Zabinski et al. 2002).

Depending on weather conditions in early July, the trail survey will be undertaken along trails in either the Cow Creek or Eleanor Creek areas. In either area, field work will include survey along slightly over 20 km of USFS maintained backcountry trails (Figure 2). The field crew will consist of about 9 undergraduate students (CSU Archaeological Field Class), 3-5 graduate students, a camp manager, and the PI. When terrain permits (Figure 3), a 25m wide transect, centered on the existing trail will be surveyed by a team of five spaced at 5 m intervals. As artifacts are encountered (both prehistoric and historic/recent), they will be marked with pin flags and subsequently documented. In compliance with Shoshone National Forest stipulations for working in Wilderness settings, although some artifacts may be temporarily removed for specialized analysis (e.g., obsidian sourcing), no prehistoric artifacts will be permanently collected. In-field documentation will include metric and descriptive attributes as well as digital photographs and latex molds taken of all diagnostic pieces (Figure 4). Temporally diagnostic projectile points will serve the basis for preliminary assessment of settlement history and documentation of lithic raw material types will aid in refining interpretations of settlement dynamics. Although the possibility of finding materials to date archaeological sites directly is extremely low, cutbank exposures will be examined and charcoal samples suitable for refining the local chronstratigraphic framework will be collected. Such samples need not be associated with artifacts in order for them to be suitable for gaining a better understanding of the geochronology of these mountain valleys. These data will serve to begin to address the questions of basic archaeological research noted above.

Information for the two applied goals (monitoring and recreation ecology) will be collected simultaneously with the basic site documentation. Diagnostic and highly visible artifact locations will be recorded using sub-meter accuracy GPS (Trimble GeoXT and Thales MobileMapper). One of the key components of site condition monitoring will be to assess whether artifacts most prone to collection remain on a site as indicators of recreational use increase over time. In order to make relocation of these “indicator artifacts” most effective, the location of each will be photographed at 2 scales and additional narrative on the specific micro-setting will be recorded. For sites with more than 100 artifacts within 50 m of the trail, sample plots will be recorded in which artifact frequencies are documented as several scales (Burger 2004; Burger et al. 2004), as well as attributes of importance to assess artifact counts such as 1) bare ground percentage, 2) vegetation height, 3) pocket gopher mound frequencies, 4) indicators of grazing/trampling intensity (pellet counts and game trails), and 5) proximity to pack trails or recent camping features. In terms of the recreation ecology aspect of the project, data on 1) trail condition (e.g., erosional depth, number of parallel paths, etc.), and 2) recent campsite properties (e.g., hearth areas, horse tying locations, latrine areas, proximity to water sources, fire wood gathering areas, etc.) will be documented. Each contemporary or recent campsite will be recorded using the same basic field methods used for the prehistoric archaeological sites. Documenting the variety of attributes needed for archaeological site recording and collection of information for monitoring site condition provides a variety of information on soils and water (erosional rills and cuts), vegetation (bare ground and height), wildlife (rodent burrow and pellet counts) in addition to the basic archaeological data (Figure 5). The crew will include field school students and graduate students from Colorado State University and the project will provide training in transdisciplinary research.

OUTCOMES

Outcomes of this survey project will include basic documentation of the archaeological record of human landuse in a little know portion of the Rocky Mountains; provide baseline data for monitoring condition of archaeological sites in this, as yet, minimally damaged archaeological landscape (although recreational use of these remote areas have been low in the past, all indications are that the number of visitors will increase and so will concomitant threats to surface archaeological sites from artifact collection); and exploration of the use of archaeological methods as an important contribution to recreation ecology and to integrative management of a range of cultural, biological, and physical recourses. The project will result in both immediate advance in basic information about this little know area and document archaeological sites in ways to allow their condition to be monitored in the future. Developing ways to monitor archaeological site condition is an essential component in the pursuit of long-term sustainability of research potential and is fundamental for any attempts to manage and conserve heritage resources.

Figure 3. Survey (a) and (b) use of Trimble GeoXT (sub-meter accuracy GPS) to record surface archaeology along the upper Greybull River drainage. Initial survey of trail corridors will be at 5m crew spacing at a speed of 2.5-3 km/hr, with areas of high artifact density re-covered at 1 m spacing as shown here. In some areas, steep slopes or heavy timber preclude a full 25 m transect and crew members will be focus on the trail alone. GPS tracklogs (each crew member has a recreational grade GPS unit [Garmin Rino] that provide general locational information – the GeoXTs and MobileMapper units are used for site documentation and for any other mapping requiring greater locational accuracy) will be maintained for each crew member so that the actual extent of survey areas are documented.

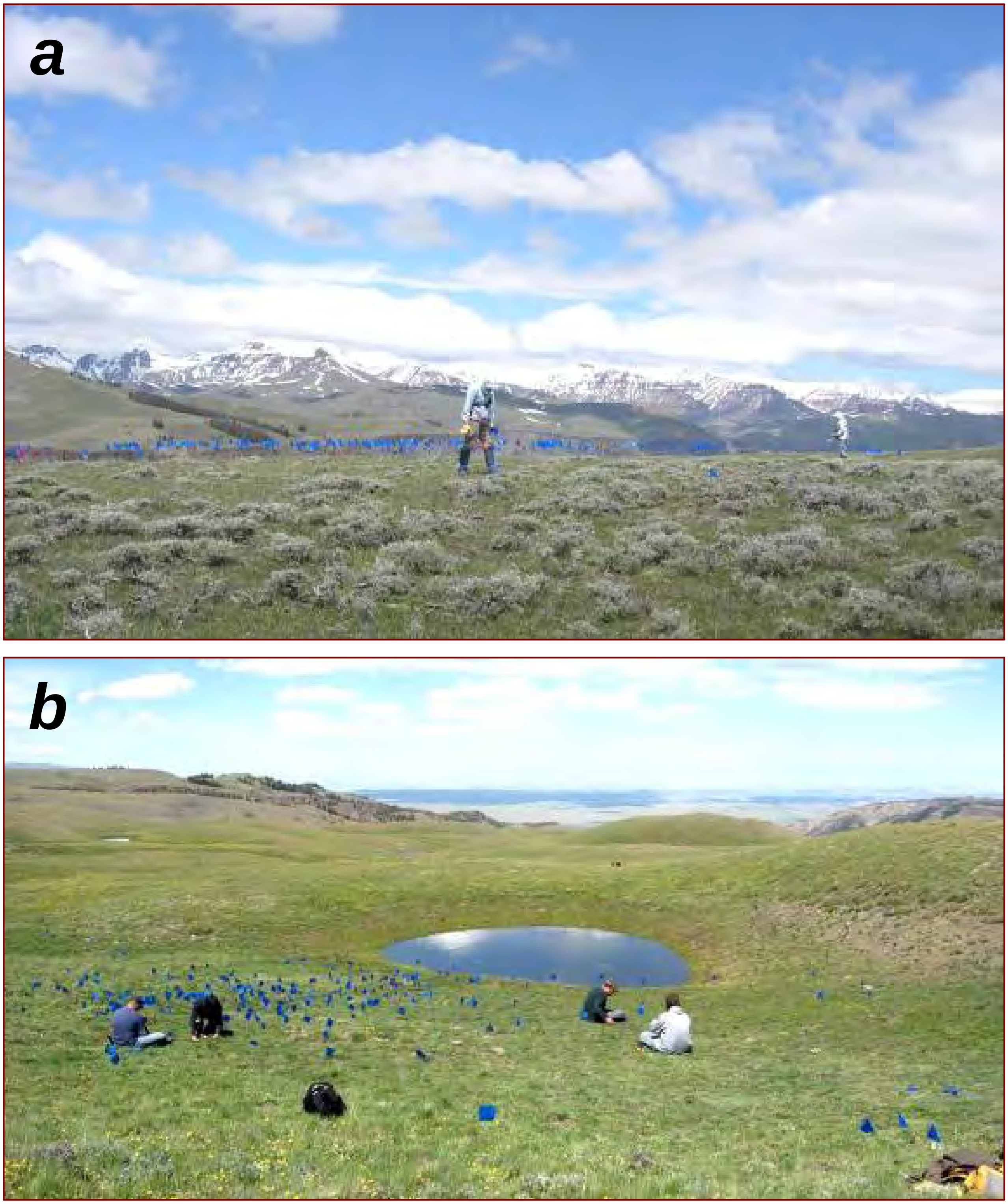

Figure 4. Examples of high elevation sites within the upper Greybull River area: a) Jack Creek flats area and b) upper Francs Fork. These sites have been recorded with 100% in-field documentation and with non-collection protocol. Photo b shows two-person coding teams, each of which will use sub-meter GPS with ArcPad to document individual artifacts. Comparable documentation is proposed for the Cow Creek and Eleanor trail corridors (Figures 2) will provide a basis for monitoring condition of the surface archaeological record in the Washakie Wilderness.

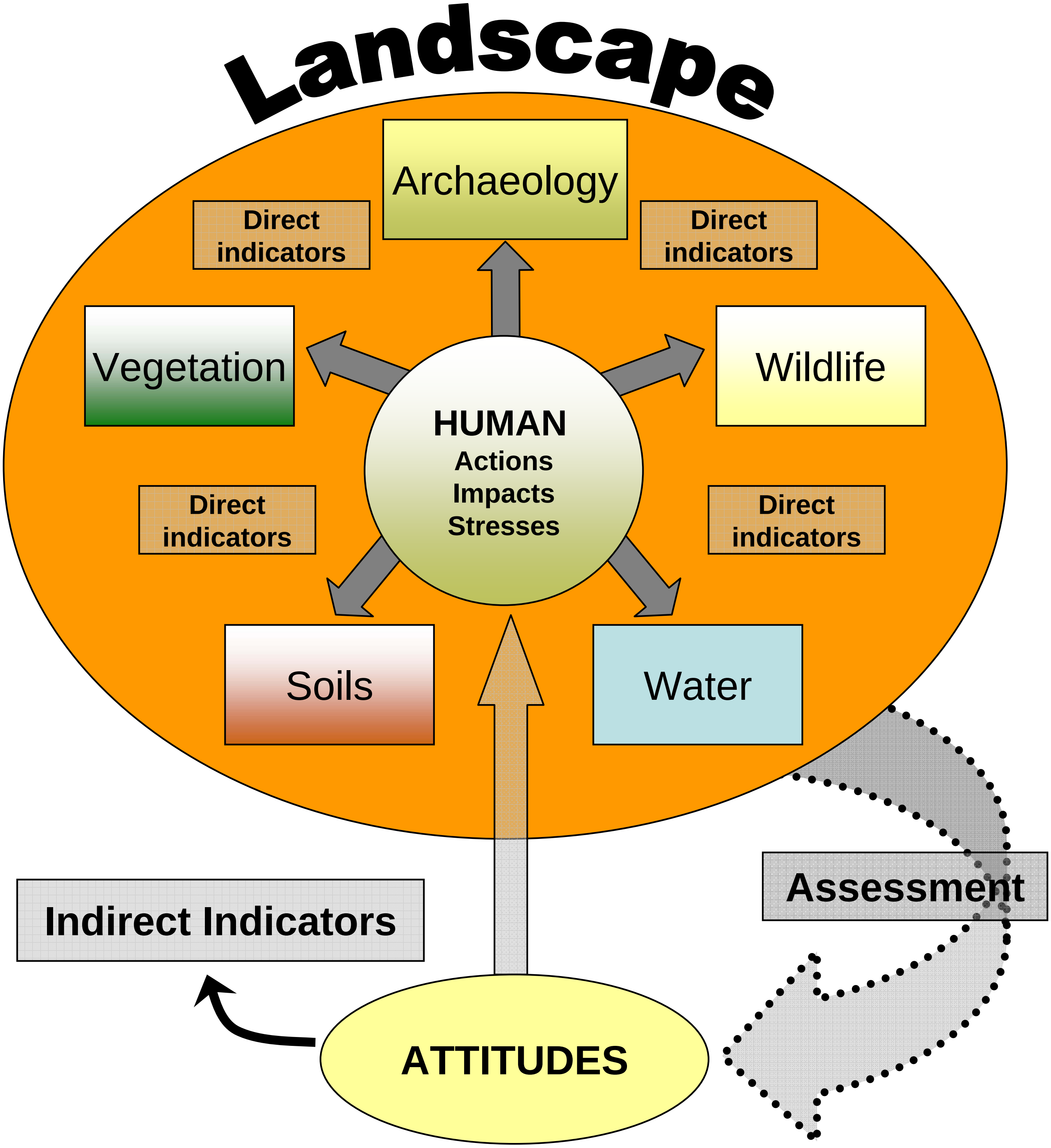

Figure 5. Most models of recreation ecology impacts address issues of interactions between humans, wildlife, water, soils, and vegetation (e.g., Liddle 1997:Figure 1.2). We argue that impacts on heritage resources need to be considered in conjunction with the other resources and that archaeology offers unique methodological perspectives on assessing human impacts and attitudes. Effective documentation to monitor archaeological site condition requires that observations on contemporary landuse, vegetation cover, soil erosion, and grazing all be incorporated. In addition, as an archaeological site monitoring program develops, deterioration of site condition due to recreational uses (e.g., artifact collection) can provide a direct assessment of public attitudes about resources conservation. Artifact removal can see seen as an indicator of an "extractive" attitude, while artifact persistence in the face of increased recreational use can be taken as an indicator of effective public education and development of an "experiential" wilderness attitude set.