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In an effort to make archaeological knowledge of Loess Hills prehistory more comprehensive, a three stage archaeological research design is outlined. It involves: (1) obtaining an unbiased sample of archaeological sites through probabilistic survey; (2) evaluating sites identified in terms of function, age and cultural affiliation; and (3) examining selected sites with specific problem-oriented research in mind. The research goal is to test the proposition that there were unique, prehistoric Loess Hills adaptations among groups who utilized the region.
INDEX DESCRIPTORS: Loess Hills, archaeological survey, archaeological research design.

Archaeological research has been conducted in various portions of the Loess Hills since the latter part of the 19th century (Anderson 1975). The results of these studies show that portions of this unique landform region have been continuously occupied for 12,000 years with all major cultural traditions found in Iowa represented (Anderson 1975; Rowe 1952). While some of this research has been problem-oriented (Henning 1968; Thompson and Bettis 1980), most archaeological studies have been site or culture specific. Loess Hills archaeological resources have not been evaluated systematically as representative of regional adaptations with respect to site distribution, functional variability among sites of a given time period or culture, or in terms of cultural evolution. Limitations in interpreting the archaeological record are not due to lack of expertise or concern for such problems by archaeologists, rather they result from the problems encountered in conducting regional research in an area as extensive and rugged as the Loess Hills.

The need for regional research designs has been recognized by archaeologists for a number of years and continues to be an area of methodological concern (Binford 1964; Ruppé 1966; Mueller 1974; Redman 1973; Schiffer and Gumerman 1977). It is the purpose of this paper to provide an outline for examining the prehistoric archaeological resources in the Loess Hills. As Goodyear et al. (1978) note:

> A research design is an explicit plan for solving a problem or set of problems. It is a plan that must contain theoretical goals in the form of a specific problem or hypothesis, relevant analytical variables, and specification of data that will allow empirical testing. To be complete, the design must lay out the methods and techniques for acquiring and analyzing the data, and predict the expected outcomes of the analysis (Goodyear et al. 1978:161).

The goal of the proposed research design is to determine if there are unique prehistoric Loess Hills cultural adaptations among the prehistoric groups who utilized this region. There are several means to pursue this goal, and the methods proposed are similar to approaches in general use by archaeologists. Regardless, one of the main purposes of this research design is to delineate the problems that may be encountered by archaeologists attempting to implement it. These are: (1) the research area is large and imperfectly known archaeologically; (2) it is characterized by rugged topography and closed vegetative cover; (3) based on present evidence, there is a presumed high potential for fluvially buried sites in the drainage systems and deflated archaeological deposits in the uplands; (4) project cost; and (5) the impact that present and future land use will have on the archaeological resources has not been evaluated systematically.

To expand on these issues which are of practical concern in utilizing Loess Hills archaeological data, there is the continuing need to manage the archaeological resources of the Loess Hills in particular and the Loess Hills landform region in general. The Loess Hills province is an evolving landform region. The western bluffs facing the Missouri Valley Alluvial Plain are backwasting; modern land use and the cyclic nature of Loess Hills alluvial deposition lead to rapid filling and downcutting of streams in the various watersheds draining the region. Vegetative cover is shifting in portions of the Loess Hills from xerophytic prairie communities where surficial erosion is high, to deciduous forest where soil erosion is slower. These phenomena have an impact on archaeological sites in predictable ways.

Alluvial processes which bury terrace sites preserve them, but make location and access to these sites difficult (Thompson and Bettis 1981). When the streams go through a downcutting episode, archaeological sites in the drainageways are exposed, but they can also be damaged or destroyed. Upland erosion in the Loess Hills is variable depending on ground cover and land use. Erosion leads to deflation of upland archaeological deposits. At the same time soil forming processes can bury upland sites, affording them some protection.

Modern uses of the Loess Hills such as quarrying operations for road construction and the like are literally mining away portions of the Loess Hills. The loss of important archaeological sites as a result of the use of loess for earthen fill has been documented in Pottawattamie, Woodbury, and Mills counties (Anderson et al. 1979; Perry 1983; Anderson et al. 1978). Efforts to control soil erosion in the Loess Hills by constructing empoundments has also led to the destruction of significant sites (Benn 1981).

Archaeology is not the only resource of concern in the Loess Hills. In fact, archaeological preservation of sites may be in conflict with other management and preservation needs. Attempts to preserve Loess Hills prairie communities in the face of on-going plant succession may lead to destruction of upland archaeological sites due to the more rapid rate of soil erosion under prairie. The proposed research design will result in the identification of important archaeological resources and the distribution of archaeological sites generally in the Loess Hills. Such information is clearly necessary before archaeology can be properly incorporated into future land use management and preservation plans for the region. With these problems in mind the research design is divided into three parts or stages: data collection, data analysis and data application.

Data Collection

This stage involves delineating the study area geographically and outlining appropriate survey methods for locating archaeological sites. The Loess Hills comprise approximately 7511 km^2 (2900 sq mi) of western Iowa (Oschwald et al. 1965:55). Prior describes the area in the following manner:

> . . . loess accumulation during the Pleistocene took place in varying degrees along most major river valleys in the Midwest. However, along the Missouri Valley bluffs, in western Iowa, this loess accumulated in such proportions that a unique landscape developed. Only in corresponding latitudes of China

does a similar landscape exist anywhere in the world. The most prominent bluffs and ridges of the Western Loess Hills are directly adjacent to the Missouri River valley and extend eastward for a distance of three to twenty miles. The landscape has a corrugated appearance of alternating waves and troughs. Hills are sharp featured, with narrow broken ridge-crests, intersecting spurs and steep sideslopes. Though the western boundary of this region has a very sharp topographic expression and is easily distinguished in the field, the eastern border is difficult to define. The rough terrain gradually tapers off, as does the loess thickness, and merges with the rolling landscape of the Southern Iowa Drift Plain (Prior 1976:33-34).

Because the goal of the proposed research design is to identify and interpret man-land relationships presumably resulting from the uniqueness of Loess Hills physiography, precise delineation of the boundaries of the survey universe and the geomorphic features within it in terms of a landform model should be done by geomorphologists rather than archaeologists (Plog et al. 1978:609).

The Loess Hills is too large a region for a survey with 100% coverage. Therefore, the main thrust of a reconnaissance survey of the area is to develop and implement a statistically valid sampling procedure. Another reason for probabilistic sampling pertains to one of the problems identified — the extent of our present archaeological knowledge of the study area. Our present data base is biased. Some prehistoric cultures are over-represented while others are under-represented. The same is true for some site types. Information on the sites presently known in the Loess Hills was obtained in piecemeal fashion from a variety of sources such as contracted archaeological work or as a result of problem specific research such as Thompson and Bettis's (1980) study of buried sites in fluvial deposits. Clearly, an unbiased sample is crucial if the archaeology of the Loess Hills is to be understood.

Of the other problems identified, the size of the study area, the rugged topography, the closed vegetative cover and the presence of buried colluvial and alluvial sites are all factors which contribute to the difficulties that will be encountered in attempting to survey the Loess Hills systematically. These kinds of constraints are not usually encountered in the arid Southwest where many of the probabilistic surveys reported in the literature have taken place (Lovis 1976:364; Nance 1979:172). The practical difficulties posed by the Loess Hills, however, are not reasons for conducting an extensive, non-systematic type of survey of the kind described by Ruppé (1966:314).

A stratified, systematic unaligned sampling procedure is recommended for the reconnaissance survey (Berry 1962; Gourley 1983). The entire study area should be sampled because of the high degree of within-unit variability reflecting a variety of depositional histories among the landform types comprising the Loess Hills. The strata to be used are the various landform units within the Loess Hills such as alluvial fans, hillslopes, ridge crests, terraces, and the like. These landforms can be identified on USGS 7.5 minute quadrangle maps. Once their boundaries are demarcated on the quadrangles, the areal extent of each landform type can be measured. This work will be greatly facilitated by the fact that quadrangle coverage is complete, and all but two counties have recent soil surveys.

Since the legal system is already superimposed on the quadrangle maps, the sampling unit recommended is a ¼, ¼ section (40 acres). The sample units can be located with a properly scaled acetate overlay. The sampling units can be further subdivided within this system to increase the number of observations (Nance 1983:295-297; Plog et al. 1978:619-622). Units much smaller than 40 acres (16 ha) would be more difficult to locate in the field, however.

In order to determine sample size one possibility is to do a relatively small pre-sample such as .1% of the study area, and from these results, establish an estimate of the population (sites) variance. With this information a reliable sample size can be determined statistically (Dixon and Massey 1969:44-46; Freese 1967:12-14). It should be noted that a sample as small as 1% is approximately 18,560 acres (7511 ha) or 464 sampling units. Project cost as mentioned becomes a key factor in research design implementation.

The sample units can be allocated several ways including in proportion to the size of the stratum or in proportion to the inferred archaeological value of the stratum. To eliminate potential biases, it is suggested that the sampling units should be allocated equally among the strata. Since the Loess Hills are transected by numerous roads, farmsteads and fence lines, location of the sampling units should not be difficult if equal allotment is utilized.

Accessibility will be a major problem, however. In a practical sense some of the strata in the Loess Hills such as hillslopes will be difficult if not physically impossible to survey. The likelihood of archaeological sites being found in some of the strata is remote. Regardless, all strata must be sampled. Replacement should occur only if access to a sampling unit is denied by a landowner. The archaeologist can make quantifiable decisions in the field on the strata in question as to whether or not they can be surveyed.

In addition to a statistically valid sampling procedure, an integral part of the reconnaissance survey is systematic field evaluation. Plog et al. (1978) and Dunnell and Dancey (1983) address many of the problems associated with the mechanics of modern archaeological field surveys; their research should be consulted prior to implementation of the field work. The goal of the field survey should be to use identical techniques for site definition and location within each survey unit (Plog et al. 1978; Dunnell and Dancey 1983:271; Fitzhugh 1972:146; Schiffer and Gumerman 1977:183-184). The rigor proposed in the field phase is necessary mainly to avoid introducing sampling errors. While some decisions will have to be made at the surveyor's discretion, minimal survey of each unit should involve complete pedestrian coverage supplemented by subsurface inspection through shovel testing, probing or use of drill rigs or augers. Cutbanks and other exposures should be inspected and faced if possible. These field techniques should be used irrespective of vegetative cover and are a necessity due to the nature of the archaeological remains that occur in fluvial deposits in the Loess Hills (Thompson and Bettis 1980).

Local collectors should be identified and interviewed and their collections documented. Information can be obtained in this manner on unrecorded sites in the immediate area or in sampling units to be investigated. Minimally, private collections should help provide a better idea of the range of material culture present in the general vicinity of the collector.

Data Analysis

The first portion of this stage involves preparation of an inventory of sites identified in the Loess Hills from the survey as well as those previously recorded. A history of Loess Hills archaeology assembled in a manner following Anderson's (1975) overview of Iowa archaeology would be relevant and useful to help direct research needs. Assemblages recovered should be categorized by cultural affiliation if possible. All artifacts should be classified following criteria detailed by the archaeologists; diagnostic specimens should be noted and described in detail. Finally, all sites should be plotted on USGS quadrangle maps and on Soil Survey maps for later study.

The second portion of this stage involves specific evaluations. The purpose is not only to classify the sites culturally and functionally but to determine what factors may have been involved in location of the sites. These three concerns bear directly on identifying unique adaptations to the Loess Hills by prehistoric groups. Site types can be defined on the basis of assemblage content and context within a site, associated surface and subsurface features and landform position of the site (Trubowitz 1977:147). To this end the field techniques utilized must produce the horizontal and vertical extent of the archaeological deposits in the site, establish the range of cultural material present, identify features and the density distribution of the artifacts and obtain floral and faunal information systematically. These data categories include a wide range of archaeological concerns such as paleoenvironmental reconstruction, subsistence patterns, identification of single or multicomponent sites, changing site use through time, site formation processes and landform stability, and collection of chronometrically datable material to supplement stratigraphic observations and diagnostic artifacts recovered.

Obviously, no one site will produce all data sets; consequently, the scope of analysis of each site is contingent on what the particular manifestation under study produces. Even so, since this stage of the research design is largely interpretative, there should be considerable emphasis placed on uniformity in the field methods used to examine the sites and in methods of analysis of materials recovered (Nance 1983:319-320). Due to the nature of the Loess Hills physiography, the field work for this stage will be constrained by the same problems presented earlier for the survey work.

An unbiased sample of sites for evaluation must be obtained and is the only practical way to implement this stage of the research design if the number of identified sites is large. Random selection of sites within each stratum for evaluation is one method; simple random sampling of sites for evaluation is certainly more feasible at this level of study. Regardless, statistical analysis of site types, densities and distributions are possible only with an unbiased sample. Development of reliable predictive models to explain where these sites are located and why is presently hampered by the use of biased data in the Loess Hills and elsewhere (DeBloois et al. 1984:3; Cordell and Green 1984:83-89, 91, 93).

Data Application

In the final stage of the research design the emphasis shifts from data gathering and analysis to problem-oriented research on specific topics. Since no two archaeologists have the same research interests or expertise, major excavation projects will in large part utilize field strategies developed independently and will vary in purpose contingent on what the researcher chooses to investigate. The ability of archaeologists to develop problem-oriented studies, however, provides a measure for evaluation of this research design.

With respect to the project goal an example of data application can be provided with Woodland stage subsistence and settlement patterns which may be indicative of a unique Loess Hills adaptation. Woodland stage societies are characterized by the presence of pottery, burial of the dead in mounds and incipient agriculture (Griffin 1967). Woodland groups were intensive hunters, gatherers and foragers. These activities probably involved specific seasonal rounds of activities within established territories. Woodland cultures maintained semi-permanent villages and produced a variety of specialized activity areas in addition to cemeteries such as chert quarrying areas and storage facilities within habitation areas.

Pottery has been found in the Loess Hills which is similar in form and decoration to established Woodland traditions of the prairies such as the Havana tradition. Loess Hills pottery types also apparently shift in popularity coevally with related styles regionally (Tiffany 1977, 1978). Pottery from the Rainbow site (13PM61), however, is distinctive and may reflect a Loess Hills' style (Benn 1981:191-222). Other research possibilities can be expressed as a series of expectations which can be resolved empirically within the framework of the proposed research design.

For Woodland stage cultures in the Loess Hills:

(1) A more dispersed settlement pattern is expected than that associated with Woodland settlement systems found in large riverine areas. Dispersed settlement is proposed because of the rugged nature of the Loess Hills as a regional landform feature. Similarly, smaller population aggregates are expected throughout the year. Larger villages, if present, should be confined to major valleys transecting the Loess Hills such as the Little Sioux-Maple River system.

(2) It is expected that some portions of the Loess Hills may have very limited use. This expectation is also based on the topography which would have also affected subsistence activities, settlement and travel. For example, even though economically important plant resources would have been abundant in the Loess Hills, they presumably would have been confined to smaller communities and distributed more unevenly due to the rapidly changing slope, aspect and drainage characteristics found in the Loess Hills. This would make access to them difficult, resulting in perhaps less effective use or use limited to very small groups.

The terraces of the small interior streams in the Loess Hills drainage systems may have afforded ideal protection for winter encampments by single family groups. It is possible that these locales were utilized only on a seasonal basis.

(3) Some portions of the Loess Hills such as the western bluffs may have been used strictly for symbolic or other special purposes. The treeless western bluffs provide an outstanding view for several miles to the north, south and west. This feature may have been exploited specifically to facilitate communication through signal fires, for example. While Archaic and Woodland burials have been found in gully fills (Anderson et al. 1978; Fisher et al. 1985; Tiffany 1983), burials in mounds may be confined only to the western bluff edge. Mound burial in the Loess Hills may be indicative of status burial. It is expected that evidence for involvement in the Hopewell Interaction Sphere in the form of grave goods would be very limited in the Loess Hills. If present, Hopewell contact may be associated only with Middle Woodland age mounds and not with coeval burials from terrace deposits. A related problem is the presence of non-mound burials in the western bluffs which may be post-Woodland in age such as the Rock Creek ossuary and the Siouxland Sand and Gravel site (Anderson and Baerreis 1973; Anderson et. al. 1979).

(4) Lithic resources are limited in the Loess Hills. Woodland assemblages should show proportionally higher percentages of non-local cherts when compared with other Woodland assemblages. Because cherts were brought into the Loess Hills, lithic assemblages may have significantly higher amounts of micro-debitage indicative of extensive tool use. Implements may appear cruder because of the lack of quality cherts.

(5) Evidence for agricultural activities may be limited spatially to the larger valleys. Trade or importation or cultigens from other areas by Loess Hills Woodland groups is expected and can be verified contingent on whether the sites produce corn cobs as well as corn. Presumably, if Loess Hills groups were trading for produce like corn, only kernels would be found in the sites.

These are a number of many possible expectations that can be developed with respect to utilizing the information gathered from the first two stages of the research design to address the project goal. In this regard data application in Stage 3 parallels the summary of research questions posed by Goodyear (1977:163) for the South Carolina highway archaeology research design which is similar in scope to the Loess Hills research design proposed.

SUMMARY

The research design presented was developed to produce information necessary to determine whether there were unique prehistoric cultural adaptations to the Loess Hills among prehistoric societies who utilized this area. The data recovered can be viewed descriptively, analytically and synthetically. Descriptive results are basic to this research design. This research design should produce statistically manageable information obtained from a systematically derived, unbiased sample which can produce measurable results (Rootenberg 1964:181). These data are at the core of any continuing research whether or not it is directed toward the specific goal of this research design. A summary of the known archaeological information including the history of archaeological research in the Loess Hills was identified as an important product of this research design. The historical information would be of value even if no other aspects of the research design were to be implemented.

Important results of the Stage 1 reconnaissance survey are an estimate of the total number of sites and their distribution on a range of landforms. The second stage of the research design refines these data. From an analytical standpoint this portion of the research design utilizes systematically collected assemblages to produce definitions of site types, site density by landform unit, site distribution by age and cultural affiliation, subsistence pursuits and paleoenvironmental reconstruction. Beyond noting a range of field methods, specific means for accomplishing these ends are not offered because, at this point in time, it is not known except in a very general way what the sites found will produce. An important element in implementing the field research, however, is the use of trained personnel. A project of the scope proposed should not be done as a field school or a public archaeology training exercise. In addition, it was emphasized that the analytic methods utilized and the concepts pertaining to them should be explicitly defined, consistently applied from site to site and directed towards the problems associated with conducting field work in the Loess Hills.

Stage 3 involves synthesis of the information gathered. There are a myriad of possible research questions resolvable with the Loess Hills archaeological information assembled. All require to some extent establishment of associations among sites and assemblages and documentation of similarities and differences among them. The Iowa State Plan (RP3) (Henning 1982) may be useful for exploring avenues of potential archaeological research other than the specific goal identified for this research design.

Finally, a number of limiting factors were discussed with respect to the feasibility of conducting the proposed research and obtaining the archaeological data expediently. These include: the enormity of the project area when compared to study areas reported in the literature where probabilistic sampling has been utilized (Lensink 1981; Schiffer and House 1977; Mueller 1974); the rugged topography and closed vegetative cover which impose considerable surveying and excavation problems; and the extensive costs associated with a research project of this scope. The probabilistic sampling and use of uniform field methods address project cost to some extent. In reality this research design could probably only be implemented as a multi-year sponsored project. However implemented, the Loess Hills research design would provide much needed information on a poorly known, but extremely important resource in Iowa's most unique landform region.

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