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Significance Evaluation and Research Potential of Prehistoric Sites in Thunder Basin National Grassland, Wyoming

Christopher A. Cojeen
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SIGNIFICANCE EVALUATION AND RESEARCH POTENTIAL OF PREHISTORIC SITES IN THUNDER BASIN NATIONAL GRASSLAND, WYOMING

by

Christopher A. Cojeen

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Anthropology

Western Michigan University
Kalamazoo, Michigan
August, 1982
Known and potential prehistoric archeological sites in Thunder Basin National Grassland in Wyoming are examined and problems involved in significance evaluation are discussed. Emphasis is placed upon the need to develop research strategies to contend with two frequently encountered site types — lithic scatters and stone circles. Some archeologists (Frison 1978; Tibesar et al. 1981) have suggested that further research on these site types would contribute substantially to an understanding of High Plains prehistory. In conclusion, a recent attempt to develop a conceptual basis for prehistoric study in Thunder Basin National Grassland is discussed, and some regional research orientations and questions are suggested.
ACKNOWLEDGMENTS

Although this thesis is the result of long hours of labor on my part, it could not have been accomplished without the assistance and guidance of others to whom I am deeply grateful. In particular, I would like to thank my major advisor, Dr. Elizabeth Garland, for her patience and wise counsel. She will be pleased to know that I have learned much during this process. I should also like to thank Dr. William Cremin and Dr. Nedenia Kennedy, members of my committee, for their careful reading of the manuscript and for their constructive comments. In addition, I would like to acknowledge the contribution of my wife and my parents. Their assistance and encouragement were most beneficial. Responsibility for the contents and conclusions is, of course, entirely mine.

Christopher A. Cojeen
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CHAPTER I

INTRODUCTION

Objectives

Federally mandated cultural resource management has become increasingly important as the operative mechanism for conducting archeological investigation in the United States. In some areas, contract investigations represent the first professional attempts to identify and record cultural resources. Frequently, there is an absence of specific research objectives for such areas with the result that emphasis is placed only on the inventory of archeological resources. This objective would be adequate if landscape-altering activities could await the completion of the inventory. However this is rarely the case. More typically, cultural resource managers must contend simultaneously with inventory and significance evaluations, without the benefit of knowing the redundancy or rarity of cultural resources within an area.

This thesis will examine research potentials of Thunder Basin National Grassland, an area little known archeologically, yet currently suffering extensive impact from recent energy development activities. The objectives will be two-fold: to identify problems encountered in significance
evaluation of prehistoric cultural resources, and to suggest some research orientations which could aid in the development of a research design for the Thunder Basin area. Pertinent to this study is an understanding of federal legislation protecting archaeological resources, and a discussion of factors involved in significance evaluation.

Study Area

Thunder Basin National Grassland, administered as a unit of Medicine Bow National Forest, is located in the northeastern portion of Wyoming (Map 1). It consists of two physically separated areas. The larger segment is a contiguous sweep of land which occupies parts of Converse, Weston, Campbell, and Niobara counties. It extends from a few kilometers south of Bill, Wyoming, northward almost
to Gillette and Moorcroft, and from its eastward extreme of Newcastle westward to Pine Tree Junction. The smaller, separate area lies entirely in northwestern Campbell County, about seventy-two km north of the larger grassland region. Approximately 809,400 ha of land lie within the boundaries of Thunder Basin National Grassland, 231,495 of which are federally owned.

Four factors make the Grassland important for archeological study:

1. It is part of the eastern Wyoming shortgrass Plains and studies of its prehistoric manifestations could suggest occupational patterns of the shortgrass Plains as a whole, which include all of Wyoming and parts of Colorado, Montana, Nebraska, and South Dakota.

2. Substantive hunter-gatherer activity, extending over the past 11,000 years, is evidenced in the area.

3. In accordance with federal mandates, National Grassland areas require archeological impact assessment prior to disturbance of the land; therefore a funding mechanism for data collection is available.

4. A computer coding system devised from previously recorded site information is currently being developed for use in Medicine Bow National Forest, Wyoming, and this system will include data on Thunder Basin National Grassland. When completed, this should
increase the retrievability of statistical information on the character and distribution of prehistoric sites in Thunder Basin.

The Data Base

During the field season of 1981, while employed as a field assistant by a private contracting firm, the author conducted numerous smale-scale compliance surveys in Thunder Basin National Grassland and became involved in the computer coding of archeological localities. In this capacity the author was able to examine most of the archeological site records pertaining to the Thunder Basin area. Use of the information in these site records for purposes of this thesis has been authorized by Mr. Ray Light, Bureau of Land Management State Archeologist for Wyoming (personal communication, November 24, 1981).
CHAPTER II

HISTORY OF ARCHEOLOGICAL RESOURCE CONSERVATION THROUGH FEDERAL LEGISLATION

Since the turn of the century increasing emphasis has been placed on protecting cultural resources within the United States. Legislation has been enacted to diminish the negative effects of the ever-escalating exploitation of land, water, and mineral resources. Protection of archeological and historical assets presents a challenge to the Congress, as laws must be drafted without full knowledge of the resource base they are created to protect. As information on the resources in question becomes available, a need emerges for revised government policies, more explicit in scope.

Major legislation pertaining to historical and archeological recovery and protection is outlined in recent literature (Holden 1977; King and Lyneis 1978; McGimsey 1972; and Schiffer and Gumerman 1977). Also, the American Society for Conservation Archeology Newsletter prepares up-to-date reviews of current legislation affecting archeological interests. This summary, developed primarily from the literature cited above, will review major federal legislative acts in historical sequence.
The Antiquities Act of 1906 (Public Law 59-209, 34 STAT. 225) was the first legislation protecting historic and prehistoric sites located on government owned or controlled land in the United States. It made destruction of ruins or monuments a federal offense, punishable by not more than a five hundred dollar fine and/or ninety days imprisonment (Public Law 59-209; Section 1). It also authorized the President of the United States to preserve landmarks, structures, and objects, and to reserve the lands on which these resources are located (Public Law 59-209; Section 2).

This Antiquities Act was an outgrowth of the conservation efforts of President Theodore Roosevelt and a handful of preservation minded groups who observed increasing destruction of the American heritage, primarily in the southwestern United States.

Schiffer and Gumerman (1977:4) have described this law as "notoriously unenforceable." Although it was designed to protect the vast expanses of government owned land, no adequate means of patrolling these areas was available at that time. Indeed, even today the problem of patrolling large areas remains a critical issue (Reyman 1979).

The first attempt at a conviction under the 1906 act occurred in the 1970s, but though the case was upheld (U.S.
v Diaz, 1977), the fine was a mere $500 (Collins and Green 1978). Although this law has failed to function as intended, that is, to prohibit excavation and removal (without permit) of artifacts from federal lands, it set a precedent for legislative actions geared toward a preservation/conservation concept.

Historic Sites Act of 1935

Public Law 74-272 (49 STAT.666), known as the Historic Sites Act of 1935, assigned responsibility to the Secretary of the Interior, through the National Park Service, for surveying "...historical and archeological sites, buildings, and objects for the purpose of determining which possess exceptional value as commemorating or illustrating the history of the United States" (Public Law 74-292; Section 2b). It also provided for "...necessary investigations and researches in the United States relating to particular sites, buildings, or objects to obtain true and accurate historical and archeological facts and information concerning the same" (Public Law 292; Section 2c).

During the Great Depression programs directed at creating work for the unemployed functioned under these guidelines, initiating in the United States the concept of governmental contracting for archeological investigation. King and Lyneis (1978) suggest that a split was created between historic preservationists and salvage ar-
cheerleaders during the 1930s, and that the Historic Sites Act functions mainly to serve historic interests. The historic preservationists stress the "...permanent, physical preservation of historic things...", while the salvage archeology approach recognizes that "...historic properties must be sacrificed to progress and attempts to obtain and preserve information about these resources ...")(Ibid:874).

The split between historic and archeological interests, according to King and Lyneis, is reflected in programs working toward different objectives. The historic preservationist found the Historic Sites Act adequate to protect historic interests. Conversely, the archeological sector found the act inadequate for their needs and developed the River Basin Salvage Programs, administered by the Division of Archeology of the United States National Museum, Smithsonian Institution. During the 1940s these River Basin Salvage Programs worked toward large-scale site mitigation prior to watershed projects, e.g., the Missouri Basin Project. These efforts initiated the term "salvage archeology."

The River Basin Salvage Programs were poorly funded; the Reservoir Salvage Act of 1960 was an attempt to increase funding for archeological salvage projects.
Reservoir Salvage Act of 1960

Public Law 86-523 (74 STAT.220), the Reservoir Salvage Act of 1960, functions to preserve historical and archaeological data which otherwise would be lost by flooding, building, or maintaining a dam constructed either by a government agency or by a private person holding a government agency license. This act delegates responsibility for salvage efforts related to watershed projects to the National Park Service and requires that the contract firms involved cooperate.

It is suggested by King and Lyneis (Ibid) that the Reservoir Salvage Act occupied the major efforts of professional archeologists engaged in salvage work throughout the sixties and that this preoccupation with dam salvage resulted in a lack of participation in the formation of the Historic Preservation Act of 1966.

National Historic Preservation Act of 1966

With the passage of the National Historic Preservation Act of 1966 (Public Law 89-665, 80 STAT.915), the federal government became directly responsible for the identification, protection, and restoration of historic sites in the United States. The National Register of Historic Places was created and maintained under the provisions of this legislation. The act provides for the appointment of the President's Advisory Council for Historic Preservation and
of a State Historic Preservation Officer in every state.

Because the National Register was initiated originally for historic preservation, some individuals doubt whether it can function appropriately with respect to prehistoric resources (Butler 1979; Raab and Klinger 1977). According to Raab and Klinger, the National Register encourages preservation as opposed to research. They stress that it is difficult to assess the value of prehistoric resources without a research parameter. Others, however, hold the view that the National Register can function adequately in both historical and prehistoric capacities (Barnes, Briggs, and Neilsen 1980).

National Environmental Policy Act of 1969

With the passage of the National Environmental Policy Act of 1969 (Public Law 91-90, 83 STAT.852) Congress took a critical legislative step to insure the basic public right to an environment of quality. Section 101.b2 of Public Law 91-190 states that it is the government's responsibility to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings." In respect to antiquities protection, the law functions to "preserve important historic, cultural, and natural aspects for our national heritage, and maintain, whenever possible, an environment which supports diversity and variety of individual choice" (Public Law
The National Environmental Policy Act was created to fulfill the following objectives:

To declare a national policy which will encourage production and enjoyable harmony between man and his environment to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality. (Public Law 91-190; Section 2)

It is the responsibility of the Council on Environmental Quality to assist the President in preparing an annual environmental quality report, which informs Congress on the status and condition of the environment and suggests methods of remedying the shortcomings of the current program. The preparation of the report requires up-to-date information on the status of cultural resource management.

According to Schiffer and House (1977) the National Environmental Policy Act is most important for understanding the new social philosophy fostering current contract archeology. In order to conform to the requirements of this law, the agency or private contracting firm involved in a land-altering project must document the probable effect of the project in terms of related disturbance to environmental and cultural resources. In the case of cultural remains, proposals for mitigation alternatives are required.
Executive Order 11593

In 1971, Executive Order 11593, entitled "Protection and Enhancement of the Cultural Environment," was signed by President Nixon. In effect, this order made it the stated policy of the federal government to provide leadership in the preservation of the historic and cultural environment. It directed federal agencies to initiate the necessary measures to preserve properties under their control for the benefit of the people (Holden 1977). Agencies were charged with the responsibility for inventorying and evaluating cultural resources under their domain by July 1, 1973; they were cautioned not to destroy resources until these responsibilities were fulfilled (Ibid). Surveys were initiated for the nomination of qualified sites to the National Register of Historic Places.

The Secretary of Interior was given responsibility for developing criteria for federal agencies evaluating cultural resources and for expediting action upon sites nominated to the National Register.

Archeological and Historic Preservation Act of 1974

Until 1974 funding the surveys required for compliance to Executive Order 11593 was the responsibility of each federal agency.

The Archeological and Historic Preservation Act of
1974 (Public Law 93-291, 74 STAT. 220), also called the Moss-Bennett Act, was the first legislation authorizing federal agencies to apply part of contract monies (up to one percent of the cost of a federal construction project) for archaeological mitigation.

Passed as an amendment to the Reservoir Salvage Act of 1960, Moss-Bennett expanded the application of the 1960 law to all federal or federally assisted or licensed construction projects and efforts, including airport and road construction, that could possibly impact cultural resources. The original Reservoir Salvage Act had limited funding to federal dam and reservoir impact areas.

Additionally, the new act expanded the managerial and fiscal responsibilities of the Secretary of the Interior. It allowed federal agencies to conduct the preservation efforts themselves, under the direction of the Secretary of the Interior, or, to request that the Secretary of the Interior undertake the recovery and preservation effort (Public Law 93-291; Section 3a).

The Secretary of the Interior also is responsible for compensation for loss of use of nonfederal property, or damages related to construction delays caused by a federally authorized survey or salvage effort (Public Law 93-291; Section 3b). The responsibility of compensation for loss of use has been readdressed and refined in the AHPA Statement Approach 1979: Guideline (5).
The Moss-Bennett Act was a landmark in cultural resource legislation.

Archeological Resources Protection Act of 1979

Previously described legislation has dealt mainly with federal policy and agency responsibilities toward this country's cultural resources. In addition to destruction in the name of progress, these resources also are vulnerable to willful acts of vandalism or looting by private citizens. The Archeological Resources Protection Act of 1979 (Public Law 96-96) is a recent effort to clarify portions of the 1906 Antiquities Act, primarily stipulating what constitutes illegal removal of archeological resources from federal lands. A clear concept of what qualifies as an archeological resource is developed, and the process for obtaining a permit to excavate on federal lands is outlined. Currently an archeological site must be two hundred years old to achieve protection. Isolated finds such as projectile points are not protected by this law.

Present State of Antiquities Legislation

During the last eighty years a new philosophy has emerged in respect to nonrenewable resource conservation in the United States. The apex of this philosophy is seen
in the National Environmental Policy Act of 1969 and in Executive Order 11593. The needed addition of a funding process was achieved in 1974 with the passage of the Moss-Bernett Act.

A current overview of preservation policy as required by legislation is outlined by King and Lyneis (1978:876):

1. Each state is to develop a plan for the identification, evaluation, and systematic treatment of all types of historic properties.

2. Each state is to undertake a statewide survey ...

3. States and local agencies are encouraged to acquire and record historic properties ...

4. All [federal agencies] must systematically consider the effects of their undertakings on historic properties ...

5. All federal agencies controlling or having jurisdiction over land are instructed to locate their historic properties and to nominate them to the National Register ...

6. Federal agencies may expend their own project monies for protection or salvage of data contained in historic properties ...

7. The Secretary of the Interior, through the Office of Archeology and Historic Preservation, provides professional guidance to federal agencies in their preservation activities nationwide, and determines which properties qualify for inclusion in the National Register of Historic Places. The Advisory Council on Historic Preservation, which reports directly to the President, reviews activities of all agencies to ensure that historic values are not slighted.

Federal policies have been initiated and legislation enacted to protect cultural resources on federal lands. Regulations have been established to organize technical standards and procedures to carry out the pertinent law.
Regulation 36 CFR 800, "Procedures for the Protection of Historic and Cultural Properties," outlines the steps to be taken when federally licensed or assisted projects affect properties listed in or eligible for the National Register. It is important to note that properties must be listed in the National Register, or be eligible for inclusion in the National Register, to require financial expenditure for mitigation or protection.
CHAPTER III

SIGNIFICANCE OF ARCHEOLOGICAL RESOURCES

Significance is a concept which can be interpreted using numerous methods and criteria. Because of the great variety of interpretative processes involved in significance assessment, this aspect of cultural resource management is highly controversial.

Introduction

Significance refers to the value of archeological resources. This general definition becomes infinitely more complex when the dimension of justifying the value placed on a cultural resource is considered. Justification of significance is a responsibility of the archeologist assessing the resource, and it is critical that substantive criteria are referenced when conducting this evaluation.

Recent government mandates dealing with archeological preservation insist on the development of "... criteria and procedures to be applied by Federal agencies in the reviews and nominations [of historical and prehistoric resources]..." (E.O.11593, Section 3b). The National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Executive Order 11593 of 1971, and the Archeological and Historic Preservation Act of
1974 all require assessment of the significance of archaeological resources prior to preservation, mitigation, or destruction. However, according to Raab and Klinger (1977: 630) "there is little guidance in the statutes and directives indicating how significance is to be assessed."

Vague guidance for determining the significance of cultural resources emerges in the National Register criteria for evaluation (36 CFR 69.6):

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and:

1. That are associated with events that have made a significant contribution to the broad patterns of our history; or

2. That are associated with the lives of persons significant in our past; or

3. That embody the distinctive characteristics of a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

4. That have yielded, or may be likely to yield information important in prehistory or history.

Still, defining guidelines is difficult because significance cannot be measured on a graduated scale. Though in practical application archeologists may find it necessary to assign an order of importance to a given set of cultural resources, significance criteria can change through time. There is no guarantee that an order of im-

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portance employed today will remain justifiable tomorrow.

Approaches to significance assessment have been suggested by Barnes, Briggs, Neilsen (1980), Glassow (1977), Grady (1977), LeVasseur (1981), Moratto and Kelly (1976), Raab and Klinger (1977), and Schiffer and Gumerman (1977). As these authors expressed their rationales for assessment, they have constructed various interdependent categories of significance. Aspects of significance relevant to this study are selected from the literature cited above.

Types and Levels of Significance

In a recent publication, LeVasseur (1981:26) introduced a frame of reference for interpretation which separates significance into "types" and "levels". Observing types and levels as separate aspects will aid in developing a better understanding of their relationship.

Types of Significance

Four types of significance will be discussed here: scientific, historical, social, and practical. Though all contribute, they may not carry equal weight in an assessment.

Scientific Significance

Scientific significance assessment of an archeological resource is achieved by equating the value of the resource
with its research potential (Schiffer and Gumerman 1977). An initial problem with scientific significance is that almost all sites provide information of some type. Moratto and Kelly point out that "... the importance of archeological material will vary according to the research interests of the evaluator" (1977:195). Whether this bias should be, or can be, avoided is a current issue.

Raab and Klinger (1977) believe that significance in archeology can best be assessed through a research design that takes into consideration current research questions. This approach stimulates the development of methodologies for continued improvement in field archeology.

An important consideration in scientific significance evaluation is the integrity of a resource. Integrity directly reflects the potential of a site to contribute useful information.

**Historical Significance**

Historical Significance is established by the association of a location with a specific event in the historical record. Within this definition Grady (1977) includes areal knowledge of particular cultures, periods, and lifeways. The National Register further defines historical significance to include resources:

that provide a typical or well preserved example of a culture, activity, or time period, and are associated with a specific event, or the work of
a prominent archeologist or other historic person (36 CFR 60.6).

When applied to significance assessment, historical and scientific criteria types can be interdependent. A review of historical information is preparatory to scientific research, and scientific research may in certain cases verify historical records.

Social Significance

Social significance, as defined by Grady (1977), refers to the benefits that the public might gain from the study and conservation of archeological resources. Significance with this orientation is determined by public interest in local archeological remains, through ethnic affinities with the resource base, and through local pride in a resource. Archeologists have tended to overlook this type of significance. Moratto and Kelly (1977) observe that this insensitive treatment of social significance has caused conflict between archeologists and native Americans.

Practical Significance

Practical significance combines the previously outlined types of significance in an attempt to provide a format suitable to contend with current pressures on cultural resources. Its objective is to achieve realistic management of archeological resources, with consideration to both cultural resources and the existing demands for
land development. It is pointed out by LeVasseur (1981: 27) that this type, "includes aspects of significance which are controversial to archeologists because they separate archeological resource management from ideal archeology."

Levels of Significance

According to LeVasseur (Ibid) archeological resources should be assessed on different levels with respect to the areal extent of the research questions which may be resolved by their study. Most effective for defining areal extent are the concepts of site, zone, and region. These concepts conform to physical geographic boundaries of varying scope, and the importance of each level is dependent on individual research orientations. However, cultural resource managers often find it expedient to approach significance levels with political boundaries of local, state, and national affiliation. Although these are less meaningful archeologically, they are managerially well defined.

Significance Assessment in Application

Though it is possible to identify types of significance, and to observe their respective levels, it remains difficult to demonstrate to what extent different types are weighted in significance evaluation. It appears,
however, that scientific significance is depended upon most frequently in the evaluation process. Weinland's list of criteria used in Kentucky during the 1970s for National Register nomination demonstrates this emphasis on scientific considerations (Table 1). Out of thirty-five criteria, only four nomination categories do not relate to a scientific type of evaluation. These are: two sites nominated for public education, a site preserved by local government, two sites which are visually impressive, and a site of general archeological interest. All four criteria would be classified as having social significance.

Site forms used in eastern Wyoming for determining National Register eligibility depend solely on scientific criteria. Commonly considered and used in Wyoming are the presence of one or more of the following: subsurface features, activity areas, diverse materials, large quantity of materials, and buried deposits.

Summary

The need for a formal rationale to evaluate the significance of archeological resources in the United States has increased during the last decade due to legislation enacted to recover and preserve a nonrenewable resource base. However, multiple concepts are involved in determining significance, and different types of significance are not equally utilized in determining National Register
Table 1. Criteria of significance used in Kentucky to nominate archaeological resources to the National Register of Historic Places (from Weinland 1980:15)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Cited Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>14</td>
</tr>
<tr>
<td>Undisturbed</td>
<td>12</td>
</tr>
<tr>
<td>Rarity of culture</td>
<td>10</td>
</tr>
<tr>
<td>Rarity of site type</td>
<td>9</td>
</tr>
<tr>
<td>Subsistence pattern</td>
<td>9</td>
</tr>
<tr>
<td>Paleoenvironmental data</td>
<td>8</td>
</tr>
<tr>
<td>Stratified deposits</td>
<td>8</td>
</tr>
<tr>
<td>Culture change</td>
<td>7</td>
</tr>
<tr>
<td>Local chronology</td>
<td>4</td>
</tr>
<tr>
<td>Deep deposits</td>
<td>4</td>
</tr>
<tr>
<td>Lithic resources and technology</td>
<td>4</td>
</tr>
<tr>
<td>Multicomponent</td>
<td>3</td>
</tr>
<tr>
<td>Intensity of occupation</td>
<td>3</td>
</tr>
<tr>
<td>Settlement pattern</td>
<td>3</td>
</tr>
<tr>
<td>Origins of horticulture</td>
<td>3</td>
</tr>
<tr>
<td>Size</td>
<td>3</td>
</tr>
<tr>
<td>Dryness</td>
<td>3</td>
</tr>
<tr>
<td>Visual impression</td>
<td>2</td>
</tr>
<tr>
<td>Public education</td>
<td>2</td>
</tr>
<tr>
<td>Lack of excelled data*</td>
<td>2</td>
</tr>
<tr>
<td>Preserved by local government</td>
<td>1</td>
</tr>
<tr>
<td>Paleontological data</td>
<td>1</td>
</tr>
<tr>
<td>Authorities cited***</td>
<td>1</td>
</tr>
<tr>
<td>Local landmark</td>
<td>1</td>
</tr>
<tr>
<td>Overlapped cultural areas</td>
<td>1</td>
</tr>
<tr>
<td>Burial customs</td>
<td>1</td>
</tr>
<tr>
<td>Technology of cave dwellers</td>
<td>1</td>
</tr>
<tr>
<td>Totally unique</td>
<td>1</td>
</tr>
<tr>
<td>Social organization</td>
<td>1</td>
</tr>
<tr>
<td>C-14</td>
<td>1</td>
</tr>
<tr>
<td>Paleo component</td>
<td>1</td>
</tr>
<tr>
<td>Type site</td>
<td>1</td>
</tr>
<tr>
<td>Unique artifacts or features</td>
<td>1</td>
</tr>
<tr>
<td>General archeological interest***</td>
<td>1</td>
</tr>
<tr>
<td>Method and technique</td>
<td>1</td>
</tr>
</tbody>
</table>

*interpreted here to mean no better preserved example of the site type exists

**interpreted here to mean an historian or archeologist has referenced this site as significant

***interpreted here to mean a site nominated for general enrichment
eligibility status.

Weinland's data and the author's observations in Wyoming indicate that in practice the National Register evaluation process emphasizes scientific significance as the major criterion for eligibility.

The following discussion of the Thunder Basin National Grassland provides examples of practical problems that are encountered in significance assessment and demonstrates the importance of research objectives.
CHAPTER IV
THE ENVIRONMENT

The study area, Thunder Basin National Grassland, is part of the Great Plains, a semiarid grassland environment which extends from the Canadian border south to west central Texas and from the Rocky Mountains east to the Mississippi-Missouri Valley (Wedel 1961). It is a region of environmental extremes: in seasonal temperature, in precipitation, and in exposure to sun and wind. The prehistoric subsistence base offered by this marginal environment is poorly understood, but growing evidence suggests that man adapted by utilizing a dual-component system of large game hunting and foraging.

The following is an environmental description of Thunder Basin National Grassland and a discussion of possible paleoenvironmental variations.

Topography

Geologically, Thunder Basin National Grassland is located in the eastern portion of the Powder River Basin. This basin was formed between 125 and 38 million years B.P. by the uplifting of adjacent mountain blocks (Grasso 1981). Today, the Bighorn Mountains lie to the west and the Black Hills to the northeast. Open grasslands continue to the
north, following the course of the Powder River (Map 2).

Major topographic features are limited to the Rochelle Hills, located within the eastern portion of the larger tract of land, and the Pumpkin Buttes, immediately to the west. These features result from erosion of the softer matrix around resistant scoria deposits (Ibid:5). Minor relief also derives from extensive erosion, expressed in a "badlands" topography. Bedrock outcroppings of the Wasatch formation occur throughout the area, and in some cases demonstrate abrupt surface expression (Ibid:5). The predominant soil type is medium textured sandy/silty loam, high in mineral constituents.

The western part of the grassland is a rolling terrain, while the eastern region is a sloping plain. Elevation ranges from 1550 m in the west to 1340 m in the east. The western rolling divide is less dissected than the eastern plain, which is scored by ephemeral channels of the Cheyenne River Basin (Ibid:5-6). The Cheyenne River is a major structural feature and functions as the primary drainage system. Tributaries such as Beaver, Lance, and Porcupine Creeks are perennial in the higher elevations and intermittent when they reach the basin floor.

Three alluvial terraces lie above the present flood plain of the Cheyenne River and its tributary system. The Kaycee Terrace, 7.5 m to 9 m above the flood plain, is the oldest and the highest. Moorcroft Terrace rises 3.5 m to
Map 2. Locational map of Thunder Basin National Grassland and vicinity
6 m above the present flood plain and the Lightning Terrace, 1.5 m to 1.8 m above (Leopold and Miller 1954:7-8). These river terraces and alluvial flood plains represent potential sources of geological and archeological information.

Climate

Thunder Basin National Grassland is in a climate zone classified as middle latitude semiarid steppe (Ibid:8). Mean annual temperature is 7°C, with an average range between -6°C to -3°C in January and 21°C to 23°C in July (Ibid). Temperature extremes are from -34°C in winter to above 38°C in summer.

The climate is controlled by Mild Pacific, Arctic, and Tropical Maritime air masses (Reeves 1973:1223). Of these three, the dry Mild Pacific air dominates, resulting in a low winter snowfall of 100-150 cm. Intrusions of Arctic and Tropical Maritime air masses are responsible for the little rain the area does receive, approximately 25 to 38 cm annually (Wedel 1961). Summer solar radiation creates a situation of yearly drought, which immediately follows the spring rainfall pattern. In response to this condition, vegetation of the region has evolved shallow root systems, to make best use of the short-lived rain showers.

Winds contribute to the aridity by increasing evapotranspiration, which is as high as 61 cm annually. Intensity and frequency of winds increase from November to
April; winds average 12-19 km/hr, gusting to 64 km/hr (Grasso 1981).

Vegetation

Vegetation is dominated by blue grama and short grasses; and plant cover varies from 20 to 50 percent. Other small plants and shrubs characteristic of this environment are bunch grass, sage, rabbit bush, small prickly pear, and narrow-leaf yucca. Cottonwoods are found along drainage bottoms, and juniper stands frequently occupy hillsides. Floral variability is primarily controlled by the low rainfall and short growing season, the same factors which make an agricultural economy based on maize and other domesticates not feasible (Wedel 1961). The dry climate creates a grass high in protein, ideal for grazing mammals.

Fauna

The grassland environment is well known for its large carrying capacity for herbivores. Late Pleistocene megafauna apparently thrived on the high protein grasses, and fossil evidence includes extinct species of bison (*Bison antiquus*), camel, and mammoth. Three other species of bison appear in the fossil record of the Holocene: *Bison crassicornis*, *Bison occidentalis*, and the modern form *Bison bison*.

Present fauna of the Thunder Basin area include ante-
lope, dear, rabbit, coyote, rodents and birds.

The Paleoenvironment

The paleoenvironment of the Northwestern Plains has long been the subject of debate (Grasso 1981; Mulloy 1958; Reeves 1973; Reher 1977; Wedel 1961). The main issue involves climatic conditions during the Altithermal, an episode of maximum aridity extending from 4500 B.C. to 2500 B.C. (Prison 1978).

Mulloy and Wedel theorize that the Altithermal was a period of intensive drought which reduced the Plains to a near desert environment and forced the out-migration of herbivores and man. They suggest that the hiatus in dated archeological manifestations in the Northwestern Plains supports this view. Reher's (1977) explanation of bison evolution provides further support. He suggests that drought created an environment to which Bison occidentalis and Bison crassicornis were not well suited, resulting in the evolution of the smaller Bison bison.

However, Reeves (1973) offers an alternative view of the Altithermal. He believes that this episode of increased aridity extended the shortgrass environment into the surrounding prairie regions. Since bison are best suited to a shortgrass habitat, the herbivore population increased during this period, allowing a continued occupation by human groups. Post-Altithermal reduction of the
shortgrass Plains forced herbivores to compete for prime habitat, resulting in the evolution of Bison bison. Reeves (1973) further suggests that the cultural hiatus is largely a factor of sampling error and nonrecognition of diagnostic artifact types in surface collections. He notes that present knowledge of the prehistoric record of the High Plains does not result from a designed study, and that research has been limited primarily to the periphery of the Northwestern Plains (Ibid:1231).

Grasso (1981) considers both theories extreme. He suggests that, aside from minor fluctuations, the grassland environment has persisted throughout the past 10,000 - 12,000 years. Periods of extended drought possibly caused human groups to adjust adaptive strategies; however, this does not necessarily suggest an abandonment of the area.

Further study of the Altithermal episode and related phenomena is necessary to resolve this issue. Site excavations within the shortgrass Plains (e.g., the Thunder Basin area) could possibly fill the temporal gap in cultural information, or substantiate the hiatus theory.
CHAPTER V

THE PREHISTORIC RECORD

No prehistoric archeological sites have been excavated in the Thunder Basin National Grassland. Known archeological sites are primarily the result of small-scale compliance surveys conducted prior to energy related impact within the federally owned portion of the National Grassland.

Construction of a prehistoric overview for Thunder Basin requires both a summary of the published archeological literature of the surrounding area and a review of the compliance survey reports. To begin with, a summary of archeological excavations in the eastern Wyoming Plains will aid in delineating the types of sites which may exist within Thunder Basin.

Published Archeological Investigations

Archeological excavation in the eastern Wyoming Plains comprises particularistic studies investigating spectacular and/or unique cultural manifestations. Indeed, with the exception of the Hell Gap site, bison kill sites are the primary sources for the formulated prehistoric chronology of the area.

Bison kill sites are a visually impressive cultural
resource found throughout the High Plains region. Investigation of these site types has been the life work of George Frison, who recently has published a monograph entitled *Prehistoric Hunters of the High Plains* (1978). At least six bison kill sites in the vicinity of the Thunder Basin have been investigated by Frison (Map 3, Table 2). Chronologically, these sites extend throughout the duration of human occupation of the Plains, with the possible exception of the Altithermal period. It is not yet understood to what extent communal bison hunting contributed to the subsistence base. Frison (1978) suggests that bison drives were an annual event, taking place in the late fall, necessitated by a need to store dried meat for the winter months. The size of bison kill sites and the methods of procurement (e.g., pound, trap, or jump) are not unique to any particular chronological period.

While the actual number of bison kill sites is problematic, Frison speculates that:

One can stand at the Roberts Buffalo Jump in northern Colorado and probably look from one Late Prehistoric Period bison jump to another all the way to Canada ... (1978:246).

If this is true, within an area as large as Thunder Basin National Grassland numerous such sites may exist. It is surprising that kill sites have not been observed during compliance surveys, especially considering the erosional nature of Thunder Basin topography. Until the distribu-
tion of these phenomena is better understood, kill sites should be considered as having a high potential for contributing scientific information.

Large campsites constitute an unusual cultural manifestation in the eastern Wyoming Plains, as the existence of nomadic large game hunters usually is evidenced by small campsites with limited artifactual remains: lithic debris and possibly deflated fire hearths. The Hell Gap site (Map 3, Table 2) is a large, multi-component campsite which has been instrumental in establishing the paleochronology of the High Plains. The occupation levels at the Hell Gap site make possible the construction of the most complete sequence of Paleo-Indian complexes in the High Plains (Irwin-Williams et al. 1973:52):

<table>
<thead>
<tr>
<th>Site</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goshen</td>
<td>circa 9000 to 8800 B.C.</td>
</tr>
<tr>
<td>Folsom</td>
<td>circa 8800+ to 8600 B.C.</td>
</tr>
<tr>
<td>Midland</td>
<td>circa 8700 to 8400 B.C.</td>
</tr>
<tr>
<td>Agate Basin</td>
<td>circa 8500 to 8000 B.C.</td>
</tr>
<tr>
<td>Hell Gap</td>
<td>circa 8000 to 7500 B.C.</td>
</tr>
<tr>
<td>Alberta</td>
<td>circa 7500 to 7000 B.C.</td>
</tr>
<tr>
<td>Cody</td>
<td>circa 6800 to 6400 B.C.</td>
</tr>
<tr>
<td>Frederick</td>
<td>circa 6400 to 6000 B.C.</td>
</tr>
<tr>
<td>Lusk</td>
<td>circa 6000 to 5500 B.C.</td>
</tr>
</tbody>
</table>

It is possible that buried cultural deposits similar to the Hell Gap site exist within Thunder Basin National Grassland. Such a buried, stratified multi-component site would of course constitute a highly significant cultural resource.
Map 3. Published prehistoric sites in the eastern Wyoming Plains

A) Carter-Kerr McGee site
B) Ruby site
C) Casper site
D) Glenrock Buffalo Jump site
E) Hell Gap site
F) Powder River site
G) Agate Basin site

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### Table 2
Published prehistoric sites in the eastern Wyoming Plains

<table>
<thead>
<tr>
<th>Smithsonian site number</th>
<th>Site (Reference)</th>
<th>Site type</th>
<th>Site chronology; cultural affinity</th>
<th>Date of approximate occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>48NO201</td>
<td>Agate Basin (Prison 1978)</td>
<td>bison trap, kill site</td>
<td>Paleo-Indian; Agate Basin</td>
<td>8400 B.C.</td>
</tr>
<tr>
<td>48CA12</td>
<td>Carter-Kerr McGee site (Prison 1978)</td>
<td>bison kill site</td>
<td>Paleo-Indian; Clovis, Folsom, Agate Basin, Hell Gap</td>
<td>9000 B.C. - 6000 B.C.</td>
</tr>
<tr>
<td>48NA304</td>
<td>Casper site (Prison 1974)</td>
<td>bison kill site</td>
<td>Early Prehistoric; Hell Gap</td>
<td>8000 B.C.</td>
</tr>
<tr>
<td>48CO304</td>
<td>Glenrock Buffalo Jump site (Prison 1970)</td>
<td>bison kill site</td>
<td>Late Prehistoric; unknown affinity</td>
<td>A.D. 1670 - A.D. 1740</td>
</tr>
<tr>
<td>48GO305</td>
<td>Hell Gap site (Irwin-Williams et al. 1973)</td>
<td>multicomponent campsite</td>
<td>Paleo-Indian; Goshen, Midland, Folsom, Agate Basin, Hell Gap, Alberta, Cody, Frederick</td>
<td>9000 B.C. - 5500 B.C.</td>
</tr>
<tr>
<td>48SH312</td>
<td>Powder River site (Prison 1968)</td>
<td>bison kill site</td>
<td>Early Middle Prehistoric Period; unknown affinity</td>
<td>2500 B.C. - 600 B.C.</td>
</tr>
<tr>
<td>48OA302</td>
<td>Ruby site (Prison 1971)</td>
<td>bison corrall, kill site</td>
<td>Late Middle Prehistoric; Basin</td>
<td>A.D. 200</td>
</tr>
</tbody>
</table>
The Cultural Chronology

No distinctive regional cultural chronology for the eastern Wyoming Plains has been formulated; however, archeological excavations throughout the High Plains have permitted the construction of a sequence which has application to the eastern Wyoming region. A cultural scheme based on stratigraphy and lithic tool typology was first conceived by Mulloy (1958), and this scheme has subsequently been refined by Wedel (1961), Willey (1966), and Prison (1978). The sequence presented here is derived primarily from the works of Prison and Wedel.

Early Prehistoric (Paleo-Indian) Period

The Early Prehistoric period extends from earliest occupation to approximately 5000 B.C. Radiocarbon dates from the Lindsay Mammoth site, Montana, evidence the presence of man in the High Plains as early as 9975 B.C. (Prison 1978). This period is characterized by small bands of wandering hunters subsisting principally on large game. Campsites were occupied for short durations, and, other than lithic artifacts, little evidence of domestic activity exists. Paleo-Indian sites consist largely of isolated surface finds of dart and spear points. Diagnostic lithic artifacts are associated principally with the Clovis, Folsom, Agate Basin, Hell Gap, Alberta, and Cody Complexes. The
hunting of mammoth and other extinct megafauna was part, if not the primary focus, of subsistence activity.

**Early Middle Prehistoric (Altithermal) Period**

This period, extending from 4500 B.C. to 2500 B.C., correlates with the Altithermal climate episode, which was the Holocene arid maximum for this region. No sites of this period are known to exist on the shortgrass Plains; however, archaeological material is found in the adjacent foothills of the Bighorn Mountains and Black Hills, e.g., Medicine Lodge Creek site (Prison 1976) and the Hawken site (Prison, Wilson, and Wilson 1976). These sites suggest a change in projectile point styles from the lanceolate to a side-notched form. Although no cultural complex is yet associated with the Altithermal in eastern Wyoming, similar points of this period occur in Idaho and are called "Bitterroot side-notched" (Prison 1978:45). Reeves' argument that the shortgrass Plains might indeed have been occupied during this period has previously been discussed (Chapter IV).

**Middle Prehistoric Period**

The Middle Prehistoric period, extending from 2500 B.C. to 1000 B.C., is characterized by a subsistence strategy shifting from that of large game hunting to a foraging way of life. The crushing of seeds, roots, and other vegetal
material is evidenced by the increasing occurrence of manos and metates. A wide range of animals was exploited, including rabbit, antelope, deer, elk, bison, and mountain sheep. The foraging lifeway required that material goods be kept to a minimum comprising necessary tools and portable household items. Sites of the Middle Prehistoric Period are more abundant than Paleo-Indian sites. Projectile points of the McKean Complex (Mulloy 1954), characterized by an indented base, are diagnostic of this period. Yonkee projectile points with lanceolate blades and concave bases are a regional variant of the McKean Complex exclusive to the Powder River Basin area (Frison 1978) and, therefore, are likely to be present in Thunder Basin National Grassland.

**Late Middle Prehistoric Period**

The Late Middle Prehistoric period, extending from 100 B.C. to A.D. 500, is identified by a change in projectile points from the earlier McKean types to the corner-notched points of the Pelican Lake Horizon (Wettlaufer 1955). Pelican Lake diagnostics are found in association with bison jump sites. Also linked with this period are large side-notched dart points characteristic of the Besant bison hunting manifestation. Artifacts found at Spring Creek Cave indicate that material goods used during the Late Middle Prehistoric include coiled baskets, hide, feathers,
and shell (Prison 1978).

**Late Prehistoric Period**

The Late Prehistoric period extends from A.D. 500 to the Protohistoric period. Major changes in material goods are observed, including the introduction of the bow and arrow and the appearance of thick, cord roughened pottery. Tool assemblages are more diverse and include sandstone arrow shaft smoothers, arrow shafts, chipped stone knives, coiled basketry, and the remains of bison hide and hair (Wedel 1964). Diagnostic of this period are the grooved maul, the Shoshone knife, and small side-notched arrow points. A marked increase in population is associated with the Late Prehistoric period; communal bison jump and trap sites from this period also appear in the archeological record in increasing numbers.

**Protohistoric Period**

This period commenced in the early eighteenth century with the introduction of the horse, which initiated a subsistence based on mounted bison hunting. Diagnostic of this period are hand hammered iron points and small amounts of European trade goods (Prison 1978).

**Historic Period**

Historic sites on the High Plains are predominately
the result of agricultural and pastoral activities. Site types include: farmsteads, homesteads, trash dumps, fence lines, historic trails, and mining related structures.

**Summary of the Cultural Sequence**

A central theme evident in the aboriginal cultural sequence of the High Plains is that social organization has remained at a band level almost throughout the 10,000 years of human occupation. According to Frison:

... the Paleo-Indian hunting group was about the same size and of the same complexity as the terminal Late Prehistoric period hunting group and was doing about the same thing (1978:19).
CHAPTER VI

CONTRACT ARCHEOLOGICAL INVESTIGATIONS

The provisions of the Moss-Bennett Act together with the recent energy crisis have been responsible for a substantial increase in archeological investigation in Thunder Basin National Grassland. The eastern Wyoming Plains are rich in oil and natural gas resources, and impact related to extractive activities has required compliance surveys prior to construction. These compliance surveys offer an unprecedented opportunity to compile archeological data. However, the data have yet to make their contribution to the culture history of Thunder Basin since they have not been analyzed.

The Wyoming Office of the Bureau of Land Management has overall responsibility for regulation and control of archeological policies and procedures relating to impact on federal lands within the state. Administration of these regulations in the National Grassland is the responsibility of the United States Forest Service (USFS), Thunder Basin District Office. Surveys and their completion reports are conducted and prepared by private consulting firms. Construction permits are issued by the USFS District Office and are contingent on recommendations in the survey reports.
Present regulations applicable to Thunder Basin require that, prior to the issuance of a well pad construction permit, a 16.19 ha (40 acre) intensive cultural resource survey must be conducted and a survey report submitted to the USFS. Authors of reports must have a minimum of a Bachelor's degree in Anthropology or a related field and three months of practical experience.

Survey procedures require that study areas be traversed by pedestrian transects no greater than 30 m apart. In practice, special attention is given to areas of greater site potential and visibility, such as sandy areas, eroded areas, animal holes, and hilltops. When cultural resources are located, a more intensive examination of the immediate area is conducted. Shovel testing as a survey data recovery method is not required in Thunder Basin, since ground visibility on the shortgrass Plains is typically 50 to 80 percent due to erosion and sparse vegetation.

Well pads directly impact only about 1.42 ha of land. The additional area surveyed (ca. 14.16 to 14.77 ha) functions as a buffer zone. Although the requirement of surveying such a large buffer zone has been criticized by oil companies, it has contributed to a more comprehensive archaeological inventory of Thunder Basin.

Cultural resources located directly within the impact area of a proposed well pad are recorded and mapped, and
a determination of National Register eligibility is made. Proposed locations on or near eligible cultural resources usually are relocated to avoid the site. If relocation is not a viable alternative, then mitigation is required. Few sites, probably less than five percent, reach the mitigative level of investigation.

On impact areas determined ineligible for the National Register, surface materials are mapped and collected, if possible. Surface materials in the buffer zone areas are recorded and mapped, but not collected. Recommendations as to the National Register potential of sites in the buffer zones also are required.

Literally hundreds of such contract surveys have been conducted in the Thunder Basin National Grassland since 1974, and though these surveys could greatly facilitate development of regional research orientations, usefulness of such a large data base depends on the retrievability of the information. In recognition of this need, the USFS is attempting to computer code and store all available archeological information on the Grassland area.

Computer Coding of Archeological Information

The process of coding information requires the review of all sites within the proposed region of study. During this review, problems in the site reports, such as lack of adequate description, become apparent. Shortcomings in
site information should be recognized as possible biases to future computer analysis of site data.

Problems in Thunder Basin site reports are twofold:

1. There is no standardized state site form, and the result is a lack of structure in site recording. This is responsible for the technical problem of incomplete or unstandardized data recording.
2. Archeological concepts are misused, both in the interpretation of site data and in the evaluation of National Register eligibility.

Problems in both categories interfere with the validity of the coding process. Possible biases that result will be identified in order to demonstrate the need for a standardized site recording format and to direct more attention to conceptual problems in High Plains archeology.

Technical Problems

Wyoming currently does not have a standardized site form; instead, numerous formats are used to record archeological sites. The Office of the Wyoming State Archeologist has used several different formats during the last five-year period. In addition, the various federal agencies have their own site recording forms; and private contractors working on federal lands have created forms for use within their own firms. For example, between 1980 and
1981 the firm Archeological Services used four different formats. The State of Colorado requires the use of a standardized site form for recording archeological localities within its jurisdiction, and some companies use this form to record sites in Wyoming.

Understandably, this variety of formats has made it difficult to computer code site information, since many formats vary in informational content and depth of detail. Technical inconsistencies result, such as unstandardized measurement systems, inadequate locational information, and different interpretations of what information is pertinent. A standardized form will provide guidance as to the information that should be collected and the measurement systems and terminology that should be used. Pertinent data could then be recorded in a standardized format.

Conceptual Inconsistencies

Inconsistencies of a conceptual nature are more difficult to eliminate than technical problems of format and incomplete information. Consistent application of archeological concepts is critical for adequate justification of National Register eligibility and for avoidance of contradictions within site forms. Internal contradictions in field reports, such as failure to justify the estimated vertical extent of deposition and the inaccurate use of lithic flakes and stone circles as temporal indicators,
cast doubt on the credibility of the original fieldwork and limit the usefulness of the stored data. It is not the intent of this section to reevaluate the sites used as examples; certainly this would require extensive fieldwork. However, it is possible to review site reports and observe whether or not the recorded information and subsequent recommendations correspond with accepted archeological concepts and cultural resource mandates.

**Recommendations and National Register Eligibility Status**

For National Register purposes, a site must be evaluated as "potentially eligible" or "not eligible"; it is not acceptable to evaluate eligibility status as "unknown." However, site forms submitted by the Office of the Wyoming State Archeologist as recently as August, 1980, have evaluated National Register eligibility as "unknown" (e.g., 48CR2064). Such evaluations demonstrate a misinterpretation of the function of the National Register.

In accordance with E.O. 11593, sites must be deemed eligible for inclusion in the National Register before agencies can require that funds be expended for avoidance or mitigation. If a site is evaluated as not eligible for inclusion in the National Register, recommendations for further work are not valid. According to the Thunder Basin National Grassland's listing, the following sites were "not eligible," yet recommendations for future work were
made:
a. 48CA497; not eligible, recommendations: avoid, map.
b. 48CA803; not eligible, recommendation: avoid.
c. 48CO471; not eligible, recommendation: monitor construction.
d. 48CO549; not eligible, recommendations: map, surface collect.
e. 48CO596; not eligible, recommendations: map, surface collect.
f. 48WE155; not eligible, recommendations: avoidance, files search.
g. 48WE176; not eligible, recommendations: map, surface collect.
h. 48WE227; not eligible, recommendation: map.

Recommendations to map and surface collect cultural resources can be justified only if the site is potentially eligible for the National Register. Mapping and surface collecting of sites are tasks of the initial survey, and the concluding recommendations for ineligible sites should then be "no further work."

Avoidance is a recommendation frequently attached to buffer zone sites which are ineligible for inclusion in the National Register (cases a, b, and f). The permit allowing construction to proceed can not stipulate avoidance of sites not eligible for the National Register.

Recommendations for the more distant future present
a problem. It has been observed in the discussion of significance concepts (Chapter III) that significance evaluation, and the resulting recommendations, must consider current research questions. Since these questions will vary as research orientations shift, significance evaluations and recommendations made today may not be valid in future years. For example, recommendations are necessary for sites located in the buffer zones of current construction areas. If and when these sites are impacted, archaeologists will have to review, and possibly revise, recommendations in light of as yet unknown research orientations.

Testing Recommendations

When a recommendation for subsurface testing is attached to an archeological resource, the evaluator should be certain that the site is potentially eligible for the National Register and that an adequate justification for the recommendation is presented. The observed presence of features and subsurface deposits contributes to the justification of a testing recommendation. However, such recommendations for sites where only surface materials have been observed require conceptual justification for mitigative action.

Table 3 lists several sites recommended for subsurface testing. Cases i, j, and l appear to be adequately justified for a testing recommendation. All three sites
Table 3
Sites recommended for subsurface testing

<table>
<thead>
<tr>
<th>Site</th>
<th>National Register Eligibility</th>
<th>Vertical Depth</th>
<th>Presence of Tools</th>
<th>Presence of Dating Diagnostic</th>
<th>Presence of Features</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 48C0608</td>
<td>Yes</td>
<td>0-1 ft</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>lithic flakes fire cracked rock (PCR)</td>
</tr>
<tr>
<td>(j) 48C0645</td>
<td>Yes</td>
<td>0-5 in</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>(k) 48CR2064</td>
<td>Unknown</td>
<td>Unknown</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>lithic flakes historic trash</td>
</tr>
<tr>
<td>(l) 48WE224</td>
<td>Yes</td>
<td>0-30 cm</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>lithic flakes lithic raw material</td>
</tr>
</tbody>
</table>
manifest a combination of factors, including observed features and depth of deposits, which contribute to each site's significance, and all have been deemed potentially eligible for the National Register.

Case k presents a problem. Due to the presence of observed features and the unknown depth of deposits, subsurface testing is possibly a sound recommendation; however, the National Register eligibility of site k is recorded as "unknown." A testing recommendation suggests that the site has the potential for yielding additional scientific information, which is a criterion for National Register eligibility (see National Register criteria, Chapter III). Therefore, the site should be considered eligible and consistency of site form data would be preserved.

Testing recommendations appended to sites with only surface materials being observed require more explicit conceptual treatment. A discussion in the recommendation of specific research values with reference to regional considerations would contribute to an understanding of why subsurface testing was considered necessary. This conceptual treatment should consider both the potential value of what may be found during testing and the value of negative information should no artifacts be recovered. Table 4 outlines two sites with lithic scatters that are similar both in the amount and type of artifacts observed. Case m is recommended for testing and Case n is not. Both cases
Table 4
Surface sites recommended for subsurface testing

<table>
<thead>
<tr>
<th>Site</th>
<th>Site Type</th>
<th>Vertical Depth</th>
<th>Presence of Tools</th>
<th>Presence of Diagnostics</th>
<th>Presence of Features</th>
<th>Other Subsurface Testing Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 480A886</td>
<td>Lithic Scatter</td>
<td>Surface</td>
<td>Yes (retouched flake)</td>
<td>No</td>
<td>No</td>
<td>–</td>
</tr>
<tr>
<td>(b) 4800549</td>
<td>Lithic Scatter</td>
<td>Surface</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Bone (Antelope or Deer)</td>
</tr>
</tbody>
</table>
lack a discussion of their respective recommendations. Without this discussion it is difficult, if not impossible, to determine whether there are substantive differences between the research potential of these sites, or whether the evaluations resulted from the arbitrary assessment of the individual archeologist.
CHAPTER VII

RESEARCH POTENTIALS OF LITHIC SCATTERS AND STONE CIRCLES

Archeological resources which appear redundant present a problem in cultural resources management, as seen in the last chapter. This chapter will examine the two most numerous site types in Thunder Basin National Grassland, discuss interpretations of their significance, and suggest some of their research potentials. The site types under examination are lithic scatters and stone circles.

Lithic Scatters

The vast majority of archeological assemblages in Thunder Basin National Grassland are lithic scatters. According to Tibesar et al. (1981), a lithic scatter refers to a site type consisting of a density of surface materials greater than two artifacts per 3600 m². A large number of lithic scatter sites within a given region is not unusual. Stone is practically indestructible, long outlasting other cultural material that may have been abandoned.

Characteristics of Eastern Wyoming Lithic Scatters

Lithic scatters in the eastern Wyoming Plains have yet to be systematically studied; however, many similari-
ties among these sites exist.

1. Most scatters are located on eroded bedrock deposits, making the integrity of the resource questionable.
2. Lithic debitage typically numbers 30 or less.
3. Rarely do these sites contain intact cultural levels or buried deposits.
4. The sites demonstrate minimal deposition, seldom exceeding more than a few centimeters.
5. Amateur collecting of lithic artifacts by ranchers and shepherders has been extensive (most local restaurants and service stations have collections on display). This possibly accounts for the frequent absence of diagnostic tools at many sites.

Potential Significance of Lithic Scatters

In spite of the research difficulties imposed by these listed characteristics, some archaeologists in the Plains regard lithic scatters as potentially significant:

There are many sites of this nature [lithic scatters] and without the methodology to handle such data our knowledge of prehistoric Plains hunters will suffer (Prison 1978:13).

... lithic scatters are the most common, and perhaps the most important, material remains resulting from the adaptive strategies employed by prehistoric inhabitants of the area [Campbell County] (Tibesar et al. 1981:81).

Lithic scatters offer a challenge to archaeological interpretation, and many times this challenge is not met.
According to Flenniken and Stanfill (1980:24), many archaeologists mistakenly consider that "when the end products, e.g. projectile points, are not present, most sites are ... of little cultural significance." Even with the presence of diagnostic artifacts, interpretation of lithic scatters may fall victim to unstated assumptions. It is not unusual for an archaeologist to observe a surface scatter of chipped stone as a single archaeological component. Testing of this site, and the evaluation of the site's significance for National Register eligibility, all too often would involve a search for an intact cultural level. If testing does not uncover the anticipated cultural level, the site may be deemed insignificant.

Tibesar et al. (1981) point out that the archaeologist may be searching for something that does not exist. High Plains lithic scatters may be the result of hunter-gatherer activities over a long period of time. These archaeological localities are possibly multievent accumulations which may contain not only different components of a single system, but also artifacts deriving from multiple distinct behavioral systems. Supporting this concept of multiepisodal lithic scatters is the fact that archaeological localities containing diagnostic artifacts from more than one cultural period are not uncommon in eastern Wyoming.
The "Off Site" Concept

Multiepisodal accretional localities are possibly the result of "off site" activities. This term is used by Binford (1980) in reference to archeological locations that are dispersed over the landscape, as opposed to recognizable activity or subsistence sites. In regions occupied by hunter-gatherer peoples, this concept explains the frequency of isolated finds and, over a period of accumulation, multiepisodal lithic scatters. Tibesar et al. (1981) pose two questions pertaining to the research potential of multiepisodal sites:

1. Can an area which has been demonstrated as multiepisodal be used to distill meaningful organizational attributes?

2. Can long-term adaptive strategies be observed within the context of a multiepisodal lithic scatter?

To deal with these questions, Tibesar et al. suggest that research must broaden its scope beyond that of a "standard site approach" to include the application of general concepts pertaining to hunter-gatherer subsistence. For example, the concept of subsistence systems is relevant to an understanding of hunter-gatherer site types, location, and artifact distribution.

Types of Subsistence Systems

Binford (1980) identifies two hunter-gatherer sub-
subsistence systems: the forager system and the collector system. A forager system is characterized by the daily gathering of food on an encounter basis. Food is procured in areas called resource "patches." A large amount of "off site" artifactual remains results from this subsistence system, which requires frequent residential moves to achieve an annual subsistence round. Figure 1 depicts artifact density and distribution in and around one residential locality; this pattern of artifact distribution may account for the apparent random archeological occurrences in Thunder Basin. Studies of artifact distributions in terms of geographic variables (e.g., vegetation patterns, topography, and water resources) undoubtedly would increase our understanding.

For example, the foraging system probably relied on plant resources, e.g., saltbush (Atriplex canescens), amaranth (Amaranthus retroflexus), and Indian ricegrass (Oryzopsis hymenoides). To what extent these resources contributed to the prehistoric subsistence base is not known; however, Frison (1978:13) suggests that the exploitation of plant foods was "undoubtedly significant." Research on the current distribution of plant resources may suggest further interpretations of artifact distribution; however, this assumes similar environmental factors in Thunder Basin past and present, which has not been proven.
Figure 1. Artifact distribution in a forager system

Figure 2. Artifact distribution in a collector system
A collector system does not rely on an encounter approach for food procurement. Task groups, seeking specific resources, are logistically organized with the objective of large-scale food procurement and subsequent food storage. Specific site types will result at the location of these target resources, and artifactual remains will tend to be centralized around them (Figure 2).

A collector system of subsistence is also in evidence in the High Plains, e.g., the bison kill sites. However, a forager system, attested to by multievent lithic scatters, also may have existed concurrent with, or as a seasonal variant of, the collector system (Tibesar et al. 1981). It is possibly more accurate, at least in the High Plains, to view forager and collector strategies as components of the same system (Figure 3). This dual-component system could account for bison kill sites and multiepisodal lithic scatters, explaining the complexity of site distribution and site type variability evident in eastern Wyoming. Within the system, hunter-gatherer subsistence components would be in continual flux dependent on factors which might affect variability in resource abundance, e.g., seasonal precipitation, and prolonged low temperatures during spring bison birthing season.
Figure 3. Artifact distribution in a dual-component system
Consideration of this dual-component system is instrumental in the development of research strategies for Thunder Basin lithic scatters. Possible research orientations are:

1. To demonstrate whether lithic scatters are indeed a result of multiepisodal accumulations.
2. To define relevant patterns of lithic scatter location over areas larger than that of the individual "site."
3. To investigate the subsurface deposition of these lithic scatters and observe the characteristics of lithic materials in the depositional zone. Tibesar et al. (1981) point out that while excavation is likely to produce primarily negative evidence (since depositional material is considered to be minimal), it would be beneficial to establish how well surface scatters reflect the total assemblage of a location.
4. To suggest and improve methodologies for investigating the lithic scatter phenomena of the eastern Wyoming Plains area.

The areas of Thunder Basin could function as a study unit for the above considerations, and possibly could contribute to an overall understanding of this site type for the entire Northwestern Plains.

Research on lithic scatters depends primarily on ob-
bjective 4; therefore, it is now necessary to address possible directions of methodological improvement.

Research Methodology

The dating of lithic scatters by hydration could prove a valuable research methodology for the area. Establishing the age of individual lithic flakes in a scatter indeed would determine if a site is multiepisodal. The author is aware of only two attempts at hydration dating in the High Plains: the Kobold site, Montana (Prison 1970) and Yellowstone National Park obsidian sources (Prison 1978).

Recent research has suggested the possibility of dating lithic scatters by debitage analysis. Plenniken and Stanfill (1980) reason that reduction stages for specific tool types are unique, and the resulting debitage could function as a temporal indicator which ultimately could be as accurate as the lithic tools themselves. Plenniken and Stanfill reconstructed several reduction systems in order to apply this type of analysis to the Great Basin region. Although this research is intriguing, whether this methodology could be applied to multievent scatters in the High Plains seems unlikely.

Raw material sources could also provide information on lithic scatter sites. Within the immediate vicinity of eastern Wyoming two extensive procurement localities exist, the Spanish Diggings quarries and the Hartville Uplift
formation. In addition, Prison (1978) points out that literally hundreds of smaller chert and quartzite procurement areas exist throughout and adjacent to eastern Wyoming. Material types in each area exhibit considerable variance, and the development of a research strategy based on trace element analysis must await as yet undeveloped means of material comparison (Ibid).

Stone Circles

Stone circles are a highly characteristic site type in the Northwestern Plains. These sites are found in northern Colorado, the extreme western portion of Nebraska, the Dakotas east to the Missouri River, and in greatest numbers in Wyoming, Montana, and Alberta (Wedel 1961). Frequently these phenomena are called "tipi rings," the name arising from the assumed function of holding down the covers of skin lodges. Such circles commonly contain a single or double row of rocks, or slab stones, and vary from about 3.4 m to 6.3 m in diameter (Quigg 1979).

Possible Functions of Stone Circles

Numerous investigators have compiled information on stone circles in an attempt to understand their function, variations in size, locational constraints, and the presence or absence of artifactual remains (Keboe 1958, 1960; Malouf 1961; Mulloy 1960; and Quigg 1979). The first
studies were primarily concerned with the possible domestic origin of the circles. Kehoe (1960), through ethnographic accounts provided by Blackfoot Indian informants, presents a good case for the use of stone circles as structural supports for skin lodges. However, Malouf (1961) notes that a Kutenai Indian informant claims his people placed stones around the tipis not for physical support, but to make the skin lodges magically invisible. Although the function of stone circles is generally assumed to be in accordance with Kehoe's findings, Prison (1978) acknowledges that some stone circles may have been built for religious purposes.

Environmental Setting

Stone circles appear both singly and in groups, within a variety of environmental settings. Though many hypotheses have been advanced to explain circle location, no detailed regional studies assessing environmental factors have been conducted. Some possible locational considerations are:

1. Stone circle sites located away from water sources possibly were situated so as not to scare off game (Malouf 1961).
2. Sites located on high ridges and ridge spurs possibly were situated to avoid being covered by snow-drifts.
3. High ridge locations may also have been selected for visual advantage.
4. Stone circle sites in low areas may have been located in these settings to avoid winds.
5. Variability in stone circle site locations possibly could reflect circumstantial camping situations, as opposed to locations selected solely for geographical factors: i.e., an unexpected snowstorm may have forced a nomadic band to make camp hastily (Kehoe 1958).

Research on the environmental setting of stone circle sites may produce valuable information concerning seasonal constraints upon site location and allow the formation of hypotheses as to the activities taking place at individual sites.

Some Results of Excavations

Malouf (1961) notes that stone circle excavations have frequently failed to produce fire hearths, lithic tools; and discernible entrance ways. However, recent investigations by Quigg (1979) have associated internal hearths with 34 percent of the sites excavated. Further, Quigg observes that some sites contain a greater percentage of cultural material outside the circles, and suggests that the technique of excavating primarily inside the circles, common in the past, is no longer a satisfactory method of data
recovery. This may account for the previously observed lack of cultural material. Quigg also suggests two as yet untested hypotheses regarding these occupations: large quantities of debitage and other artifactual remains may evidence more lengthy occupations, and a tendency for artifacts to be located inside the stone circle may indicate a winter occupation.

**Age**

The age of stone circles has been problematic. Until recently, these sites were considered indicative of the Late Prehistoric, Protolithic, and Historic periods. Research on stone circle sites has demonstrated that they possibly extend from the Middle and Late Middle Prehistoric periods, to historic times (Frison 1978). And a stone circle uncovered in the Frederick component (6400 B.C. – 6000 B.C.) of the Hell Gap site (Irwin-Williams et al. 1973) suggests that they were also a phenomenon of the Early Prehistoric period.

**Significance of Circles**

Previously it was assumed that stone circles lacked "substantive significance" (Mulloy 1960). In light of recent research, this assumption appears inaccurate. Stone circle sites located in Thunder Basin National Grassland could function as a spacial study unit for ques-
tions relating to:

1. the seasonality of site occupation
2. the size of hunter-gatherer groups on the Plains
3. the correlation of geographic factors with site location.

The author has observed numerous stone circle sites in Thunder Basin that appear ideal with respect to the third question, having characteristics of slab stone entrance ways, ridge crest locations offering a view in two or more directions, and large quantities of both local and imported lithic debitage (e.g., Yellowstone obsidian).
CHAPTER VIII

RESEARCH ORIENTATIONS

Prehistoric archeology in Thunder Basin National Grassland only recently has progressed past the data gathering stage. The paleoenvironment and the adaptive strategies by which man contended with this setting are not yet well understood; hence, research orientations need to be flexible to ensure their ability to evolve as the data base increases.

Critical to the development of research orientations is the review of extant data. The Medicine Bow National Forest District's new data storage system was mentioned in Chapter VI. Coding procedures are included in an appendix to this report. When this system becomes operational, and if it is continually updated, it will facilitate access to and analysis of such data as:

1. Extant prehistoric sites.
2. Site types represented, i.e., lithic scatters, stone circles, lithic procurement sites, possible bison kill sites, and campsites.
3. Presence of temporal indicators and chronological sequences represented.
4. Physical distribution of sites relative to critical life support resources, such as water.
The Conceptual Basis

Although knowledge of the data base is prerequisite to research orientations, orientations cannot be developed without a conceptual bridge between data and research. The author is aware of only one investigation in Thunder Basin National Grassland that has aided in the development of a conceptual basis for prehistoric study. In 1981, William Tibesar et al. conducted a block area survey (over 809.4 ha) of the proposed Rochelle coal mine, with the objective of developing:

... a methodology to recognize, translate, and interpret the long term archeological results of hunter-gatherer adaptive strategies (Tibesar et al. 1981:63).

Although archeological resources were located and recorded as individual sites, the concept of "sites" was not utilized in the analysis. The entire block area was studied as a single archeological phenomenon in which all surface materials (including isolated finds) were considered relevant to an understanding of archeological occurrences arising from hunter-gatherer land use.

An arbitrary grid of 40-acre units was imposed over the mine area to facilitate distributional analysis of artifactual remains. Artifact and lithic debitage diversity indices and vegetational diversity indices were constructed in an attempt to demonstrate patterning. Also, the distribution of diagnostic materials was plotted on the grid.
in order to show any temporal relationships in artifact clusters.

The analysis of artifact patterning revealed by this study is not yet available; however, the single universe concept did result in a "noncontiguous archeological district" nomination to the National Register for 29 archeological sites. Tibesar et al. feel that the possibility of encountering multiepiscopal sites, as well as sites with internal organization, enhances the research potential of Thunder Basin; however they acknowledge that further understanding of this potential is contingent on excavation.

Research Orientations and Questions

Drawing on selected archeological reports and his own experience in Thunder Basin National Grassland, the author has constructed the following list of research orientations and questions:

1. To refine the chronology and identify complexes unique to the Thunder Basin area: (a) Did the Altithermal create, as Prison (1978) suggests, increased regional diversity in cultural activity, and is this evidenced in the archeological record (e.g., Yonkee projectile point forms)? (b) To what extent does the High Plains cultural sequence represent the chronology of the eastern Wyoming Plains cultures?

2. To reconstruct the paleoenvironment, with emphasis
on increased understanding of the Altithermal:
(a) Did this arid maximum alter subsistence strategies? (b) Was it indeed a period of cultural hiatus in the Thunder Basin area or, as Reeves (1973) suggests, is this apparent gap the result of sampling error and nonrecognition of artifacts? (c) Are Altithermal period sites located closer to a permanent water source than sites of other periods?

3. To examine the dual-component concept of collector and forager strategies in terms of an annual subsistence round: (a) To what extent did big game hunting contribute to the subsistence base? (b) Was communal bison procurement primarily a seasonal activity in preparation for winter? (c) To what extent was small game utilized? (d) Were plant resources a significant part of the subsistence base? (e) What is the present distribution of exploitable plant resources in Thunder Basin, and does this reflect past plant distributional patterns?

4. To examine the density and distribution of lithic artifacts with consideration to possible multiepisodal accretional processes: (a) What percent of lithic scatters are indeed multiepisodal? (b) Is it possible to develop a set of criteria to identify multiepisodal scatters, and how would these scatters differ from sites with internal structure? (c) Would
subsurface investigation further our understanding of these phenomena? (d) Do present vegetational patterns correlate with lithic scatter locational patterns? (e) Can lithic procurement areas be isolated by the physical properties of the stone in order to interpret distributional patterns of specific material types?

5. To investigate the phenomena of stone circles:
(a) Do these sites offer explanations of settlement patterning? (b) Do type, density, and distribution of artifactual remains in or around stone circles imply seasonality and duration of occupation or the size of hunter-gatherer groups on the Plains?
(c) Were there possible functions for stone circles, other than as skin lodge supports (e.g., religious)?

These research questions are offered as a start toward development of a regional research strategy for prehistoric cultural resources in the eastern Wyoming Plains. A regional strategy would provide the conceptual framework needed in assessing significance of redundant resources such as lithic scatters and stone circles. Further understanding of research potential, together with the accelerated number of energy related compliance surveys now being conducted in the area, hopefully will lead to identification and excavation of key archeological sites. Such excavations should contribute to a clearer understanding of some 12,000 years
of human occupation of the High Plains, possibly refining
the aboriginal cultural sequence of this region and further-
ing our knowledge of the adaptive strategies utilized.

To be of maximum value the above list of research ori-
entations must be expanded and refined as additional infor-
mation becomes available.
APPENDIX

Computer Coding Used for Sites in Medicine Bow National Forest
### Medicine Bow National Forest Overview

#### Card 1

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<thead>
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<th>Space</th>
<th>County</th>
<th>Code</th>
<th>Site number (Smithsonian)</th>
<th>Quad (see attached sheets)</th>
<th>Township</th>
<th>Range</th>
<th>Section</th>
<th>Site size (square meters)</th>
<th>Site depth (centimeters) Code:</th>
<th>Ownership Code</th>
<th>National Register status Code:</th>
<th>Organization (company) Code:</th>
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</thead>
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<td>5-6</td>
<td>AG</td>
<td>Albany</td>
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<td>NE</td>
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<td>Campbell</td>
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#### Card 2

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<td>Site type and components</td>
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<td>1) Lithic scatter</td>
<td>10) Stone circle, tipi ring</td>
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<td>2) open camp</td>
<td>11) Rock alignment</td>
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<td>3) Lithic procurement station</td>
<td>12) Cairn, cache, rock pile</td>
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<td>4) hunting camp</td>
<td>13) Religious/ceremonial</td>
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<td>5) gathering camp</td>
<td>14) Petroglyph/pictograph</td>
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<td>6) kill site</td>
<td>15) Hearth, firecracked rock</td>
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<td>7) game trap</td>
<td>16) Ceramics</td>
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<td>8) burial</td>
<td>17) Ground stone</td>
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<td>9) rock shelter</td>
<td>18) Projectile point</td>
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<td>19) bone</td>
<td>24) mining camp</td>
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<tr>
<td>21) subsurface component</td>
<td>25) tie-hack camp</td>
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<td>23) timber lodge</td>
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<td>27) herder camp</td>
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<td>29) ranch</td>
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<td>31) stage station</td>
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<td>33) fort, military camp</td>
<td>34) forestry camp or station</td>
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<td>35) CCC camp</td>
<td>36) fire tower</td>
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<td>37) trail, road</td>
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<td>39) one-story log cabin</td>
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<td>41) one-story frame house</td>
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<td>43) stone house</td>
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<td>45) mine excavation-shaft, tunnel, quarry, prospect hole</td>
<td>46) ore processing-smelter, arrastra, mill, tailings</td>
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<td>47) placer operation</td>
<td>48) saw mill</td>
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<td>49) flume, sluice, aqueduct</td>
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<td>54) aspen carving</td>
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<td>57) trash dump</td>
<td>58) kiln-charcoal, lime</td>
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<td>59) bridge</td>
<td>60) snowshed, snowfence</td>
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<td>61) telegraph, telephone, electric line</td>
<td>62) natural landmark</td>
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<td>63) battle site</td>
<td>64) recreational area</td>
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<td>65) diagnostic artifact</td>
<td>66) fencing</td>
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<td>68) timber cutting/driving operations</td>
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<td>69) camp (general)</td>
<td>70) snowshed, snowfence</td>
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**Site age Code:**
- a) Paleo-Indian
- b) Early Plains Archaic
- c) Middle Plains Archaic
- d) Late Plains Archaic
- e) Archaic (general)
- f) Late Plains Prehistoric
- g) Prehistoric (general)
- h) Historic-pre 1900
- i) Historic-1900-1940
- j) Modern-post 1940
- k) Specific date list under comments

**Dating method Code:**
- 1) C14
- 2) diagnostic artifacts
- 3) documentary sources
- 4) dendrochronology
- 5) obsidian hydration
- 6) stratigraphy
- 7) architecture

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**Space**: 1-4 Blank  
5-6 County  
7-10 Site number (Smithsonian)  
11-14 FS Geographic ID  
15-22 FS Capability type and number  
23-26 FS Site type and number

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BIBLIOGRAPHY

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Binford, Lewis R.  

Butler, William B.  

Collins, Robert Bruce and Dee F. Green  

Dunnell, Robert C. and William S. Dancey  

Flenniken, J. Jeffrey and Alan L. Stanfill  

Prison, George C.  


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Raab, L. Mark and Timothy C. Klinger

Reeves, Brian

Reher, Charles A.

Reyman, Jonathan E.

Rouse, Irving

Schiffer, Michael B. and George J. Gumerman, eds.

Schiffer, Michael B. and John H. House

Sharrock, Floyd W. and Donald K. Grayson

Tibesar, William L., Lawrence C. Todd, Thomas K. Larson, B. Miles Gilbert, and Keith H. Dueholm

Wedel, Waldo R.
Weinland, Marcia  

Wettlaufer, Boyd  

Willey, Gordon R.  