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16. Abstract

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ABSTRACT

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INTRODUCTION

The primary concern of the Environmental Studies Group (E.S.G.) of the Dolores Archaeological Program (D.A.P.) is the reconstruction of the paleo- environment, particularly as it relates to the prehistoric cultural activity of the project area. To this end, the group conducts studies in several areas, including palynology, botany, zoology, and geology. This report describes the activities, during 1979, of that particular branch of the E.S.G. which deals specifically with botanical studies. A discussion of the E.S.G. research design emphasizes the development of testable vegetation models based on archaeological and modern botanical data. This is followed by a description of the various vegetation zones which were identified during a reconnaissance survey of the project area, using the releve technique. Finally, the information recovered from this reconnaissance project is viewed in terms of its ecological and archaeological implications. A list of the various plants of the project area, including associated vegetation zones and ethnographically documented uses of many of the plants, is presented. Information generated through these efforts will ultimately be used to address specific questions of the D.A.P. Research Design (Kane et al. [1]), although such an undertaking lies beyond the scope of this report.

THE ENVIRONMENTAL STUDIES RESEARCH DESIGN

The D.A.P. Research Design is composed of five Problem Domains (Kane et al. [1]). The E.S.G. is attempting to provide data for these Problem Domains over the duration of the program. The five Problem Domains are as follows:

1. Economy and adaptation
2. Paleodemography
3. Social organization
4. Foreign relationships
5. Cultural process

In order to address the questions raised in the Research Design, the D.A.P. is developing a set of midlevel research designs which relate specific data to the Problem Domains. Information requirements are identified and the information is placed into a context where it can be related to the questions posed in the Problem Domains. In all cases, assumptions must be recognized and their applicability to the data and to the Problem Domain questions must be demonstrated.

This discussion describes the midlevel research design directing the activities of the E.S.G. Other investigations accomplished with respect to this midlevel design are described in Emslie [2], Leonhardy [3], and Scott [4]).

The E.S.G. is concerned with providing information about the ambient environment of the human populations during the periods of occupation in the D.A.P. area, and the types and intensitites of interactions between the environment and humans. The subsequent relationships and the interactions of certain aspects of cultural change are derived from the

integration of these data with other archaeological data.

The basic concept to keep in mind is that culture and environment interact--they have a mutual, direct influence upon each other. Such interactions result in the formation of processes when they occur over time and space. Some processes of interaction may be manifested in different ways. In order to understand a process, one can look at the system within which the process operates. A system consists of major components which are the essential categories which must be present if the process is to be active within the system. The importance of a given component within the system and to other components may vary. The effect of a given component on others may vary, but it is assumed to be predictable and may not change over time if the relationship is assumed to be the same. Within each component are elements. These elements can vary over time in terms of the kinds of elements present, and in terms of their respective characteristics.

The interactions between human populations and their ambient environment are of fundamental interest to those concerned with cultural and environmental changes through time. The principles associated with these interactions should reflect basic relationships that could exist at any point in time. The specifics of the interactions would vary depending upon cultural and environmental variables. These principles can be applied to specific time periods, places, cultures, and environments if one realizes that these interactions are active and represent processes and not end products.

Subsistence is a basic process which is important for human survival. Human beings must maintain a certain critical level of nutrient intake (e.g., calories, protein, vitamins) in order to survive as individual

organisms and as populations. A subsistence system can be considered to be the framework within which a human obtains the basic requirements for survival. One type of subsistence system would be agriculture. An agricultural system is composed of certain components, all of which need to be present if food is to be available for human consumption. Components would include cultural input, primary productivity, secondary productivity, light, soil, temperature, moisture, etc. Within a given component, various elements could be included. For instance, primary productivity would include various crop plants such as maize. Each element (e.g., a particular race of maize) could vary over time. As part of a component, this element would be expected to have certain general responses to the influence of other components (e.g., light, temperature, moisture) but the specific response would depend upon the characteristics of the element and the intensity and duration of the effects of the other components on it. The elements could change over time and consequently the response would change. Different crops as well as different races of a given crop (e.g., maize) would respond differently to the same conditions.

Because humans are part of the process as well as the system, they are critical in evaluating these responses. Humans must perceive certain characteristics as being necessary for human survival and must reinforce the human value of these products. Also, humans can modify the nature of the different components and their influence upon each other. Even though the pattern of influence between and among the components can be considered fixed, the relative intensity of the influence can be modified. An example of this modification of influence by humans can be seen in the germination and establishment of cultivated plant seeds. In the open

field, the temperature and available moisture may severely limit the establishment of these crops. However, humans can plant seeds in containers and place them in a modified environment (e.g., a kiva) so that the temperature and moisture will be favorable. Also, selection of a planting site to take advantage of favorable temperature and moisture in microenvironments could occur. Another possibility is to modify the microenvironment by shading and watering. The primary productivity component can also be modified by altering the elements. Other crops or races which respond well to given environmental conditions can be introduced and established. Also, within plant populations, humans can select for segments which respond better to environmental conditions; thus, the element changes genetically over time due to human selection.

The Midlevel Research Design for Biotic and Abiotic Resources

The general research design for the E.S.G. (Figure 6.1) is applicable to biotic and abiotic resources that are related to the prehistoric occupations in the Dolores Project area. The five Problem Domains of the D.A.P. Research Design yield a series of questions which is of interest to the fulfillment of the Cultural Resource Mitigation obligations. From that point, a series of steps of inquiry is taken; some of the steps involve some crosschecking and integration with other data.

After asking the questions, two data sources are investigated. One data source is derived from the archaeological record, the other from modern botanical and ethnobotanical evidence. Archaeological sites yield materials of varying analytial potential. Once this potential is known, the Bulk Soil and Pollen Sampling Design (Litzinger [5]) must be employed to produce the information required. The data generated can be in the

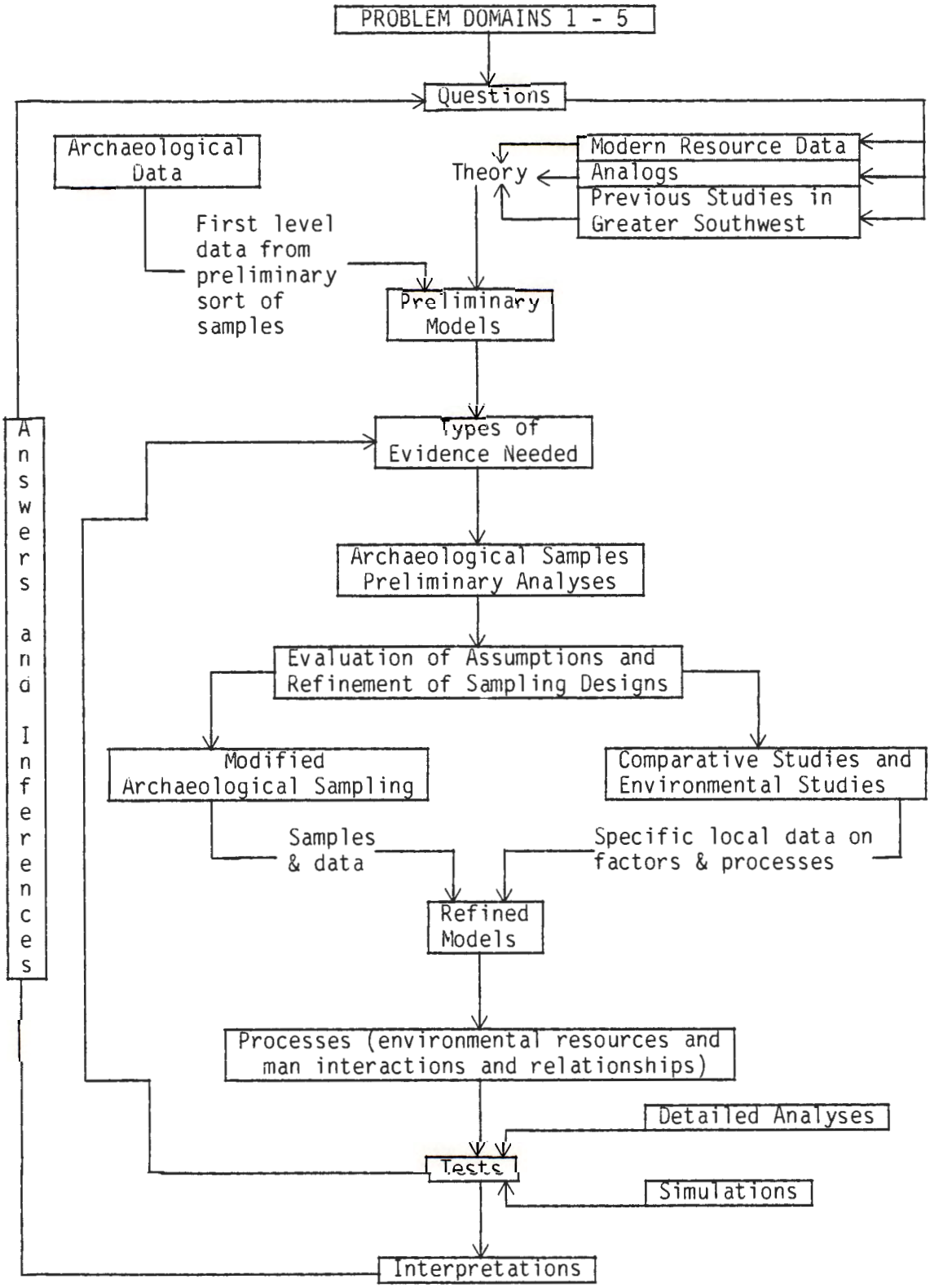

Figure 6.1 General research design for the Environmental Studies Group.

form of specimens from samples taken from the archaeological site. The samples must be taken in such a way so as to minimize contamination. It must be possible to associate the samples with other cultural materials and stratigraphic evidence in order to place them within a chronological perspective. The nature (random versus biased) and adequacy (in terms of number per feature, site, or area) of the samples should be recognized.

Once the biotic samples (i.e., bulk soil and pollen samples) are obtained, the data must be extracted from them. The data are analyzed and interpreted. The initial phase of this operation includes processing the samples according to standardized procedures in order to prepare specimens so that they are in a condition proper for analysis. The analysis stage consists of identifying certain materials, noting their characters (attributes), and determining their characteristics (state of the characters). Also, these items must be associated with given quantity, space, and time in the study area. The results from the studied samples are compared with known information, and if they are comparable, limited interpretation can be made as to their significance.

The archaeological material (i.e., macrovegetal specimens) recovered from site excavation is also submitted for preliminary analysis. Preliminary analysis of these specimens involves the identification of the materials to the most reliable level possible (given time constraints, material condition, and investigator expertise), as well as the gross quantification of each taxonomic unit.

Once preliminary analysis of the material from the archaeological samples has been completed, the data from the samples must be studied in light of a set of guiding assumptions. Some of the assumptions include the following:

1. Biotic and abiotic materials reflect cultural/environmental interaction, and these materials are represented in the archaeological record.
2. Cultural material can be recovered through sampling and the processing of samples.
3. Contamination from noncultural material or from unrelated cultural features can be minimized in sampling and can be isolated in the processing and analysis of the specimens.

The samples must reflect material which represents cultural activity. Contamination (e.g., bioturbation) must be recognized and minimized. The sample size must be adequate in order to recover meaningful data. The number of samples per site, activity locus, etc., as well as the recovery rate per sample, must be adequate. The use of control samples (on- and offsite, in cultural strata and noncultural strata) can aid in determining the adequacy of these factors.

After these assumptions are evaluated the amount of further work is determined. If the assumptions are fully met, sampling and further analysis proceed. If the assumptions are partially met, refinement of the Sampling Design needs to be made in order to improve the return. If refinement is impossible, several limitations on the value of the material must be recognized. Usually, the Sampling Design needs continuous modification in order to maintain a consistent level of return as new conditions arise in the field and in the lab.

Two steps follow after the evaluation stage. The first step implements the modified archaeological Sampling Design so as to improve the direct data needed to insert into the model. The second step involves comparative studies and experimental studies. The former entails the

generation of material from known environmental and cultural conditions which will be comparable to archaeological material of unknown environmental and cultural conditions. It is assumed that there will be a correlation between the archaeological and modern counterparts in terms of characters, characteristics, and the effects of the cultural and natural processes which led to their expressions. Experimental studies involve the evaluation of these processes as they occur in the D.A.P. area. Because factors of the environment influence certain processes, the parameters of given processes and their products (which could be incorporated into the archaeological record) need to be established. By manipulating conditions and comparing the end products of the treatments with controls, these parameters can be established. At this point, the relationship (cause and effect, if possible) between specific archaeological remains in the D.A.P. area and the environmental and cultural processes which may have given rise to them may be elucidated.

The second data source used to address the questions posed in the Problem Domains is drawn from modern botanical and ethnobotanical evidence for specific resources which are important to human populations. Information from three such sources is employed. The first consists of modern resource data drawn from studies which describe the contemporary setting of the archaeological site. The second source, analog, serves as the baseline for comparison between the present-day environment and other environmental/cultural processes as they have been described in other studies and disciplines. The third source consists of previous studies in the greater Southwest (southwestern United States and northern Mexico) which have addressed similar questions or which have dealt with similar materials.

These three data sources (modern resource data, analog, and previous studies) are used to develop a theoretical framework which, when combined with the archaeological data, serves as the basis for the development of preliminary models for given resources. These models identify the systems and components which are needed and can be tested. Because the focus is on the process, the relative importance of given components in a system, as well as the relative relationship among the systems, may vary. Such variation must be recognized so that data are not forced to fit preconceived notions of how humans and the environment interacted.

Once preliminary models for various resources are constructed (i.e., systems and components identified and relationships established), the diagnostic elements of the components need to be determined. Also, the likelihood of those elements which reflect the process occurring directly as archaeological evidence or being represented indirectly must be ascertained. The types of evidence which are related to the models, as well as the types of evidence which can be obtained from D.A.P. excavation, must be identified.

With improved sampling and better samples, and with a better understanding of how materials might have been deposited under local conditions, the models can be refined. The refinement may include information which was not known earlier in the process, but which has since become available. The refined model represents the working model into which archaeological and contemporary environmental reconstruction data will be fed.

With these data in the refined model, some reasonable alternatives, which could reflect various pathways of processes, can be identified. The individual process would reflect the interactions and relationships of

human populations and the ambient environment. The alternative pathways can be developed as hypotheses and tested. The tests can be carried out as detailed (secondary) analysis of archaeologically derived material. The state of the characters would further suggest certain conditions or manipulations. Simulations to produce specific known effects which would be comparable to results observed from preliminary and secondary analyses of archaeological material would help strengthen certain decisions and weaken others.

Should a test prove negative, one could reevaluate the types of evidence required and their relationships to the questions. Perhaps further modifications are needed. Alternatively, negative results may suggest the inappropriateness of a particular pathway to an understanding of the process.

Should a test prove positive, one could recommend the alternative or alternatives as probable processes and products. The alternative(s) could be integrated with other archaeological data to provide interpretations of the archaeological material. These interpretations, at given confidence levels (as determined by the limitations and parameters), would be the basis for formulating answers to the questions generated in the Problem Domains.

RECONNAISSANCE OF THE VEGETATION OF THE DOLORES ARCHAEOLOGICAL PROGRAM AREA

Introduction

The D.A.P. area is situated at the interface between two major ecoregion provinces of the United States: the Rocky Mountain Forest Province to the east, and the Colorado Plateau to the west (Bailey [6]). The specific sections of each of the provinces are the Ponderosa Pine-Douglas-fir Forest and the Juniper-Pinyon Woodland, and the Sagebrush Saltbush Mosaic, respectively. These sections of the ecoregions are defined by the combinations of landform, climate, vegetation, soils, and fauna (Bailey [6]).

In a recent classification of biotic communities of the Southwest (Brown and Lowe [7]), the D.A.P. area falls within two formations: the Scrub Formation and the Woodland Formation. The Woodland Formation includes the Great Basin Conifer Woodland and the Madrean Evergreen Woodland. The Scrub Formation consists of the Great Basin Montane Scrub.

Vegetation can be defined as the relative assemblage of plant species in a given area. It can be characterized by the dominant or noticeable plants present, plus the physiognomy (or form) of these dominant plants. Flora, on the other hand, is the inventory of the plant species present without regard to their abundance or relative assemblages.

The Actual Vegetation describes the assemblage of plants as they occur under present-day conditions--often because of the influence of past and contemporary human activities. Potential Vegetation would result if all human influences were removed from the environment and the vegetation was allowed to "recover" to a "natural" state. Although solid argument can be made for the irreversible alteration of the local environments by

exotic plants and animals (including humans), the two working assumptions concerning vegetation for this study are as follows:

1. Potential Vegetation (into the future) will reflect the vegetation prior to human influence (which resulted in the Actual Vegetation).
2. Types of contemporary vegetation that are close to Potential Vegetation types have been similar in relative composition and behavior during periods of previous human occupation in the D.A.P. area.

Determination of Vegetation Zones

There are many methods available for the determination of vegetation in any given area (Kuchler [8]). Based on time restrictions and facilities available, and because basic assumptions in certain elaborate approaches could not be met, a simplified field approach was instituted. Reconnaissance was conducted during the summer (June-August) of 1979. It involved the use of aerial photos (color with scale 1:22000), topographic maps for the area (U.S.G.S. 7.5 Topographic Series), and ground-checking in the field. A first approximation was constructed in order to reflect the Actual Vegetation and a map at the scale 1:22000 was drawn. A Potential Vegetation map at the same scale was constructed by placing the various vegetation zones into Potential Vegetation zones from which the Actual Vegetation zones could develop. The Actual Vegetation zones originally consisted of 12 zones while the Potential Vegetation zones were composed of five classes. In 1980, the first approximation was revised by R. Bye after field checking and additional studies of aerial photos were

undertaken. This effort resulted in an Actual Vegetation map at the scale 1:24000 (Figure 6.2)--the same scale as other base maps of the D.A.P. One Actual Vegetation zone was dropped from the second approximation (Zone F). The Potential Vegetation map is still in the planning stage.

Determinations of the vegetation zones were based upon a few dominant (common and unmistakably observable) perennial plants and upon the physiognomy of these dominant plants in the assemblages. This approach allowed for recognition of vegetation zones (1) in a short period of time, (2) from aerial photos (with some ground experience), and (3) by untrained personnel (which is important in future applications of the maps to other project activities). This limited input is much more efficient in terms of personnel time and training than other techniques (e.g., ordination) which would demand a number of highly trained ecologists and large sample sizes to adequately cover the diverse types of vegetation (disturbed and undisturbed). The end product is of a general type which can only be applied to D.A.P. questions under certain conditions. Further use of this baseline information would necessitate special studies applied to specific problems.

Definition of Vegetation Zones

Each vegetation zone is named and defined by dominant species and physiognomy. The Actual Vegetation zones include the following broad categories:

1. Woodlands - trees with overlapping canopies which are over 1 m above ground, with open areas around the trunks
2. Shrublands - woody perennials forming overlapping canopies less than 1 m above ground

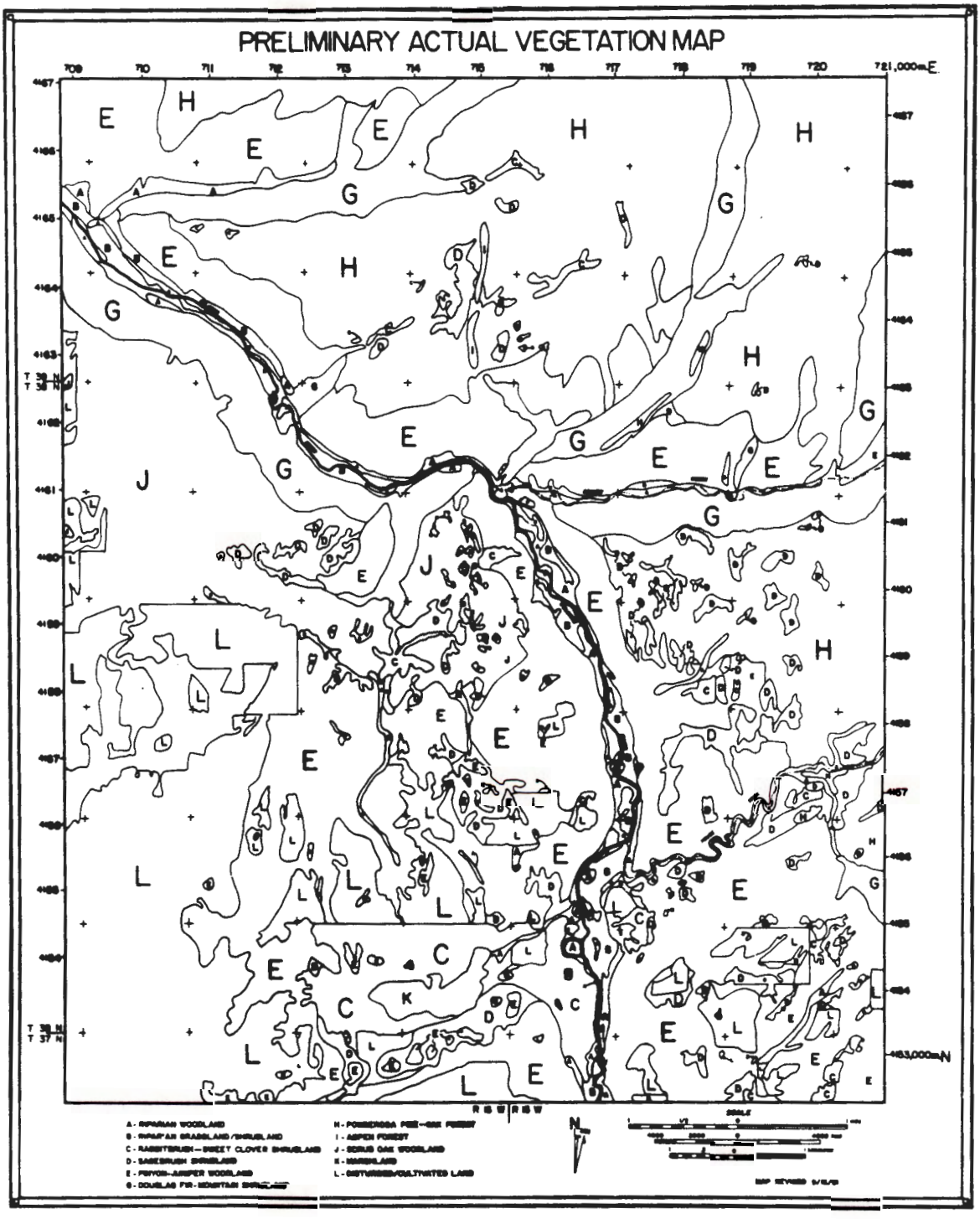

Figure 6.2 Preliminary Actual Vegetation map.

3. Forests - trees with overlapping canopies greater than 3 m above ground
4. Grasslands - usually mesic--drylands with grasses with erect stems and leaves which do not form horizontal overlapping canopies; usually less than 2 m high
5. Marshlands - plants in mesic-to-wet sites, with or without horizontal overlapping canopies which are usually greater than 2.5 m high

The physiognomy is modified by a name representing the dominant plant, group of codominant plants, or plants readily visible and characteristic of the zone.

Those specific zones of the Actual Vegetation Zones recognized in the D.A.P. area (primarily the Escalante Sector) include the following (the letter designations correspond to the letter designations in Figure 6.2):

A - Riparian Woodland - Riparian Woodland consists of Populus angustifolia and Salix sp., and includes the oxbow formations in the riverbed. This is a highly transitory community.

B - Riparian Grassland/Shrubland - Riparian Grassland/Shrubland consists of open flat areas with grasses and herbaceous plants and small shrubs which have frequently been used as pasture and cultivated fields.

C - Rabbitbrush-Sweetclover Shrubland - This zone consits of a principally "weedy" type of vegetation which quickly invades abandoned fields or other disturbed areas, such as gravel pits and road cuts. It will soon be replaced by other types of vegetation and thus is an early successional sere. Chrysothamnus, Melilotus, Helianthus, and Lupinus are frequently found.

D - Sagebrush Shrubland - Sagebrush Shrubland consists of Artemisia tridentata with scat- tered Chrysothamnus and Purshia tridentata. This type exists as a "climax" (mature) community in flat areas of well-drained soils.

E - Pinyon-Juniper Woodland - This zone consists of Pinus edulis, Juniperus osteosperma, and/or Juniperus scopulorum, and a high percentage of Quercus gambelii. This is considered to be a successional sere in which the tree element will eventually outcompete the shrubs. This is probably a "climax" association.

G - Douglas Fir-Mountain Shrubland - This zone consists of Douglas Fir (Pseudotsuga menziesii) distributed in a mountain shrub vegetation that consists primarily of Amelanchier, Fendlera, and Quercus. This association is found on steep slopes.

H - Ponderosa Pine-Oak Forest - The Pnderosa Pine-Oak Forest zone consists of Pinus ponderosa and often a high percentage of oak (Quercus gambelii) or grass.

I - Aspen Forest - The Aspen Forest zone consists of Populus tremuloides, often in areas opened by logging.

J - Scrub Oak Woodland - Scrub Oak Woodland is dominated by Quercus gambelii, often with scattered sagebrush or pinyon elements.

K - Marshland - The Marshland is dominated by cattails (Typha) and bulrush (Scirpus), and is localized in the wet region of Sagehen Flats Locality created, in part, by the irrigation canal.

L - Disturbed/cultivated - These zones occur in recently cultivated or present fields, gravel pits, etc., and reflect human disturbance.

If these zones were allowed to progress to a natural, stable, "mature" state (e.g, "climax" stage), one would be able to delineate major

associations which would represent Potential Natural Vegetation. These natural units are named according to the dominant perennial plants and are developed from one or more Actual Vegetation zones listed above. These associations are assumed to have developed from anthropogenic or cultural vegetation upon removal of human influence. Whether these types of vegetation reflect the Original Vegetation (prior to human disturbance) is open to question.

The five associations recognized in the D.A.P. area (Escalante Sector) consist of the following (these correspond to the five Potential Vegetation Zones referred to earlier):

Ponderosa Pine Association

Douglas Fir-Mountain Shrub Association

Riparian Association

Pinyon-Juniper Association

Sagebrush Association

Inherent in the above discussion are the concepts of (1) units of vegetation, and (2) dynamic changes within units of vegetation. A zone may contain one or more communities in which one or more dominant species are present. The zone concept is used when data generated on a multi-seasonal and multiyear basis are insufficient to identify specific vegetation communities; therefore, the community concept is not applied at this time. It is assumed that zones can and do change in a predictable manner under present-day environmental conditions. For example, an abandoned cultivated field could develop in a few years into a Rabbitbrush-Sweet Clover Shrubland. Later this vegetation type could change to a Sagebrush Shrubland. Depending upon local conditions (soil, topography, elevation, exposure, drainage, etc.), this type could remain

stable or could develop into Scrub Oak Woodland and eventually become a Pinyon-Juniper Woodland. This sequence could lead to the formation of a Sagebrush Association or to a Pinyon-Juniper Association if human influence was removed and the area was allowed to recover.

Many species are found in more than one vegetation zone as well as in multiple associations. This situation reflects the "individualistic species" response of plants to environmental and time gradients. This continuum concept is important in viewing the presence and availability of plant resources. Although this situation argues against the uniqueness of community floras, it provides the basis for varying responses to human and natural influences of the same plant in different communities. Perhaps the most puzzling plant which reflects this condition is the oak, Quercus gambelii. Although Quercus gambelii forms pure stands (and is recognized as a transitory Actual Vegetation zone), it is a member of at least three mature associations (Ponderosa Pine, Douglas-fir-Mountain Shrub, and Pinyon-Juniper).

The plants documented to be present in various D.A.P. vegetation zones are documented in Appendix A. This listing recognizes the fact that more than one zone may be the habitat for a given species. This information was derived from releve analyses along transects in the Riparian, Oak, and Ponderosa Pine zones. The releve technique refers to "a plant list method which aims at obtaining a complete checklist of plants in a series of relatively small environmentally uniform habitats" (Mueller-Dombois and Ellenberg [9]). More complete listings and a useful basis for interpretation will be derived from information during the 1980 season when the identifications of the specimens have been completed.

Additional Activities of the Environmental Studies Group

In addition to vegetation mapping, other complementary projects were initiated by the E.S.G. during 1979. These activities were designed to provide the data base to link the base-level vegetation units with the information needed for specific problems. These studies, though not complete, include the following:

1. Community analyses via releve analysis of the major vegetation zones (i.e., relative abundance of major species along transects)
2. Structural analyses in order to provide demographic data on a given species (e.g., pinyon pine)
3. Floristic surveys in order to document the vascular plant species present and provide comparative plant materials for identification and interpretation of archaeological remains

Parts of these studies were initiated (but not completed) in anticipation of preliminary data for base questions generated by the D.A.P. Research Design. As support and opportunities arise, these programs will be completed.

Other projects need to be undertaken in order to establish a basis for the D.A.P. synthetic studies. These projects include the following:

1. A community dynamics study which would monitor change in the composition and density of characteristic communities in order to develop vegetation change models for anthropogenic communities during previous periods of occupancy
2. Vegetation monitering and historic mapping/photographic studies to determine the rates of change under certain environmental conditions

3. Correlations of vegetation zones and change models with biotic and abiotic factors
4. Vegetation reconstruction model development with the gathering of evidence of present-day environmental indicators which reflect present-day vegetation components (e.g., pollen, phytoliths, seeds/fruits)
5. The development of vegetation disturbance models which will allow one to predict the availability (presence, amount, density) of particular plant resources of cultural significance under present-day conditions

Application of Vegetation Information to the D.A.P. Research Design

The underlying assumption made by the E.S.G. is that humans interact with the components of their ambient environment (biotic and abiotic) so as to extract a successful living. Defining the bounds of the vegetation within which humans have acted over time is of primary importance to the botanical studies section. Also, providing predictable and testable models of plants (as individuals, populations, and in communities) which can be connected to the archaeological and historical evidence is critical.

Plant assemblages are of varying ages, from immature to mature stages. Humans can interact with the vegetation such that individual plants may vary in presence (duration, predictabiity, location), quality, and quantity, depending upon the age of the assemblage within which the specific plants are found. Eventually, each culturally important plant must be evaluated for the (1) part employed, (2) condition of the parts

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and associated parts which are procured, (3) plant community or communities where the plants can be efficiently gathered, and (4) the types of vegetation within which the plants can be found. In most cases, identification of the Actual Vegetation during given periods of occupation will answer these questions. Potential Vegetation at given periods of time will be used as a guide to determining the Actual Vegetation.

These Actual and Potential vegetations must be determined for the specific time periods of occupation. The present-day vegetation can only be used as a starting point to project back into time with certain qualifications as yet to be defined. At the present time, the interactions between the prehistoric occupants of the D.A.P. area and their environment can be only tentatively defined using present-day vegetation studies. Research to date is only a start--it does not adequately answer the main points of the Problem Domains.

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PLANT FAMILIES REPRESENTED IN 1978 EXCAVATED SITES: PRESENT-DAY ECOLOGY AND ARCHAEOLOGICAL IMPLICATIONS

The plants listed in this section are arranged alphabetically by family and then by genus and species when appropriate. The format generally followed includes taxonomic designation (family, genus, species); taxa under the identifier taxon which are present today in the region (i.e., southwestern Colorado, specifically Dolores and Montezuma counties) or area (i.e., within the current area of investigation of the Dolores Archaeological Program); ecology (habitat and vegetation zone); response to current human activities; ecological information related to period of occupation; information on the use of the plant by animals which could have been agents of introduction of the plant material into the archaeological context; and ethnobotanical information, including use and association information for different parts of the plant based upon data from Southwestern cultures. Several of these points are discussed below, followed by a presentation of the plants found in the D.A.P. area today.

Taxonomic Designation

The botanical family is a convenient taxon to focus on for tentative identification and is the most useful for aggregating related plants which may be similar. Often, diagnostic morphological characters as well as biological, chemical, and structural features are similar, so that cross-taxonomic interpretations are possible. It is easier to see similarities and retrieve cultural and biological data from this level of related plants than to list them by genus which may vary in name and reliability of accurate identification.

Within family, the remains may be assigned to genus (and species if adequate diagnostic features are present). In some cases, the genus cited may be the best considered at that time, but the reader may also be referred to a closely related taxon (within the same family). Usually a common name is cited in the text for easier identification for those individuals who are not familiar with the Latin names of the plants.

Habitat

The present-day habitat of the plant is mentioned and is based upon fieldwork currently underway. Not only is it important to look at the contemporary distribution of formal vegetation types, but also the manner in which these plants behave ecologically within these communities with different types of human disturbance. Some preliminary statements can be made in a few instances, although more accurate and useful information will come from future field work when the response and availability and quality/quantity of these plants are determined. The next step is to move back through time using environmental reconstruction to determine the plant's importance in the natural and anthropogenic communities. The availability of given resources to people at given times and under given conditions can then be estimated. Also, this information will provide alternatives for interpretation of the plant's presence in pre- and post-occupation periods.

Interaction and Relationship to Human Activity

Many plants respond to human activity and may be present regardless of the significance of a given plant's "economic" role. These plants may be present even if the people do not use or recognize them. The plants respond to human activities and become members of anthropogenic communities. The intensity and diversity of human activities will

determine the types of plants found, their association with other natural and cultural factors, and their relative abundance. These types of data are still scanty and will be derived from studies related to habitat.

Ethnobotanical Evidence (Utilization of Plants)

One of the primary goals of the current study is to assess the importance of plants in the "economic activities" of the prehistoric occupants. The Problem Domains are directly oriented toward this approach. The first step is to identify the parts of the plants recovered for each taxon and to determine whether they would be used, discarded, and retrieved in the archaeological record. In some cases, the part of the plant recovered may not be utilized directly but may be associated with other parts of the plants which may have been employed for various purposes (in the latter case, the plant part may or may not have been preserved in the archaeological record). Another possibility is that the part utilized may not appear as evidence in the archaeological record. The negative evidence in light of other data may yield some information.

This approach is based on an assumption that the plants were utilized. After testing this assumption (through correlations, associations, suites of materials, etc.), it is necessary to state the manner in which a given plant resource was used. A Comparative Ethnobotanical Data File is being developed in order to provide the potential for interpretive strategies. This file will include such values for each plant as parts directly used, parts associated, discarded parts, significance to cultural activities, ecological/ethnoecological associations, cultural development, and cultural value systems. From this base, a statement of analogy can be made as one possibility for interpretation. Other statements may be considered as well. Such

statements may suggest noncultural explanations for the presence (or absence) of plants. These alternatives are presented as a range of potential interpretations and not as the definitive statement. These interpretations need to be tested at various levels. The first level is to determine the stratigraphic and cultural context of the sample and evaluate its significance. Various tests of association with other materials from the sample or from the field specimen number (FS) are needed (e.g., lithics, ceramics). The next level is to evaluate the sample and materials in relation to the vertical and horizontal controls for each situation. After the completion of these steps and the evaluation of the preliminary site reports, the second phase can begin. This phase will focus on the integration (usually by FS) of the botanical data into the overall temporal/spatial framework of the D.A.P.

List of Plants by Families

Much of the information in this section was gathered during compilation of the Comparative Ethnobotanical Data File. Compilation of this file took place during the 1978-1979 academic year using literature available at the University of Colorado, Boulder. Sources used for compiling this file are listed in Appendix B.

AGAVACEAE

Yucca sp.

The small, shrub-like yucca is represented in Montezuma County by three species (*Y. baccata*, datil yucca; *Y. baileyi*, Bailey yucca; and *Y. neomexicana*, New Mexican yucca). Yucca baccata is the most common species in the project area. The datil yucca is found in various communities of the Sagebrush Shrubland and the Pinyon-Juniper Woodland as well as

in their ecotones in the present environment. The leaves of the species have served as a source of fibers for cordage, clothing, soap, medicine, basketry, matting, and construction. The fruits and seeds of the datil yucca have served as food sources and have been used for medicinal and ceremonial purposes by historic and contemporary cultures in the Southwest. The plant may colonize disturbed areas and may spread in areas of intense grazing pressure. The seeds and fruits are gathered, stored, and consumed by large birds and rodents.

AMARANTHACEAE

Amaranthus sp.

Pigweed or amaranth is a group of annual herbs which occur today as common ruderals in disturbed habitats in all communities and vegetation zones of the project area. The species known to occur in the region are A. graecizans (prostrate pigweed), A. hybridus (slim amaranth), A. powellii (Powell amaranth), and A. retroflexus (redroot amaranth). These species occur naturally in the area. There are cultivated species which have been grown in the Southwest for grain, edible greens, and dye material. The seeds and young foliage have been used as food by many cultures in the Southwest. No doubt this plant occurred in disturbed areas (e.g., cultivated fields, habitation sites, burned areas, trails, middens, etc.) during prehistoric periods. The seeds and plants are eaten by birds, rodents, and insects (e.g., ants). Because this plant group is common and weedy in disturbed habitats, the presence of seeds and pollen may reflect the widespread existence of anthropogenic communities during and after occupation.

ANACARDIACEAE

Rhus sp.

Sumac is a shrub which is locally abundant in the present-day environment of the project area. It is commonly found in the margins of the Riparian Woodland and in open areas of the Sagebrush Shrubland and the Pinyon-Juniper Woodland. Three related taxa are known in the region: R. aromatica ssp. trilobata (skunkbush sumac), R. aromatica ssp. simplicifolia (skunkbush sumac), and Toxicodendron rydbergii (western poison ivy). The skunkbush sumac (or squawbush) has been used by cultures of the Southwest for food (fruits), for the manufacture of implements (wood) and basketry (twigs), for medicine (fruits, foliage, twigs), for dyes and paints, and for various ceremonial purposes such as kiva fuel and offerings. The fruits are eaten by many birds and mammals.

APOCYNACEAE

Apocynum sp.

Dogbane is found in the disturbed habitats in various vegetation zones of the D.A.P. area as well as in open areas of the Riparian Woodland. Two species are known in the region: A. androsaemifolium (spreading dogbane) and A. cannabinum (hemp dogbane). The bark and base fibers from the stems have provided materials for cordage and basketry for various Southwestern cultures.

BETULACEAE

Alnus sp. and Betula sp.

Members of the birch family are represented in the D.A.P. area today by two species: Alnus tenuifolia (thinleaf alder) and Betula occidentalis (water birch). These trees are found along the river in the Riparian Woodland and in moist areas of drainages. The bark has been recorded as a dye source. The wood has been used by people in the Southwest for the manufacture of implements. The wood also might have been used as fuel and the twigs might have been employed as a medicine.

CACTACEAE

Echinocereus sp.

Hedgehog cactus is a small cactus of the Pinyon-Juniper Woodland and Ponderosa Forest in the present-day D.A.P. area. Four taxa are known from the region (E. fendleri, Fendler echinocereus; E. reichenbachii var. perbellus, lace echinocerus; E. triglochidiatus var. melanacanthus, claretcup echinocereus; and E. triglochidiatus var. triglochidiatus, claretcup echinocereus). The fruits of echinocereus have been used as food by peoples of the Southwest. The plant has been ingested as a medicine and for ceremonial purposes; it is associated with certain creation myths of some Southwestern cultures. The soft-spined fruits are eaten by small mammals.

Opuntia sp.

The genus Opuntia is represented in the D.A.P. area by members of two subgenera: Cylindropuntia (cholla) and Platyopuntia (prickly pear). The former is represented by one species (O. whipplei var. whipplei, Whipple

Cholla), the latter by four taxa (O. erinacea var. hystricina, grizzly bear prickly pear; O. erinacea var. utahensis, grizzly bear prickly pear; O. phaeacantha var. phaeacantha, prickly pear; and O. polyacantha var. rufispina, plains prickly pear). Today, Opuntia species are common elements of the Sagebrush Shrubland and the Pinon-Juniper Woodland as well as their ecotones. In some cases, its density is known to increase with human disturbance of the environment and, consequently, can be part of the anthropogenic community surrounding habitation sites and areas of frequent human activities. The many-seeded fruits have been consumed by almost all cultures of the Southwest. Also, the seeds (either from special collecting and processing of seeds from the fruit or from "second harvest" of seeds from fecal remains) have served as a food source. The fruits and seeds are eaten raw, cooked, and as a meal; the spines are usually removed from the fruits by brushing or singeing prior to preparation. The fleshy, spiny pads or stems have also provided food after the spines are removed. The plant has also been used for medicinal and ceremonial purposes. Prickly pears and chollas might have been common near the dwellings during and after occupation. The fruits, seeds, and pads are common food of large and small mammals (e.g., rodents).

CAPPARIDACEAE

Cleome sp.

Beeweed is an herb that is found in the present-day D.A.P. area in disturbed habitats in various vegetation zones. The two species known for the area are C. lutea (yellow spiderflower) and C. serrulata (Rocky Mountain beeplant). The plant, especially the young portions, has been employed as food and medicine by various cultures in the Southwest. The

whole mature plant has also been used as a paint for the decoration of pottery. The plant has been associated with ceremonial activities. The plant was probably common in disturbed areas and anthropogenic habitats such as dwellings, fields, trails, and middens during and after occupation of prehistoric sites. The seeds are eaten by birds and small mammals.

"Cheno-Am"

This is an artifical category composed of members of the family Chenopodiaceae and the genus Amaranthus. The fruits/seeds and pollen are difficult to distinguish under the light microscope due to similarities between the two and poor preservation of characters. See Amaranthus and Chenopodium for discussion.

CHENOPODIACEAE

Chenopodium sp.

Goosefoot, or chenopod, is a group of plants represented by six species in the region (C. acerifolium; C. atrovirens, dark goosefoot; C. berlandieri, pitseed goosefoot; C. fremontii, Fremont goosefoot; C. leptophyllum, slimleaf goosefoot; and C. overi). These plants are natural colonizers in disturbed sites in various communities of the D.A.P. area today and are especially common in sites associated with human activities where the plants behave as weeds. The small fruits are usually produced in great abundance. The fruits have served as a good resource for a number of cultures in the Southwest in the past. The fruits were probably gathered from dense stands and prepared by leaching and cooking or by parching and grinding into a meal and served as a hot or cold mush. The foliage of the young plants, after pretreatment, has been consumed as an

edible green. The plants have also served as medicine and as a food additive. Because these plants are commonly associated with human activities, they probably occurred on the sites during and after occupation. Also, the fruits are gathered, stored, and consumed by various animals including birds, ants, and rodents.

COMPOSITAE

Artemisia sp.

Sagebrush is found in the present-day Pinyon-Juniper Woodland, Sagebrush Shrubland, and Ponderosa Forest and is represented by 10 taxa in the region: A. bigelovii, Bigelow sagebrush; A. borealis, northern wormwood; A. dracunculus, tarragon; A. frigida, fringed sagebrush; A. ludoviciana, Louisiana sagebrush; A. nova, black sagebrush; A. scopulorum, alpine sagebrush; A. spinescens, bud sagebrush; A. tridentata vaseyana, mountain big sagebrush; and A. tridentata tridentata, basin big sagebrush. Artemisia tridentata is the largest woody species in the D.A.P. area today and is the dominant member of the Sagebrush Shrubland. Sagebrush is a common member of early as well as mature communities in various vegetation zones and can be found in ecotones between various communities. The wood and branches have served as fuel and construction materials from a number of Southwestern cultures. Also, small implements have been manufactured from the wood. The leaves and twigs have been employed as food additives and medicines. Probably because of the aromatic nature of the plant, it has been a part of certain ceremonies. The fruits have also provided food. Because the various species of sagebrush are colonizers in early successional seres, the plants could have become a common member of

the invading vegetation on abandoned sites or areas subjected to periodic surface fires. The fruits are consumed by birds and small mammals.

Chrysothamnus sp.

Rabbitbrush is a common shrub of the Sagebrush Shrubland and Pinyon-Juniper Woodland (especially in heavily grazed areas) and is represented by eight taxa today (C. depressus, dwarf rabbitbrush; C. linifolius, spreading rabbitbrush; C. nauseosus ssp. nauseosus, rubber rabbitbrush; C. nauseosus ssp. consimilis, threadleaf rubber rabbitbrush; C. nauseous ssp. graveolens, green rubber rabbitbrush; C. nauseosus ssp. leiospermus, rubber rabbitbrush; C. parryi ssp. affinis, Parry rabbitbrush; and C. vaseyi, Vasey rabbitbrush). The plant was used by Southwestern cultures for the purpose of dyes and medicine. The wood has been used for weaving, basketry, manufacture of implements, windbreaks, and construction. Rabbitbrush is also used in association with certain ceremonies and as kiva fuel. The wood has also served as a general fuel.

Helianthus sp.

Sunflower is a common member of disturbed habitats of the Sagebrush Shrubland and the Pinyon-Juniper Woodland. It is found in the vicinity of habitation sites, fields, trails, roads, and middens. Two species are known from the region today: H. annuus (common sunflower) and H. petiolaris (prairie sunflower). The fruits have been used as food by various cultures of the Southwest. The plant also has provided material for ceremonial and medicinal use. The plants are common in disturbed areas and might have been common in and around prehistoric sites during and after occupation. The fruits are collected, stored, and eaten by birds, small mammals, and large insects.

CRUCIFERAE

Members of the mustard family are common in the D.A.P. area today and are often seen as weedy plants of disturbed areas. The seeds of several species have served as food (usually prepared and consumed as a mush dish). The young plants of some of the annual herbs have been eaten as greens (before flower and fruit set). Acting as a colonizer and weed, many mustards could have been locally abundant in and around sites during and after occupation. The small seeds are also collected by birds, small mammals, and ants, and are stored by ants in underground granaries.

CUPRESSACEAE

Juniperus sp.

Junipers are common in the D.A.P. area today and form the codominant component of the Pinyon-Juniper Woodland. They are especially common on drier slopes and tend to sprout from the base of the root stumps if damaged. Four species are found in the region (J. communis, common juniper; J. monosperma, one-seed juniper; J. osteosperma, Utah juniper; and J. scopulorum, Rocky Mountain juniper). The cultures of the Southwest have employed many parts of the juniper for various purposes. The seed and cone berries have been used as food, beverage, and medicine. The twigs and scaly branches have been used for padding, medicine, and in certain ceremonies. The wood has been valued for fuel, construction, and source material for the manufacture of various implements. The fibrous bark has provided material for cordage, padding, fuel, construction, and clothing. The cone berries, seeds, and scaly twigs have been used by birds and mammals for food and construction.

CUCURBITACEAE

Cucurbita sp.

The squash is a cultivated domesticated annual which is not native to the D.A.P. area. Under present-day conditions, a number of species can grow and produce (to a limited extent) and include C. ficifolia, C. mixta, C. moschata, and C. pepo. Various parts of the plant have provided food for cultures of the Southwest in the past; the squash continues to be used as food today. The seeds, fruits, and flowers have all been consumed in various manners. The seeds can be eaten raw, parched, or cooked. The pericarp of the fruit of some species has provided material for containers, utensils, and rattles. Some species were of medicinal value. The wild species, C. foetidissima, is not known in the area today but is common in other parts of the Southwest where it has served as a food resource and been used for medicine and utensils.

CYPERACEAE

Scirpus sp.

The largest plants of the sedge family are represented by the genus Scirpus which can be found in the D.A.P. area today in the marshland, and in the oxbows of the Riparian Woodland and seepages of other communities. Four species are found in the area today (S. acutus, tule bulrush; S. americanus, American bulrush; S. maritimus, alkali bulrush; and S. lacustris ssp. valicus, softstem bulrush). The leaves and stems have provided materials to cultures of the Southwest for the manufacture of baskets and matting and for construction. The fruits provided a food resource which was usually eaten as a mush. Because it is found in moist habitats, the plant has been used in certain ceremonies associated with

water. The fruits are favorite foods of certain birds and small mammals while the leaves have been gathered by some mammals for nest construction.

EQUISETACEAE

Equisetum sp.

Horsetail is a fern relative which is found in the present-day D.A.P. area in disturbed habitats (e.g., margins of roads) and in moist habitats of the Riparian Woodland. Three species are known from the region: E. arvense (field horsetail), E. hyemale (scouringrush), and E. laevigatum (smooth horsetail). Little is known about the importance of horsetail in Southwestern cultures. It has been cited as being associated with the manufacture of ceremonial food. It might have served some purpose in certain domestic activities (cleaning, matting, etc.).

FAGACEAE

Quercus sp.

Oak is a small tree which is locally abundant in certain habitats of the D.A.P. Two species are present in the region: Q. gambelii, Gambel oak; and Q. turbinella, shrub live oak. At the present time, Q. gambelii forms dense scrublands often attributed to the historic effect of logging and heavy grazing. Under natural conditions, it would be an element of the Pinyon-Juniper Woodland, Doublas Fir Mountain Shrubland, and the Ponderosa Forest. The acorns may have provided food for some cultures of the Southwest. The wood served as a source for fuel and implement manufacture. The fruits are gathered, stored, and consumed by large birds and small mammals.

GRAMINEAE

Several members of the grass family are found in the D.A.P. area today. They are found in all the vegetation zones and the various communities. Some species are members of anthropogenic communities which develop in areas disturbed by humans. Several grasses have been used by Southwestern cultures as a food source (using the fruits) and as a fiber source (for matting, etc.). Some species have been cited as either a seasonal staple or as a famine food. Foods prepared from grasses have included the fruit as well as parts of the inflorescence (e.g., florets, glumes). Many of the species might have colonized sites during and after occupation. Many of the small-fruited grasses are collected and stored underground by ants and small mammals.

Phragmites sp.

The common reed grass (represented in the region today by P. australis) is usually found in moist habitats. To date, it has not been found growing in the D.A.P. area but would be expected to be a member of the Riparian Woodland and Marshland. The plant has served as a food source for cultures of the Southwest; the most common food was the sweet exudate caused by aphids on the culms of the grass. The culms have served as construction material as well as source material for the manufacture of such implements as musical instruments, arrows, weaving rods, bows, pipes, and prayer sticks. It has been associated with various ceremonies because of the implements derived from the culms, and perhaps because of its association with water.

Zea mays

Maize is a cultivated domesticated annual grass which is not native

to the D.A.P. area. Under present-day conditions, certain modern races are able to grow and produce to a limited extent. The plant is assumed to have been grown in the region during prehistoric occupation and may have been the staple of the traditional diet. The fruit (kernels), young leaves, and the culm (cane) have provided food to most of the Southwestern cultures. Also, various pests (insects and fungi) associated with the cultivated plant might have provided food. The leaves (husks) have served as containers for cooking and smoking. Various parts of the plant have been associated with certain ceremonies. Some parts of the plant (e.g., the styles or silks) have been used medicinally. Implements have been manufactured from the culm and cob. Cobs, culms, and roots can serve as a fuel.

GROSSULARIACEAE

Ribes sp.

Currant is a common shrub in the various vegetation zones of the D.A.P. area. Seven species are known in the region today: R. aureum (golden currant), R. cereum (wax currant), R. coloradense (Colorado currant), R. inerme (whitestem currant), R. leptanthum (trumpet gooseberry), R. mogollonicum (Rothrock currant), and R. montigenum (gooseberry currant). The fruits have been used as food and the plant has been used in construction by various cultures of the Southwest. The fruits are eaten by birds and small mammals.

LEGUMINOSAE

Many members of the bean family occur in the region and are found

in the D.A.P. area. These plants are members of various vegetation zones of the region. Compared to other families (e.g., Gramineae, Solanaceae), this family has a relatively low diversity of plants of direct importance to humans.

Lupinus sp.

The lupines are common plants of most of the vegetation zones of the D.A.P. area and are represented in the region by eight taxa: L. ammophilus, sand lupine; L. bakeri ssp. amplus; L. argenteus, silvery lupine; L. bakeri; L. caudatus ssp. argophyllus, tailcup lupine; L. kingii, Kings lupine; L. pusillus, rusty lupine; and L. alpestris, mountain lupine. Some species are found to colonize disturbed areas of various communities and can be seen today in localities disturbed by human activities. The plant has been used medicinally by some cultures of the Southwest. As a food resource, there are few reports, and caution must have been exercised in the preparation of the seeds because of their toxicity to humans. The plant might have been a colonizer on abandoned sites and fields. The seeds are eaten by birds, small and large mammals, and some insects.

Phaseolus sp.

The bean is a cultivated domesticated annual herb which is not known to be native to the D.A.P. region. Certain wild members of the genus do grow to the south. Under present-day conditions, various species of beans can grow and produce in the D.A.P. area including P. acutifolius var. latifolius (tepary bean), P. coccineus (scarlet runner bean), P. lunatus (lima bean), and P. vulgaris (common bean or kidney bean or pinto bean). The last species is the most diverse in terms of the number of races. The seeds (at maturity), fruits (immature), and young leaves have provided and

continue to provide food to many Southwestern cultures. In addition, the plant has served as a dye and medicine source and has been associated with certain ceremonies.

MALVACEAE

Members of the mallow family are represented today by species in four genera: Iliamna, wild hollyhock; Malva, mallow; Sidalcea, checkermallow; and Sphaeralcea, globemallow. Most of these plants are found in open habitats of the Sagebrush Shrubland and Pinyon-Juniper Woodland. They appear to be colonizers in disturbed habitats. Some species of these plants have been used for medicinal purposes. The schizocarps (sections of fruit with seed) are eaten by small mammals and birds.

PINACEAE

Pinus sp.

Pine is a tree which is found in the D.A.P. region. Three species are known in the region: P. flexilis, limber pine; P. ponderosa, ponderosa pine; and P. edulis, pinyon pine. Limber pine is found at higher altitudes and along drainages; ponderosa pine is found on the upper slopes of and sometimes in ecotones with the Ponderosa Forest and Pinyon-Juniper Woodland; and pinyon pine grows on the lower slopes in the Pinyon-Juniper Woodland. The seeds and inner bark have provided food for peoples of the Southwest. The resinous gum has been used as food, medicine, and an adhesive. The bark and wood have been employed in construction and in the manufacture of various implements, as well as for fuel. The needles have been used for medicinal purposes. The immature cones, seeds, needles, and bark have been eaten and used in construction by mammals.

Pinus edulis

The pinyon pine is the dominant pine in the Pinyon-Juniper Woodland of the D.A.P. area. The wood has served as fuel and material for construction and implement manufacture. The resinous gum has been employed as a medicine, adhesive, and food. The needles have been valued for medicine and for decorative and ceremonial purposes. Seeds from the sticky cones have been and still are used as food; the cones are usually collected green and processed with fire to extract the oily seeds. Pinyon is also used in the preparation of dyes. The seeds are sought, gathered, stored, and eaten by large birds and rodents. The bark is consumed by some mammals.

Pinus ponderosa

Ponderosa pine is the common conifer on the upper slopes of the Ponderosa Forest. The large trees provided construction material. The wood was also used for fuel and for the manufacture of implements for domestic and ceremonial purposes. The seeds are eaten by birds and small mammals.

POLYGONACEAE

Members of the buckwheat family are represented today in the D.A.P. region by species in five genera (Eriogonum, Oxyria, Polygonum, Rumex, and Stenogonum). These plants are common members of early and mature communities of various vegetation zones in the D.A.P. area. The plants of some of the genera have been reported to be used by cultures of the Southwest for food and medicine. These plants were probably common weeds in disturbed areas such as fields and dwelling sites during and after

occupation. The fruits are gathered, stored, and eaten by birds, mammals, and insects.

Polygonum sp.

Six species of knotweed are known from the region and four of them are in the D.A.P. area (P. aviculare, prostrate knotweed; P. convolvulus, dullseed cornbind; P. kelloggii, Kellogg knotweed; and P. sawatchense, Sawatch knotweed). These plants are common members of early successional seres and anthropogenic communities in the various vegetation zones of the D.A.P. area today. In the past and present, various cultures of the Southwest have employed the plant as medicine. The plants were probably common weeds in fields and trails as well as around dwellings. The fruits are collected, stored and eaten by small mammals, birds, and insects (especially ants).

Portulaca sp.

The prostrate herb known as purslane is a common weed in disturbed habitats in the various communities in the D.A.P. area today. It is most notably found in the Sagebrush Shrubland and the Pinyon-Juniper Woodland. Two species are known in the D.A.P. area today and include P. olearacea and P. retusa. The seeds as well as the succulent, leafy stems have been consumed raw or cooked by various cultures in the Southwest. The plants may have been abundant in anthropogenic communities surrounding fields, trails, and dwellings in prehistoric times during and after occupation. The seeds are eaten by a number of small birds, mammals, and insects (especially ants).

RANUNCULACEAE

Members of the buttercup family are represented by 11 genera in the

region. The species are found in all the vegetation zones in the D.A.P. area. The introduced buttercup, Ceratocephalus testiculatus, is a common flowering annual in open areas in the spring. Its fruits are gathered, stored, and eaten by ants. The native species of the buttercup family have been used as medicines.

ROSACEAE

Various members of the rose family are found in all the vegetation zones of the present-day D.A.P. area. The fruits of some species are eaten by some of the Southwestern tribes. Some plants are also used for ceremonial and medicinal purposes. The woody species have been used as fuel, in construction, and in the manufacture of implements. The fruits and seeds are also eaten by birds and large and small animals.

SALICACEAE

Populus sp.

Poplar or cottonwood is a common tree in the present-day D.A.P. area. Five species are known from the region today: P. angustifolia (narrowleaf cottonwood), P. balsamifera (balsam poplar), P. deltoides ssp. wislizenii (Rio Grande cottonwood), P. tremuloides (quaking aspen), and hybrid P. angustifolia x P. deltoides (lanceleaf cottonwood). Quaking aspen is a common element of the Ponderosa Forest. The other species are phreatophytic and grow in the Riparian Woodland and along drainages. The fruits, bark, and buds have been used by various Southwestern tribes for food and medicinal purposes. The wood of larger stems have been used in construction and in the manufacture of implements and utensils. Also, the wood

has been used as fuel for different purposes. Among some cultures, the tree is associated with certain ceremonial activities.

Salix sp.

Willow is found in moist habitats in the D.A.P. area today and usually grows in the Riparian Woodland and in drainages. About 13 species are known from the region as small trees and shrubs. The stems have been used by Southwestern cultures for the manufacture of basketry. The wood has been employed for the manufacture of implements and utensils. The inflorescences have served as food. A dye has also been made from the plant.

SOLANACEAE

Nicotiana sp.

Wild tobacco is represented in the present-day D.A.P. region by one species, N. attenuata (coyote tobacco). It is found in open areas in the Sagebrush Shrubland and Pinyon-Juniper Woodland after the first year of disturbance. Indian tobacco (N. rustica), a native to the south, is easily cultivated in the D.A.P. area under present-day conditions. The plant has been used by Southwestern cultures in the past as a medicine and for ceremonial purposes. In prehistoric periods, the herb might have been common in and around dwellings, trails, trash middens, and fields during and after occupation. The glandular leaves and stems tend to gather small items (e.g., seeds) from the immediate vicinity of the plant which may be carried with the plant when gathered or used.

TYPHACEAE

Typha sp.

Cattail is a common plant in moist areas such as the Marshland, oxbows of the Riparian Woodland, and seepages and drainages in the Pinyon-Juniper Woodland of the present-day D.A.P. area. Two species are known from the region today (T. angustifolia, narrowleaf cattail, and T. latifolia, common cattail). The rhizomes, young shoots, and inflorescences have been used as food by various cultures in the Southwest. Also the exudates from the plant have been used as gum. The leaves and stems have provided material for contruction and basketry/matting manufacture. The plant has been used as a medicine and has been used in ceremonies associated with water. The foliage and rhizomes have been used as food and construction material by some birds and mammals.

APPENDIX A

RELEVE ANALYSIS CONDUCTED DURING 1979

by

Robert A. Bye, Jr. and Mary E. Floyd

The various types of vegetation zones established in the D.A.P. area are based on qualitative rather than quantitative criteria. This approach is based on classification rather than ordination methods. Part of this classification was carried out using the releve method which emphasizes the following points:

1. Patterns and composition of strata within communities are important.

2. Because the species present (especially herbaceous annuals, biennials, and some perennials) may vary from season to season and from year to year, plant lists are used with the acknowledgement that limitations are placed on the data if releves are not repeated.

3. Communities are considered homogeneous with respect to (a) dominant and subdominant species, and (b) layers of vegetation.

4. Plant assemblages (which are distinguished visually) are recurring and can be sampled.

5. Replicates are sampled.

6. The presence or absence of species is considered more important than minor variation in quantity.

This qualitative method uses the Braun-Blanquet rating system which is a type of cover abundance scale (Mueller-Dombois and Ellenberg [9]). In this study, the following scale is used for the reference areas:

5 = cover more than 75 percent

4 = cover between 50 percent and 75 percent

3 = cover between 25 percent and 50 percent

2 = cover between 5 percent and 25 percent

1 = numerous but less than 5 percent cover

+ = few plants with small cover

r = solitary plants with small cover

Four releve transects were sampled with a total of 22 plots recorded. All transects can be located using zone 12, Trimble Point Quadrangle 7.5 minute U.S.G.S. topographic series transect locations. The four transects are as follows:

Plots no. 1-9: UTM 716040 E 4154970 N

Plots no. 10-13: UTM 716300 E 4155820 N

Plots no. 14-18: UTM 715780 E 4162880 N

Plots no. 19-22: UTM 717820 E 4155680 N

RELEVE NUMBER AND DATE: 1 13 June 1979

LOCATION: McPhee, along transect no. 1; elevation ca. 6866 ft.

ZONE: sweet clover meadow on flood plain; Pinyon-Juniper Woodland with oak at base of rock outcrop

POSITION: SW-facing slope; direction N28E

SIZE OF RELEVE: 10 by 10m

REMARKS: film: roll 120, photos 11 & 12

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	absent	
Shrub layer:	absent	
Herb layer:	Achillea millefolium	2
	Chrysopsis sp.	+
	Chrysothamnus nauseosus	4
	Cirsium sp.	1
	Draba reptans	r
	Erodium cicutarium	1
	Lupinus sp.	r
	Melilotus officinalis	5
	Sphaeralcea coccinea	+
	Taraxacum officinale	r
	unknown (narrow leaf herb)	+

RELEVE NUMBER AND DATE: 2 13 June 1979

LOCATION: McPhee, along transect no. 1, between 60 m and 70 m; elevation ca. 6866 ft.

ZONE: ecotone between sweet clover meadow and Pinyon-Juniper Woodland

POSITION: SW-facing slope; direction N28E

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photos 13 and 14; grazing evidence: deer feces

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Pinus edulis	r
Shrub layer:	Artemisia tridentata	4
	Rhus aromatica ssp. trilobata	2
Herb layer:	Achillea millefolium ssp. lanulosa	1
	Bromus tectorum	4
	Chrysopsis sp.	1
	Chrysothamnus nauseosus	3
	Dactylis glomerta	2
	Descurainia pinnata (BT 628)*	r
	Erodium cicutarium	1
	Melilotus officinalis	4
	Oenothera sp.	r
	Sphaeralcea coccinea	r
	Verbascum thapsus	r
	unknown (herb)	+
	unknown (narrow leaf herb)	r

*BT - Botanical specimen number (on file, D.A.P. herbarium collection).

RELEVE NUMBER AND DATE: 3 13 June 1979

LOCATION: McPhee, along transect no. 1, between 90 m and 100 m; elevation ca. 6866 ft.

ZONE: Pinyon-Juniper Woodland with oak

POSITION: NE-facing slope toward Dolores River; direction N28E

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photos 15 & 16; grazing by deer; rocky soil with rock outcrops

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	2
	Pinus edulis	3
Shrub layer:	Amelanchier alnifolia	1
	Artemisia tridentata	2
	Quercus gambelii	r
Herb layer:	Bromus tectorum	r
	Ceratocephala testiculata	1
	Descurainia pinnata (BT 628)*	+
	Erigeron sp. (inflorescence purple; disk flower yellow)	+
	Lepidium sp.	r
	Lesquerella rectipes	r
	Lupinus sp.	r
	Sphaeralcea coccinea	+
	Triticum aestivum	+

*BT - Botanical specimen number (on file, D.A.P. herbarium collection).

RELEVE NUMBER AND DATE: 4 13 June 1979

LOCATION: McPhee, along transect no. 1, between 150 m and 160 m; elevation ca. 6866 ft.

ZONE: ecotone between sweetclover flat and Pinyon-Juniper Woodland

POSITION: rock outcrop area; direction N30W

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photo 17; deer feces present

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	1
	Pinus edulis	3
Shrub layer:	absent	
Herb layer:	Bromus tectorum	r
	Ceratocephala testiculata	3
	Erigeron sp. (BT 619)*	r
	Lupinus sp.	r
	Melilotus officinalis	1
	Triticum aestivum	2
	unknown (purple seedling)	+

*BT - botanical specimen number (on file, D.A.P. herbarium collection).

RELEVE NUMBER AND DATE: 5 13 June 1979

LOCATION: McPhee, along transect no. 1, between 200 m and 210 m; elevation ca. 6866 ft.

ZONE: Pinyon-Juniper Woodland with oak

POSITION: direction N30E

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photo 18

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	3
	Pinus edulis	3
Shrub layer:	Quercus gambelii	+
Herb layer:	Allium geyeri	r - +
	Bromus tectorum	3
	Ceratocephala testiculata	2
	Chrysopsis sp.	+
	Descurainia pinnata (BT 628)*	1
	Erigeron sp. (purple flower)	+
	Erodium cicutarium	1
	Hordeum pusillum	1
	Opuntia polyacantha	+
	Sphaeralcea coccinea	2
	unknown (Compositae)	1
	unknown (seeding, purple)	r

*BT - Botanical specimen number (on file, D.A.P. herbarium collection).

RELEVE NUMBER AND DATE: 6 13 June 1979

LOCATION: McPhee, along transect no. 1, between 230 m and 240 m; elevation ca. 6866 ft.

ZONE: ecotone of Pinyon-Juniper Woodland

POSITION: direction N30E

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photo 19; dominant sagebrush with invasion of pinyon but no invasion of juniper

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Pinus edulis	2
Shrub layer:	Amelanchier alnifolia	+
	Artemisia tridentata	5
Herb layer:	Astragalus sp. (white flower)	2
	Bromus tectorum	1
	Castilleja chromosa	1
	Chrysothamnus nauseosus	1
	Erigeron sp. (purple flower)	1
	Hordeum pusillum	2
	Phlox sp.	r
	Poa sp.	2
	Sphaeralcea coccinea	+
	unknown (purple seedling)	r

RELEVE NUMBER AND DATE: 7 13 June 1979

LOCATION: McPhee, along transect no. 1, between 330 m and 340 m; elevation ca. 6866 ft.

ZONE: ecotone of Pinyon-Juniper Woodland

POSITION: direction N30E

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photo 20; deer feces

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Pinus edulis	4
Shrub layer:	Amelanchier alnifolia	2
	Fendlera rupicola	1
Herb layer:	Artemisia frigida	1
	Bromus tectorum	3
	Ceratocephala testiculata	4
	Hordeum pusillum	1
	Lepidium sp.	+
	Triticum aestivum	1
	unknown herb	r
	unknown herb Compositae	r
	unknown (narrow leaf herb)	+

RELEVE NUMBER AND DATE: 8 13 June 1979

LOCATION: McPhee, along transect no. 1, between 390 m and 400 m; elevation ca. 6866 ft.

ZONE: ecotone of Pinyon-Juniper Woodland

POSITION: S-facing slope

SIZE OF RELEVE: 10 by 10 m

REMARKS: film: roll 120, photo 21; deer feces; sagebrush common in open area between releve plots no. 7 and no. 8

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	2
	Pinus edulis	3
Shrub layer:	Artemisia tridentata	+
	Quercus gambelii	4
Herb layer:	Balsamorahiza sagittata	r
	Ceratocephala testiculata	3
	Erigeron sp.	+
	Lesquerella sp.	+
	Melilotus officinalis	1
	Penstemon sp.	r
	Sisymbrium altissimum	2
	Yucca sp.	2

RELEVE NUMBER AND DATE: 9 13 June 1979

LOCATION: McPhee, end of transect no. 1 at top of ridge

ZONE: mature Pinyon-Juniper Woodland

POSITION: E-facing slope toward Dolores River

SIZE OF RELEVE: 10 by 10 m

REMARKS: representative of mature pinyon-juniper woodland with oak

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	4
	Pinus edulis	5
Shrub layer:	Amelanchier alnifolia	1
	Fendlera rupicola	2
	Quercus gambelii	2
	Ribes sp.	3
Herb layer:	Achillea millefolium ssp. lanulosa	+
	Balsamorhiza sagittata	+
	Boraginaceae (small herb with white flowers)	1
	Bromus tectorum	r
	Descurainia pinnata	2
	Hordeum pusillum	+
	Opuntia polyacantha	+
	Penstemon sp.	+
	Sphaeralcea coccinea	1
	Triticum aestivum	+

RELEVE NUMBER AND DATE: 10 17 July 1979

LOCATION: Trapgrid no. 2

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope

SIZE OF RELEVE: 15 by 15 m

REMARKS: conspicuous lack of oak in the woodland understory

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	3
	Pinus edulis	4
Shrub layer:	Amelanchier alnifolia	1
	Artemisia tridentata	3
	Quercus gambelii	1
	Rhus aromatica ssp. trilobata	1
Herb layer:	Achillea millefolium ssp. lanulosa	1
	Agropyron smithii	5
	Allium sp.	3
	Artemisia (cf. frigida)	2
	Chrysopsis sp.	2
	Chrysothamnus nauseosus	3
	Cryptantha bakeri	+
	Ceratocephala testiculata	4
	Cruciferae (small herb with purple stem)	1
	Epilobium paniculatum	1
	Erigeron sp. (purple ligulate and yellow disk flower)	2
	Eriogonum flavum	+
	Melilotus officinalis	2
	Opuntia polyacantha	+
	Sphaeralcea coccinea	+

RELEVE NUMBER AND DATE: 11 17 July 1979

LOCATION: Trapgrid no. 2

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope

SIZE OF RELEVE: 15 by 15 m

REMARKS: on line 5 of trapgrid

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	+
	Pinus edulis	1
Shrub layer:	Amelanchier alnifolia	1
	Artemisia tridentata	3
	Fendlera rupicola	1
Herb layer:	Achillea millefolium ssp. lanulosa	1
	Allium sp.	1
	Bromus tectorum	1
	Chrysopsis sp.	1
	Chrysothamnus nauseosus	1
	Compositae (unknown herb)	r
	Erigeron sp. (purple and yellow flower)	+
	Lupinus kingii	r
	Oryzopsis hymenoides	r
	Polygonum sp.	1
	Yucca sp.	+

RELEVE NUMBER AND DATE: 12 — 17 July 1979

LOCATION: Trapgrid no. 2

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope

SIZE OF RELEVE: 15 by 15 m

REMARKS: on line 5 of trapgrid

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	3
	Pinus edulis	4
Shrub layer:	Artemisia tridentata	2
	Fendlera rupicola	+
	Quercus gambelii	2
	Rhus aromatica ssp. trilobata	1
Herb layer:	Allium sp.	r
	Balsamorhiza sagittata	1
	Bromus tectorum	1
	Ceratocephala testiculata	4
	Chenopodium (cf. album)	r
	Chrysopsis sp. (type 1)	1
	Chrysopsis sp. (type 2)	2
	Cirsium sp.	r
	Coryphantha vivipara	+
	Descurainia pinnata	+
	Eriogonum leptophyllum	+
	Lepidium sp. (type 1)	2
	Lepidium sp. (type 2)	
	Lupinus kingii	1
	Opuntia polyacantha	1
	Oryzopsis hymenoides	1
	Poa sp.	1
	Polygonum sp.	r
	Sisymbrium altissimum	r

RELEVE NUMBER AND DATE: 13 17 July 1979

LOCATION: Trapgrid no. 2

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope

SIZE OF RELEVE: 15 by 15 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	4
	Pinus edulis	4
Shrub layer:	Artemisia tridentata	+
	Fendlera rupicola	1
Herb layer:	Allium sp.	+
	Balsamorhiza sagittata	3
	Bromus tectorum	3
	Chrysothamnus nauseosus	2
	Compositae (basal rosette)	r
	Compositae (narrow leaf)	1
	Compositae (purple stem)	+
	Erigeron sp.	1
	Erigeron sp.	+
	Lupinus kingii	1
	Opuntia polyacantha	4
	Oryzopsis hymenoides	+
	Poa sp.	+
	Polygonum sp.	+

RELEVE NUMBER AND DATE: 14 23 July 1979

LOCATION: North of Grass Mesa, top of switchback road, along transect no. 3, between 0 and 10 m; elevation ca. 7800 ft.

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope; direction N45E

SIZE OF RELEVE: 10 by 20 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	4
	Pinus edulis	3
Shrub layer:	Amelanchier utahensis	1
	Cercocarpus montanus	2
	Peraphyllum ramosissimum	+
	Quercus gambelii	1
	Symphoricarpos sp.	r
Herb layer:	Astragalus sp.	+
	Balsamorhiza sagittata	r
	Bromus tectorum	1
	Chenopodium (cf. album)	+
	Chrysothanmus nauseosus	1
	Compositae (unknown herb 1)	r
	Compositae (unknown herb 2)	r
	Descurainia pinnata	+
	Erigeron sp. (purpose and white flowers)	1
	Lepidium sp.	r
	Penstemon sp. (small plant with purple flowers)	2
		+
	Penstemon barbatus	+
	Poa sp.	+
	Polygonum sp.	1
	Stellaria sp.	+
	Stipa sp.	r
	Taraxacum officinale	+

RELEVE NUMBER AND DATE: 15 23 July 1979

LOCATION: North of Grass Mesa, top of switchback road, along transect no. 3, between 40 and 50 m; elevation ca. 7800 ft.

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope; direction N45E

SIZE OF RELEVE: 10 by 20 m

REMARKS: denser shrubs than other parts of transect

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	5
	Pinus edulis	1
Shrub layer:	Quercus gambelii	4
	Symphoricarpos sp.	1
Herb layer:	Bromus tectorum	r
	Cympoteris sp.	r
	Descurainia pinnata	+
	Chenopodium (cf. album)	+
	Compositae	1
	Erigeron sp.	r
	Gramineae	2
	Lesqueralle sp.	r
	Mahonia repens	r
	Polygonum sp.	1
	Penstemon sp. (small plant with purple flowers)	+
	Poa sp.	+
	Stellaria sp.	1
	unknown (white flowers)	1
	unknown herb with dissected leaves	r

RELEVE NUMBER AND DATE: 16 23 July 1979

LOCATION: North of Grass Mesa, top of switchback road, along transect no. 3, between 10 m and 11 m; elevation ca. 7800

ZONE: Pinyon-Juniper Woodland

POSITION: SE-facing slope; direction N45E

SIZE OF RELEVE: 10 by 20 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	1
	Pinus edulis	3
Shrub layer:	Amelanchier utahensis	2
	Quercus gambelii	1
Herb layer:	Allium sp.	1
	Astragalus sp.	1
	Chrysothamnus nauseosus	
	Compositae (unknown herb with yellow flowers)	r
	Descurainia pinnata	+
	Opuntia polyacantha	1
	Penstemon sp.	2
	Polygonum sp.	+
	Stellaria sp.	r
	unknown herb	r
	unknown herb with purple flowers	+

RELEVE NUMBER AND DATE: 17 23 July 1979

LOCATION: North of Grass Mesa, top of switchback road along transect no. 3, between 190 m and 200 m; elevation ca. 7800 ft.

ZONE: Pinyon-Juniper Woodland

POSITION: NE-facing slope; direction N210W

SIZE OF RELEVE: 10 by 20 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	1
	Pinus edulis	3
Shrub layer:	Amelanchier utahensis	1
	Artemisia tridentata	1
	Purshia tridentata	4
	Quercus gambelii	4
Herb layer:	Agropyron sp.	r
	Astragalus sp.	+
	Balsamorhiza sagittata	2
	Bromus tectorum	+
	Chrysothamnus nauseosus	1
	Compositae unknown	r
	Cryptantha bakeri	r
	Delphinium sp.	+
	Eriogonum sp.	+
	Lupinus sp.	1
	Penstemon sp.	r
	Poa sp.	+
	Polygonum sp.	+
	Stellaria	1
	Taraxacum officianle	+
	unknown herb	1

RELEVE NUMBER AND DATE: 18 23 July 1979

LOCATION: North of Grass Mesa, top of switchback road along transect no. 3 at top of ridge; elevation ca. 7800 ft.

ZONE: ecotone between Pinyon-Juniper Woodland and Ponderosa Pine Forest

POSITION: NE-facing slope; direction N210W

SIZE OF RELEVE: 10 by 20 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	1
	Pinus edulis	2
Shrub layer:	Artemisia tridentata	1
	Amelanchier utahensis	3
	Quercus gambelii	1
		+
Herb layer:	Achillea millefolium ssp. lanulosa	1
	Allium sp.	+
	Agropyron smithii	2
	Artemisia sp.	
	Astragalus sp.	+
	Balsmaorhiza sagittata	2
	Chrysothamnus nauseosus	1
	Erigonum leptophyllum	1
	Lupinus sp.	r
	Penstemon sp. (purple flower)	1
	Poa sp.	1
	Stellaria sp.	1
	Stipa sp.	1

RELEVE NUMBER AND DATE: 19 6 August 1979

LOCATION: House Creek, ca. 0.5 mi. west of Site 05MT2320

ZONE: Pinyon-Juniper Woodland

POSITION: W-facing slope

SIZE OF RELEVE: 10 by 10 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Pinus edulis	3
Shrub layer:	Amelanchier utahensis	1
	Cercocarpus montanus	+
	Fendlera rupicola	1
	Quercus gambelii	2
Herb layer:	Aster sp.	r
	Chenopodium (cf. album)	+
	Cymopteris sp.	1
	Lupinus kingii	+
	Opuntia polyacantha	r
	Penstemon sp. (small plant with purple flowers)	+
	Sisymbrium altissimum	+
	Stipa sp.	r

RELEVE NUMBER AND DATE: 20 6 August 1979

LOCATION: House Creek, ca. 0.5 mi. west of Site 05MT2320

ZONE: Pinyon-Juniper Woodland

POSITION: W-facing slope

SIZE OF RELEVE: 10 by 10 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	*Pinus edulis*	1
Shrub layer:	*Amelanchier utahensis*	2
	Cercocarpus montanus	1
	Fendlera rupicola	4
	Quercus gambelii	2
Herb layer:	*Chenopodium* (cf. *album*)	1
	Chrysothanmus nauseosus	1
	Descurainia pinnata	1
	Gramineae unknown	1
	Opuntia sp.	+
	Penstemon sp. (purple flower)	r
	Portulaca sp.	+
	Senecio sp.	+
	Stipa sp.	+
	Thermopsis sp.	+

RELEVE NUMBER AND DATE: 21 6 August 1979

LOCATION: House Creek, ca. 0.5 mi. west of Site 05MT2320

ZONE: Pinyon-Juniper Woodland

POSITION: W-facing slope

SIZE OF RELEVE: 10 by 10 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	Juniperus osteosperma	+
	Pinus edulis	5
Shrub layer:	Amelanchier utahensis	1
	Cercocarpus montanus	1
	Fendlera rupicola	2
Herb layer:	Chenopodium (cf. album)	3
	Compositae (purple stem)	r
	Lotus sp.	r
	Opuntia polyacantha	+
	Penstemon sp. (purple flowers)	1
	Sysimbrium altissimum	2
	unknown (herb with dissected leaves)	1

RELEVE NUMBER AND DATE: 22 6 August 1979

LOCATION: House Creek, ca. 0.5 mi. west of Site 05MT2320

ZONE: Pinyon-Juniper Woodland

POSITION: W-facing slope

SIZE OF RELEVE: 10 by 10 m

LIST OF PLANTS BY STRATA:

Strata	Plant Species	Blaun-Blanquet Rating
Tree layer:	*Pinus edulis*	3
Shrub layer:	*Amelanchier utahensis*	+
	Fendlera rupicola	4
	Quercus gambelii	2
Herb layer:	*Chenopodium* (cf. *album*)	1
	Compositae unknown 1 (purple leaves)	r
	Compositae unknown 2 (purple stem)	+
	Cruciferae	1
	Descurainia pinnata	+
	Eriogonum leptophyllum	r
	Opuntia sp.	1
	Penstemon sp.	r
	Sisymbrium altissimum	+
	Stellaria sp.	+
	Stipa sp.	r

APPENDIX B

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