USGS-NPS VEGETATION MAPPING PROGRAM

Photo Interpretation Report
of
Agate Fossil Beds National Monument

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USGS-NPS VEGETATION MAPPING PROGRAM
AERIAL INFORMATION SYSTEMS PROJECT REPORT
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I. INTRODUCTION

The National Park Service (NPS), in conjunction with the Biological Resources Division (BRD) of the U.S. Geological Survey (USGS), has implemented a program to "develop a uniform hierarchical vegetation methodology" at a national level. The program will also create a geographic information system (GIS) database for the parks under its management. The purpose of the data is to document the state of vegetation within the NPS service area during the 1990's, thereby providing a baseline study for further analysis at the Regional or Service-wide level. Aerial Information Systems (AIS) was subcontracted by Environmental Systems Research Institute (ESRI), the prime contractor, to perform the photointerpretation for the program. ESRI subcontracted The Nature Conservancy (TNC) to conduct the field sampling effort and to support the development of the National Vegetation Classification System.

Several parks, representing different regions, environmental conditions, and vegetation types, were chosen by BRD to be part of the prototype phase of the program. The initial goal of the prototype phase is to "develop, test, refine, and finalize the standards and protocols" to be used during the production phase of the project. This includes the development of a standardized vegetation classification system for each park and the establishment of photointerpretation, field, and accuracy assessment procedures.

Agate Fossil Beds National Monument was designated as one of the prototype parks. The monument is located in the high Great Plains. It contains prairie, hill, and riverine environments, with vegetation types that include prairie grassland, riverine woodland, and wetlands. AIS was responsible for the photointerpretation of the vegetation units and rectification of those units to a base. TNC directed the field sampling effort and the classification assignments. Working with the field biologists from TNC, AIS photointerpreted the vegetation units from stereo-paired, natural color photography.

II. AGATE FOSSIL BEDS NATIONAL MONUMENT - GENERAL DESCRIPTION

Agate Fossil Beds National Monument was created by the National Park Service on June 5, 1965. The park occupies 4.5 square miles of land straddling the Niobrara River in the middle of the Nebraska Panhandle.

The park is noted for its history, prehistoric fossils, and scenic quality. Historically, the park was a part of the Agate Springs Ranch, owned by Captain James H. Cook. The park has a collection of ranching and Native American artifacts and memorabilia donated by the Ranch. Paleontologically, the park contains a number of Miocene fossil quarries that were excavated through the late 19th century and early 20th century. From a scenic aspect, the park has views of rolling hills, bluffs, and the river floodplain. Cattle ranching is also an active part of the landscape.

The park is located in the grassy rolling hills of Western Nebraska. The park landscape consists of the east-west trending cap-rocked northern and southern hills, with the treeless Niobrara River floodplain running down the middle of the valley. The city of Harrison is located 23 miles to the north, Mitchell is 34 miles to the south. State Highway 29 runs north-south through the western part of the park.

Agate Fossil Beds National Monument contains four main geomorphologic features:

- The northern hills are rolling prairie hills and canyons rising from the north side of the Niobrara River Valley. Some ridge-tops contain hard cap-rock. The vegetation is composed mainly of prairie grassland.

- The southern hills are rolling prairie hills rising from the south side of the Niobrara River Valley. Some ridge-tops contain hard cap-rock. The vegetation is mainly composed of prairie grassland.

- The Niobrara River valley is the flat upland portion of the valley bottom located between the Northern and Southern Hills. The vegetation is composed mainly of prairie grassland.

- The Niobrara River floodplain is the low area of the valley. It contains the Niobrara River and its lower, middle, and upper terraces. The vegetation is riparian, composed mainly of grassland and wet meadow, with very limited shrubland and woodland.

All areas are accessible by hiking. There area a few dirt roads that run up some of the canyons. River Road is a paved road that runs east-west through the length of the park on the north side of the valley. Some areas of the park are private in-holdings, requiring permission to pass. Most of these areas are fenced off for active cattle ranching.

The following is a brief and general description of the major regions and their associated vegetation types:

THE NORTHERN HILLS

The northern hills are a series of ridges and canyons that rise up to 300 feet above the valley floor. This area can be subdivided into smaller geomorphological areas. The following descriptions are typical of the entire park:

The tops of the cap-rocked hills and ridges are usually either flat-topped or irregular in shape. The flatter ridge-tops occur in the western end of the hills. For the most part, there is a thin layer of grassland composed of *Bouteloua gracilis*, *Carex filifolia,* some *Stipa comata,* and a few low rock outcrop forbs. The flat-topped ridges, in addition, have a thin edging and or patches of rock outcrop exposure. The irregular hilltops contain mainly rock outcrop with patches of grasses, and more of the small rock outcrop forbs than the flat-topped ridges.

Just below the hilltops and ridges are short steep drop-off areas. These areas typically have a low-density cover of grasses, thin soil, and detrital material. There are also some small exposures of rock outcrop ledges and rock fragments. The vegetation includes *Stipa comata,* with some *Bouteloua gracilis* and *Carex filifolia.* Some rock outcrop forbs are also present. Scattered throughout the steep slopes are rare densities of *Rhus trilobata.* In the eastern part of the park, there is also scattered *Yucca glauca.* In the westernmost part of the park, some of these steep areas contain primarily *Bromus sp.*

The upper to middle slopes of the hillsides and canyons are moderately steep. These slopes contain primarily *Carex filifolia* and *Stipa comata*.

The middle to lower slopes of the canyons and hillsides lessen in steepness. The *Carex filifolia* tends to end at the slope break. The lower slopes contain mainly *Stipa comata* and *Calamovilfa longifolia*. The *Stipa comata* and *Calamovilfa longifolia* continue down to the canyon floor and out to the valley bottom, mixing in predominance of one or the other species. Dense areas of *Andropogon hallii* may occur in very widely scattered patches. In the eastern part of the northern hills *Carex filifolia* may extend down the lower slopes so that it mixes with the *Calamovilfa longifolia* and *Stipa comata*. Within the middle slope area, especially at the upper transition from *Calamovilfa longifolia* to *Carex filifolia,* are patchy areas of low density vegetation. These patchy areas contain gopher mounds with vegetation consisting mainly of *Stipa comata*, with *Artemisia frigida*, sometimes *Helianthus annuus*, and some forbs.

The canyon bottoms, channels and ravines contain *Stipa comata* and *Calamovilfa longifolia*, although many also contain exotic forbs and *Bromus spp*.

THE SOUTHERN HILLS

The southern hills are similar to the northern hills, but are more like a series of disconnected hills rising up 300 feet above the valley floor. They run in an east-west trend along the southern boundary of the park.

The western portion of the southern hills contains flat ridge- tops with a thin soil layer. The vegetation is composed of *Bouteloua gracilis, Carex filifolia*, and some *Stipa comata*. The flat-topped areas are edged with rock outcrop containing small rock outcrop forbs. Patches of rock outcrop also occur on the flat hilltops. Other hilltops and ridges contain mainly *Bouteloua gracilis, Carex filifolia* and *Stipa comata*. Lower hilltops also contain *Calamovilfa longifolia* mixing in. Some low hilltops contain a lower density cover of vegetation with *Stipa comata, Calamovilfa longifolia*, some rock outcrop, rock outcrop forbs, *Carex filifolia* and scattered *Yucca glauca*. Lower ridges in the east side of the park also contain small patches of *Schizachyrium scoparium*.

In the western part of the southern hills, there are steep drop-off areas below the flat hilltops. These steep slopes contain *Carex filifolia*, *Stipa comata*, scattered *Rhus tilobata*, and detrital material. There area also some rock outcrop ledges and rock outcrop fragments, with forbs typical of rock outcrop situations. The eastern portion of the southern hills contain fewer of these steep drop-offs.

The upper to middle sideslopes of the southern hills contain *Stipa comata*, *Carex filifolia*, and *Bouteloua gracilis* in varying predominance.

The shallower middle slopes, lower slopes, and canyon bottoms contain primarily *Stipa comata* and *Calamovilfa longifolia* in varying predominance of each species. Dense areas *of Andropogon hallii* occur throughout, some patches being very extensive. Some of the canyon bottoms and channels contain exotic forbs such as *Helianthus spp*., mustard forbs, and *Bromus spp*. Stream channels contain primarily *Stipa comata* with *Calamovilfa longifolia*, and sometimes a thin linear area of gravel wash.

VALLEY BOTTOM

The canyon bottoms of the northern and southern hills grade into the flat Niobrara River valley bottom. The valley bottom is roughly about one mile wide, running in an east-west trend through the park. The valley bottom contains mainly *Stipa comata* with *Calamovilfa longifolia*. *Bouteloua gracilis* also occurs in many areas. Also present are gopher mound areas with lower density vegetative cover of *Stipa comata, Artemisia frigida*, and forbs. Many areas within the central portion of the park north of the Niobrara River contain *Stipa comata* and *Calamovilfa longifolia* with *Kraschenninikovia lantana*, *Bromus spp*., and exotic forbs.

NIOBRARA RIVER FLOODPLAIN

The vegetation of the floodplain is related to the annual flow of the Niobrara River. Conditions may vary from year to year, mainly affected by climatic factors, such as seasonal rainfall, and snowmelt. The configuration of the river channel, pools, and abandoned channels may change over time due to catastrophic flooding, erosion, and deposition.

The lower floodplain, adjacent to the river, ranges from saturated to slightly drier or slightly alkaline. This area contains *Carex nebrascensis* and some *Leersia oryzoides.* Some drier, alkaline areas contain *Carex pellita, Carex praegracilis, Hordeum jubatum, Juncus balticus, Muhlenbergia asperifolia,* and *Panicum virgatum. Salix exigua* occurs adjacent to the river, or in extensive dense patches along the lower and middle terrace. Very saturated to wet ponded areas occur also, containing *Typha latifolia, Scirpus tabernaemontani*, and *Iris pseudacorus*.

The middle terrace area is higher and drier than the lower terrace, and contains *Carex pellita, Carex praegracilis, Hordeum jubatum,* and *Juncus balticus.* Perennial forbs, such as *Cirsium arvense, Glycyrrhiza lepidota,* and *Sonchus arvensis*, may occur as scattered or extensive patches. Short, scattered patches of *Salix exigua* or *Symphoricarpos occidentalis* may also be present. Some of the perennial forb patches may mix with annual forbs *Atriplex heterosperma* and *Cyclachaena xanthifolia.*

The upper terrace is on higher and drier ground. It contains mainly *Pascopyrum smithii, Equisetum laevigatum,* and *Poa pratensis.* Patches of annual forbs made up of *Cyclachaena xanthifolia* and *Atriplex heterosperma* are present. Scattered occurrences of *Cirsium flodmanii* also occur.

III. SUMMARY OF MAPPING EFFORT AT AGATE FOSSIL BEDS NATIONAL MONUMENT

The following section is a short outline, listed in chronological order, of the vegetation mapping effort at Agate Fossil Beds National Monument. For a detailed description of the tasks listed, refer to sections IV, V, and VI.

July 1996
- Field Preparation
- Preliminary Photo Signature Delineation

August 1996
- Initial Meeting at Agate Fossil Beds National Monument
- Photointerpretation Field Reconnaissance

August 1996 to December 1996
- Development of Post-Field Reconnaissance Classification by TNC
- Preliminary Photo Signature Key

January 1997 to March 1997
- Photointerpretation of Vegetation based on Post-Field Reconnaissance Classification

April 1997 to June 1997
- Review of Photo Signature/Vegetation Units by TNC

July 1997
- Development of Preliminary Classification by TNC
- Photointerpretation Verification Field Preparation

August 1997
- Photointerpretation Field Verification
- Field Revisions
- Revised Preliminary Classification, Development of Vegetation Key and Descriptions by TNC

September 1997 to November 1997
- Final Classification, Vegetation Key, and Descriptions by TNC
- Final Photointerpretation Revision based on Final Classification
- Basemap Production
- Manual Rectification
- Manuscript Map Preparation

December 1997
- Review of Final Photointerpretation Overlays by TNC

January 1998 to May 1998
- Revise Photo Signature Key (based on final classification)
- Data Conversion
  - Polygon label ID
  - Attribute Input
  - Scanning and Vectorization
  - Edit Plot QC
  - Final Processing
  - Interpretation of Pattern

June to September 1998
- Final Documentation

IV. VEGETATION MAPPING AT AGATE FOSSIL BEDS NATIONAL MONUMENT

One of the most important mandates of the Vegetation Mapping Program is the consistent capture and classification of vegetation types through the use of photointerpretation and field sampling methodologies. Mapping criteria and procedures developed during the first two prototype parks are still being tested and revised. The vegetation mapping of Assateague Island National Seashore and Tuzigoot National Monument utilized vegetation layer mapping. Layer mapping consisted of photointerpretation of individual vegetation taxa, then re-aggregating them into the appropriate alliance classes. For the third prototype park, Scotts Bluff National Monument, BRD determined that a different approach be used for mapping. The new approach also used for subsequent parks, including Agate Fossil Beds National Monument, involved the mapping of association /community, height, density, and pattern.

The following sections describe the tasks performed and methodologies used by AIS during the photointerpretation effort for Agate Fossil Beds National Monument.

Initial Meeting

A one-day meeting was held in August 1996 at Park headquarters. Its purpose was to bring together the project team members (USGS-NPS, AIS, and TNC) with park personnel to discuss the USGS-NPS Vegetation Mapping Program and specific interests of the Agate Fossil Beds National Monument. USGS BRD conducted a presentation and discussion of the USGS-NPS Vegetation Mapping Program. Park personnel presented source documents and maps for possible use in the USGS-NPS Vegetation Mapping Program.

During the meeting, imagery, basemaps, and other pertinent collateral materials were reviewed and evaluated. The study area for the project was also discussed and established to be a 400-meter buffer around the park boundary. The amount of park support (e.g., personnel, transportation, etc.), as well as permission to pass onto private in-holdings was also discussed.

Development of Photointerpretation Mapping Procedures

The normal process in vegetation mapping is to conduct a field reconnaissance, map the vegetation units through photointerpretation, and then conduct a field verification. The field reconnaissance visit serves two major functions. First, the photointerpreter keys the signature on the photos to the vegetation on the ground at each signature site. Second, the photointerpreter becomes familiar with the taxa, vegetation types, and local environments that occur in the study area. Park and/or TNC field personnel, who are familiar with the local taxa, vegetation types, and alliance/community associations, are present to help the photointerpreter understand these elements and their relationship with the local environments.

Upon completion of the field reconnaissance, the photointerpretation of the vegetation units commences. The mapping is conducted in accordance with the TNC vegetation classification and criteria. This is followed by a field verification session, whose purpose is to verify that the vegetation units were mapped correctly, and to answer any questions.

The vegetation mapping at Agate Fossil Beds National Monument in general followed the normal mapping procedure. However, there were two differences. The first involves the timing of the photointerpretation, TNC field plot sampling, final classification documentation, and photointerpretation field verification. The TNC field plot sampling was scheduled to occur during the same field season as the photointerpretation field verification. It was logistically impossible to have the sampling and the final classification completed before photointerpretation nor before field verification. Since the preliminary classification would not become final until after the photointerpretation field verification visit, there was a possibility of classification changes, and therefore, mapping changes. In fact, several preliminary classes were later aggregated. As a result, a re-drafting of the photointerpretation overlay was necessary.

Secondly, as with Scotts Bluff National Monument, it was determined that pattern, being more of a general vegetation attribute, would best be interpreted at the completion of the vegetation mapping. All mapped features could be viewed in context of each other over the entire landscape of the park in order to assess the pattern.

Development of Photointerpretation Mapping Criteria

Since mapping for the Vegetation Inventory and Mapping Program had begun, a standardized program-wide mapping criteria was being developed. Mapping criteria are a set of documented working decision rules used to facilitate the maintenance of accuracy and consistency of interpretation in the database. They assist the user in understanding the characteristics, definition, and context for each vegetation category.

The mapping criteria for Agate Fossil Beds National Monument is composed of three parts: the standardized program-wide general mapping criteria, the park specific mapping criteria and the working photo signature key, and the classification descriptions. The following is a detailed description of the criteria used during the photointerpretation of Agate Fossil Beds Bluff National Monument.

- General Mapping Criteria

  The mapping criteria listed below is a modified version of that developed during the Assateague Island National Seashore mapping effort. The criteria will serve as the standard for future photointerpretation efforts in the Vegetation Inventory and Mapping Program to ensure a consistent standard of mapping on a nationwide basis.

- Height

  Height describes average height of the life form of the specific association /community unit. If there are significant height differences within an association /community unit, then the unit can be subdivided to reflect those differences, provided they meet the minimum mapping unit (mmu) resolution.

  - Height Categories

    <0.5 meters
    0.5 - 2 meters
    2 - 5 meters
    5 - 15 meters
    15 - 35 meters
    35 - 50 meters
    >50 meters
    Not Applicable

  - Height Mapping Criteria

    - To determine the average height of the vegetation of the same life form, determine which percentage of the vegetation is at what height. If 10% of the trees are 30m tall and 50% are 36m tall, then they will fall into a height class category of 35-50m. If 80% of the trees are 30m tall and 20% are 36m tall, then the height class category assigned to the polygon will be 15-35m.

    - When there are seedlings and mature growth of the same species, the dominant growth form will be the determining factor. For instance, if a polygon contains *Pinus palustris* seedlings <.5m tall and mature *P. palustris* trees 30m tall, the dominant cover type will determine the height assignment, i.e., if the 30m tall trees compose >50% of the tree cover, then the height class category for the trees will be 15-35m.

- Density

Density refers to the spacing of plants in the landscape. It represents the total coverage based on the percentage of crown or canopy cover. This figure is a qualitative estimate based on the aerial photography. Two methods are used to determine densities from aerial photographs, Absolute and Relative (Continual) Density. Absolute density refers to the sum total of the visible plant and non-vegetative cover within a given mapping unit. The total density cover for all visible over-, mid-, and understory vegetated and non-vegetated surfaces must equal 100% present. The unvegetated areas are not delineated unless they can be delineated at the project minimum mapping unit (mmu). Vegetation not visible on the aerial photograph is not considered as part of the total plant density. For example, in a closed canopy forest the understory grasses and shrubs are not visible, therefore only the tree overstory is visible and the density class is based on the total tree cover present.

Relative density is used when the aerial photography allows the interpreter to see the understory vegetation due to the environmental conditions at the time of the photography or when detailed field notes are available. When mapping relative density, it is possible to arrive at total vegetation cover percentages well over 100%. For example, using winter photography to capture leaf-off conditions, a closed-canopy deciduous forest (over 60% crown cover) is visible along with the shrub and grass understories. In addition to the 60-100% tree cover, shrub and grass understory may make up an additional 60-100% understory cover, totaling at least 120% vegetation cover for that mapping unit.

Absolute crown density is normally the most accurate way of estimating plant coverage and will be used to determine the percentage of vegetation cover within a polygon unless noted otherwise in the park specific mapping criteria. In certain park specific situations where understory needs to be mapped, relative density estimates will be addressed if there is sufficient data. At the very least, aerial photography showing leaf-off conditions is necessary when mapping relative crown density.

For Agate Fossil Beds National Monument, density describes average absolute crown density of the life form of the specific association /community unit. If there are significant density differences within an association /community unit, then the unit can be subdivided to reflect those differences, provided they meet the minimum mapping unit (mmu) resolution.

- Density Categories
    - Closed/Continuous >60% = Canopies overlapping, touching or nearly touching in most of the mapping unit.
    - Discontinuous 40%-60% = Canopies rarely touching, however spacing is fairly minimal, especially when plants are not evenly distributed throughout the polygon.
    - Dispersed 25%-40% = An open or parkland situation where large spaces occur between trees and shrubs, or where grasses are fairly sparse throughout the mapping unit.
    - Sparse 10%-25% = Trees or shrubs are widely spaced, scattered throughout the polygon, or are clumped in very small areas making up a small percentage of the entire vegetative cover.

- Rare 2%-10% = Trees or shrubs occur only occasionally and usually do not make up enough percentage to be considered evenly dispersed. Grass coverage at this level is hard to detect on small scale aerial photography.

- Not Applicable = Density does not apply.

- Density Mapping Criteria

  - To determine the absolute density, assign percentages to the different life forms visible on the aerial photo, including non-vegetated areas. The total percent cover of trees, shrubs, herbaceous and non-vegetated should add up to 100%. Convert the absolute density percentages into the appropriate density class.

  - Non-vegetated areas are not coded in the database unless they meet the minimum mapping resolution for the park and can be mapped as a stand-alone polygon. Otherwise, it is assumed that all vegetation polygons contain non-vegetated areas.

  - Consider the coverage pattern of the vegetation before assigning a density code to the polygon. Estimating densities is more straightforward when plants occupying a particular strata are evenly distributed throughout the mapping unit. However when polygons contain populations of plants that are clumped or occurring only in portions of the polygon, the photointerpreter must consider the area that is not occupied by plant cover when determining coverage density. To ensure consistency, it is helpful to count the plants in polygons with clumped and unevenly distributed vegetation and then compare them to similar sized polygons with an even distribution of plant cover.

  - The vegetation stature type and scale of the aerial photography will determine the visibility of individual plants. Trees are usually visible as individuals and with larger scale photography so are shrubs. However, grasses are rarely seen as individual plants, regardless of the scale of the photography.

  - In the case of trees and shrubs, the percent cover at a density break is adjusted upward. If the percent cover is at about 25%, the polygon is assigned a density code of 3 (25-40%) instead of 4 (10-25%).

  - Dry grasses tend to be less dense than they appear on the aerial photographs. To accurately depict the densities, the percent cover for dry grasses should be adjusted downward. This means that if the percent cover falls at the lower end of a density category, the polygon should be assigned the next density class down. For example, if the percent cover = 25%, the polygon should be assigned a density category of sparse (10-25%) instead of dispersed (25-40%). If the percent cover falls within the middle of a density category, the polygon should be assigned that density class, i.e., if the percent cover = 35%, then the polygon is assigned to the density category dispersed (25-40%).

  - The date of the aerial photography will also influence the densities assigned to vegetation types, especially herbaceous species. Subsequent field verification must take into consideration the following factors that can cause seeming discrepancies between the densities evident on the photo and those visible in the field:

- Seasonality - the density of most herbaceous plants is variable due to their annual growth cycle. Depending on the season the aerial photography was taken, a mapped unit could show a different density on the aerial photographs than is observed during an on-site visit at a different time of the year. Another effect of seasonality is leaf on/off conditions. Photos of forest or woodland areas with leaf on conditions obscure the understory. Photos of leaf off conditions would allow photointerpretation of the understory.

- Different years - the environmental conditions at the time of the photography (wet vs. drought years, flooding, etc.) may affect the densities seen during the on-site field visits.

- Pattern

  Pattern describes the general distribution of vegetation across the landscape. Pattern of vegetation can be a reflection of the landform, soil, geology, climatic gradients, and/or elevational gradients.

  - Pattern Categories

    - Evenly dispersed = Pattern of vegetation is an even or almost even distribution of individuals, clumps, or groups.

    - Clumped/Bunched = Unevenly dispersed clumps of individuals or groups.

    - Gradational/Transitional = A gradual thinning of the individuals or clumps as one moves from one area to another.

    - Alternating = The vegetation occurs in a regular repeating pattern.

    - Not applicable = Pattern does not apply.

  - Pattern Mapping Criteria

    - For Agate Fossil Beds National Monument, pattern was mapped after the final association/community map was created. A plot of the association /community polygons was made and the vegetation was compared back to the aerial photography. The vegetation distribution was coded with the appropriate pattern code. If a polygon contained more than one pattern type, the polygon was subdivided as needed.

- Association /Community

  The assignment of association/community to the vegetative cover is based on criteria formulated by TNC. In the case of Agate Fossil Beds National Monument, TNC provided AIS initially with a preliminary classification. After plot samples were collected, TNC generated a final vegetation classification with associated vegetation key, and vegetation descriptions of each association/community within the monument.

- Aggregation

Aggregation of multiple vegetative classes is necessary when below minimum mapping unit (mmu) vegetation types are present within a polygon.

- Like life forms should be aggregated together; trees should be aggregated with other trees, shrubs with shrubs and herbaceous with herbaceous vegetation types.

- Wet vegetation types should be aggregated with other wet vegetation types, regardless of life form class.

- If a unit that is below minimum mapping resolution is completely surrounded by another vegetation type class, the unit is aggregated with the surrounding vegetation.

- Working Photo Signature Key

A photo signature key is an important tool for maintaining consistency of interpretation. It correlates the physical descriptions of the photo signature with the appropriate vegetation type. A key may also describe other useful information that would be helpful with the interpretation. For Agate Fossil Beds National Monument, a preliminary or working photo interpretation key based on signature characteristics was developed for the mapping compilation as an interim product. A final deliverable association /community photo signature key was created after completion of the mapping.

The preliminary or working photo signature key was developed for Agate Fossil Beds National Monument after the field reconnaissance visit, and was based on a preliminary classification. The data gathered in the field was analyzed. The photos, field overlays, and field notes were reviewed and consistent correlations between signature and vegetation types were noted. Each photo signature was given a unique code. The key, in table form, contained the photo signature code, Steve's (Rolfsmeier) nomenclature, association/community, photo signature description (color, texture, crown size, crown shape, density), height, context (supplemental useful information), notes, and inferred taxa.

After completion of the mapping, a final association /community photo signature key was created from the information compiled on the working photo signature key and from the final vegetation classification. This key contained association/community code, association/community name, photo signature (describing the community association life form), height, context, and notes.

- Park Specific Mapping Criteria

The park specific mapping criteria addressed items of specific interest to the park that were not covered under the general mapping criteria:

- The minimum mapping unit (mmu) was established at 1/4 hectare. (The program standard is 1/2 hectare).
- The mapping scale at Agate Fossil Beds National Monument was 1:12,000.
- After analyzing the field data, a general correlation could be made between topography and vegetation types. As a result, the park was divided into four unique physiographic areas with a description of the typical vegetation types for each area. The regions are listed below:

    - Northern Hills
    - Southern Hills
    - Niobrara River Valley Bottom
    - Niobrara River Floodplain

- Since vegetation disturbance identification and restoration is an on-going goal of the park, knowledge of vegetation disturbance locations and their rehabilitation over time is important. Areas with highly disturbed vegetation containing exotic forbs, annual forb disturbance, and *Bromus* spp. can be discerned on the aerial photography. Every attempt was made to create a polygon to capture these disturbance areas.

Project Set-Up

Two types of aerial photography were provided for the project. The photography received was natural color and color infrared (CIR), nominal scale of 1:12,000, dated July 1995. Each type consisted of prints and diapositives. Both sets of imagery were evaluated to determine which film type would be used as the primary source. Upon review, it was determined to use the natural color photography as the primary source. The CIR photos were very dark with a vignette effect.

Upon receipt of the project materials, a formal study area had to be identified. During the initial meeting, the park had expressed an interest in having a 400 meter buffer around the park. The park boundary as depicted on the United States Geological Survey (USGS) topographic quadrangle map was used as the basis for the buffer.

A flight line index was created, showing the relationship of the photos to the preliminary study area. The photos were compared to one another to ensure there were no gaps in the imagery and that there was full coverage of the study area.

Preliminary Photo Signature Delineation

A total of 10 photos (non-stereo pairs) were needed to provide full photo coverage of the study area for photointerpretation. Each photo was prepared with one mylar overlay for the photo signature delineations. All attribute codes would be assigned after preliminary classification development, subsequent to the photointerpretation field reconnaissance visit. The photo overlays were pin-registered to the photos and labeled appropriately. A study area boundary was determined for each photo, defining the area of photointerpretation. These boundaries were drafted onto the photo overlays and edgematched with adjacent photos to ensure full coverage. Using a mirror stereoscope, the photo signature units were delineated onto the mylar overlays. The delineation of the units was based on signature characteristics including color, tone, texture and relative height. The units were edgematched between photo study areas.

Field Reconnaissance Effort

A one day photointerpretation field reconnaissance visit was conducted. As stated earlier, the purpose of the field reconnaissance visit was to familiarize the photointerpreter with the vegetation types and their photo signatures before the actual attributization process. The field crew consisted of Ed Reyes of AIS, Steve Rolfsmeier of TNC, and Ralph Root of BRD.

Before the field session, several in-house preparations were made. Each photo was set-up with a field mylar overlay. Registration features (e.g., roads and trails) were drafted onto the overlays. Each photo was reviewed and field sites were chosen representing different signature types, environmental conditions and topography. The sites were drafted onto the field overlays with notations as needed. Multiple sites were chosen to provide alternatives if one or more sites were inaccessible.

The field crew conducted on-site field investigations over the one-day period. During the field visit, the photointerpreter worked with the field biologists and park personnel to identify the vegetation species found at the park. A field site number was annotated directly onto the photo field overlay, thereby correlating the field site to a specific location and photo signature. A field notebook was used to record pertinent information, e.g., species present, past disturbances, general topography, etc. Ground photos were taken at selected locations and referenced back to the aerial photos and field sites. Sites not previously identified in field preparation were also visited. These included areas between identified sites and any unusual or notable areas as they were encountered. Most readily accessible areas were visited, representing most vegetation types within the park.

Photointerpretation of Vegetation

Photointerpretation is the process of identifying map units based on their photo signature. All land cover features have a photo signature. These signatures are defined by color, texture, pattern, relative height, and tone on the aerial photography. By observing the context and extent of the photo signatures associated with specific vegetation types, the photointerpreter is able to identify and delineate the boundaries of the vegetation. Additional collateral sources (e.g., existing vegetation maps, supplemental photography, soil data, etc.) can be of great utility to the photointerpreter. Understanding the relationship between the vegetation and the context in which they appear is very useful in the interpretation process. Familiarity with regional differences also helps interpretation by establishing a context for a specific area.

The approach and development of the vegetation classification and photointerpretation utilized an integrated series of photointerpretation procedures and field ecology. At Agate Fossil Beds National Monument, the classification would not be fully developed until vegetation plot samples had been collected and analyzed. In order to maximize the field effort and schedule, the vegetation field plot sampling and the photointerpretation field verification were scheduled to occur over the same summer field season. Logistically, the field plot sampling and classification development had to occur before photointerpretation and the eventual photointerpretation field verification. It was not possible for the classification to be fully developed in time for photointerpretation and field verification to occur. As a solution, the photointerpretation process utilized an initial vegetation classification developed by the field ecologist. This approach promoted feedback from the photointerpreter to the field ecologist throughout the field plot sampling and classification development. After the photointerpretation was completed, a second field effort was initiated for the photointerpretation field verification and final edit process.

The vegetation was mapped using an initial community signature code methodology. A tentative initial classification was developed by TNC based on the photointerpretation field reconnaissance. The photo signature units were based on the initial classification development and given pseudo-community signature codes. The photointerpreter also identified other photo signatures that might possibly be subunits of the communities, or communities that had not already been identified. These additional photo signature units were given unique codes to differentiate them from the other classes. This additional information was passed on to the field ecologist. It was possible that these areas would require additional field plot sampling. The photointerpretation overlays were attached to their corresponding natural color diapositives. The stereo-paired natural color diapositives were viewed through a mirror stereoscope. Each photo was analyzed for photo signature units, photo signature description, inferred taxa, context, and the inferred initial community association. Knowledge gained from the field reconnaissance visit formed the basis of decision making. An initial community/photo signature polygon was delineated and corresponding code for each polygon was written on the photointerpretation overlay. The initial community/photo signature code, its color and texture description, the context of the unit, the inferred taxa, and inferred association/community were noted.

Each photo overlay was edgematched to the adjacent corresponding photo overlays to ensure a seamless coverage in the database. Delineations and codes were compared and discrepancies between photos were resolved and corrected on the appropriate mylar overlays. Any uncertain interpretations were flagged on the mylar overlay for review during the quality control task.

Upon completion, the photointerpretation overlays were copied onto transparencies and forwarded to TNC for review and use as supplemental information for the field plot sampling task. Any questions or clarification request on the vegetation classification criteria or photo signature units were also forwarded to TNC.

Photointerpretation Field Verification

A three-day photointerpretation field verification visit was conducted. Since the vegetation classification had not been fully developed, the field visit was not a true photointerpretation field verification, but was a verification of the preliminary mapping. The purpose of the field verification visit was to verify the initial community/photo signature units that were mapped, and further communicate with the TNC field ecologist regarding the classification vegetation types and their photo signatures. The field crew consisted of Ed Reyes of AIS and Steve Rolfsmeier of TNC.

Before the field session, several in-house preparations were made. Each photo was set-up with a field mylar overlay. Registration features (e.g., roads and trails) were drafted onto the overlays. Each photo was reviewed and field question sites were chosen. In addition, a general field route plan was identified. The route would use road and foot travel in order to visit the question sites and as many photo signature units as possible.

The field crew conducted on-site field investigations over the three-day period. During the field visit, the photointerpreter worked with the field biologists and park personnel to identify the vegetation species found at the sites. A field site number was annotated directly onto the photo field overlay, thereby correlating the field site to a specific location and photo signature. A field notebook was used to record pertinent information, e.g., species present, past disturbances, general topography, vegetation class, etc. Ground photos were taken at selected locations and referenced back to the aerial photos and field sites. Sites not previously identified in field preparation were also visited. These included areas between identified sites and any unusual or notable areas as they were encountered. Most readily accessible areas were visited, representing all vegetation types within the park.

Final Photointerpretation

Final photointerpretation/revision of the initial community/photo signature units and codes did not commence until after the revised preliminary vegetation classification, vegetation key and code descriptions were developed. The post-field reconnaissance classification differed from the revised preliminary classification enough that it was decided to draft a new photointerpretation overlay, but base it on the previous one.

The original photointerpretation overlay was attached to its corresponding natural color diapositive. Three additional mylar overlays were attached to each photo, one was the new vegetation delineation overlay, the second was the association/community code overlay, and the third was the height/density code overlay. The stereo-paired natural color diapositives were viewed through a mirror stereoscope. The height/density and the association/community code overlays were flipped up so that the photointerpretation overlay and the vegetation delineation overlays were viewed over the stereo image. Each photointerpretation delineation unit was analyzed for photo signature units, photo signature description, inferred taxa, context, and final community association. Knowledge gained from the field verification visit and information from the classification descriptions in association with the photo signature observations formed the basis of decision making. The community association polygon was delineated on the vegetation delineation overlay. The delineations were modifications of the delineations on the photointerpretation overlay. A community association code was written on the association /community code overlay. The photo was then analyzed for height and density of the association/community life form. The codes for height and density were written on the height/density code overlay. Where necessary, lines were revised or added to the vegetation delineation overlay. Attribute assignments were based on the mapping criteria and descriptions in the key.

Each photo overlay was edgematched to the adjacent corresponding photo overlays to ensure a seamless coverage in the database. Delineations and codes were compared and discrepancies between photos were resolved and corrected on the appropriate mylar overlays. Any uncertain interpretations were flagged on the mylar overlay for review during the quality control task.

Quality Control of Photointerpretations

A separate quality control step was performed for each photo upon completion of the photointerpretation. The photos and their delineation and code attribute overlays were reviewed by a senior photointerpreter. The interpreted overlays were checked for completeness, consistency, and adherence to the mapping criteria and guidelines. For those polygons flagged by the photointerpreter, the reviewer either assigned the appropriate vegetation code and/or discussed the change with the interpreter.

Upon completion, the photointerpretation overlays were copied onto a transparency and forwarded to TNC for review.

V. DATA CONVERSION

Converting the vegetation delineations to a digital format involved several steps that fall within four main procedures. The first step was the preparation of manuscript maps and attribute code files. The second was the input of the spatial data or geographic locations of the mapped features. The third was the population of the attribute tables or the information that describes the geographic features. Finally, the fourth procedure involved making the data usable for analysis within the GIS.

The following are descriptions of the broad tasks that apply to the data conversion of vegetation for Agate Fossil Beds National Monument.

Basemap Production

In order to begin the data conversion process, a hardcopy version of the base was needed. Normally for the Vegetation Mapping Program, a digital orthophoto is used as the base. However, since no adequate orthophoto for the study area was found, BRD designated the USGS 7.5-minute topographic quadrangle series map as the base. The quads used were Whistle Creek NW and Agate.

Creation of the USGS topographic quad base required having a vendor photographically reproduce the topo map onto clear mylar at the mapping input scale, which would be 1:12,000. The aerial photographs were not scaled at exactly 1:12,000. To facilitate rectification, it was decided to determine the actual scale of the photography and have the basemaps created at that scale. The photography was determined to average 1" = 1060'.

Manual Rectification

Manual rectification was conducted by attaching a new mylar overlay to each base. The photo signature delineation units were transferred to the overlay through local registration of the photos with the attached photo signature delineation overlay. A small area of the photo was registered to the base at a time. By matching photo image to topographic, hydrologic, and cultural features on the base, the delineations were transferred to the base overlay. Because of parallax distortion of the photo, care was required in transfer. When one area was completed, the photo was shifted to register to another small area. The process continued until the manual rectification and transfer of polygons was complete. Two code attribute overlays were created for each base, one containing association /community codes, the other the height and density codes. The codes were transferred from the corresponding photo overlays. An additional land use code attribute overlay was also created at this time. The Urban vegetation units were interpreted for land use.

A quality control step was performed in order to assure accuracy of the rectification and delineation, and transfer of the codes. A senior interpreter reviewed the overlays for accuracy and completeness of transfer and made the appropriate changes where needed.

Manuscript Map Preparation

The manuscript maps were used to input the spatial component of the vegetation mapping units. A manuscript map suitable for automation was created for each base. Manuscript maps were produced by pin-registering a clean sheet of mylar to each base. The vegetation delineations from the manually rectified overlay were transferred to the new overlay in ink. The manuscript maps were carefully edited to ensure completeness and correctness. The editing included comparing the manuscripts with the original delineations on the aerial photos. Each manuscript map was edgematched to the adjoining sheet assuring a seamless data flow across module (map sheet) boundaries.

Quality Assurance of the Manuscript Map

All final manuscript maps underwent a quality assurance review. The manuscript maps were compared to their corresponding manual rectification overlays to ensure that all line-work had been transferred correctly. Particular attention was given to the quality of the line delineations with respect to gaps and other irregularities.

Sequence Number Assignment

A sequential identification number overlay was produced for each manuscript map. A clean sheet of mylar was pin-registered to each manuscript, and the polygons were labeled in sequence. This was repeated for each base in the study area. The identification number labels were used to tie the spatial file to the keypunched attribute file.

Polygon Attribute Encoding

To expedite the encoding of the vegetation attributes for each polygon, an Excel file was created for each manuscript map. A separate field was created for the module number, polygon sequence number, community association code, height code, density code and land use code attributes. The manuscript map, sequence number overlay and attribute overlays were pin-registered together on a light table. The coder, following the numbers on the sequence number overlay, entered the vegetation attributes for each polygon. During this task, the coder verified the accuracy of the sequence number labels. Any errors found on the sequence number overlay were corrected to ensure that each polygon had a unique identifier.

Spatial Data Input/Scanning

The manuscript maps were scanned and converted into ARC/INFO coverages (a single coverage for each manuscript) at ESRI. Prior to any production scanning, test scans of small areas of the data maps were conducted to determine the optimum raster to vector conversion settings. The critical settings that determine the output resolution and completeness are the TOLERANCE and THRESHOLD. The TOLERANCE, which governs the output resolution and is comparable to fuzzy tolerance, would be set to .01 inches (10 feet at 1:12,000 scale). The THRESHOLD is a reflectance measure. It is dependent on the physical characteristics of the data maps and their contents and is determined through testing. Once the THRESHOLD was derived, production scanning of all manuscript maps began. The final digital coverages met NMAP standards for linework accuracy within 20 feet at 1:12,000 scale.

Assigning Polygon Identifiers

In an earlier step, the vegetation polygons were assigned a unique identifier for each manuscript map. The numbers were sequenced 1 through "n" (4-digit item width) and were drawn on the sequence number overlay. The manuscript map and the sequence number overlay were registered together on the digitizing board. The polygon identifiers were sequentially input as label points. To ensure that all labels points were entered, the processor marked off each label as it was digitized.

Delineation and Sequence Number Edit Plot Quality Assurance

ESRI produced plots of the converted spatial data and sequence numbers (label I.D.s) for each manuscript. The plots were checked by AIS for cartographic quality of the arcs defining the polygon features and the accuracy of the label I.D. assignments. The plots were overlaid to the manuscript maps to verify that the scanned data was not distorted beyond .02 map inches. Other problems were noted on the plots, such as overshoots and undershoots, missing lines, premature convergence of polygon boundary lines that intersected arcs at acute angles, and incorrect sequence number assignments.

The corrected plots were delivered back to ESRI. Processors conducted interactive ARCEDIT sessions to make the necessary corrections to the coverages.

Creation of Topology

Topology is the mathematical procedure for explicitly defining spatial relationships. In the case of maps, topology defines connections between features, identifies adjacent polygons, and can define one feature such as an area, as a set of other feature types (i.e., lines). A topological database has several advantages: efficient data storage, faster processing, and the ability to perform analysis, such as modeling transportation networks or overlaying geographic features on one another.

Once the manuscript map's polygon boundaries and label points had been input into the computer, the ARC/INFO software CLEAN command was used to create the "coverage topology." The CLEAN fuzzy tolerance was set to .002 inches to preserve the required data resolution. When other coordinate edits were made to a coverage after the CLEAN command was run, topology was recreated utilizing the BUILD command.

Label Entry Error Processing

Label errors were identified by using the LABELERRORS command in ARC through an ARCEDIT session. Any label errors identified were corrected by entering the missing label number and placing it within the correct polygon. Once all the errors were corrected, the coverage was ready for the polygon rectification process.

Georeferencing - Conversion to "Real-World" Coordinates

This task involved the transformation of the database from "digitizer inches" into "real world" coordinates. The initial vector file contained coordinates stored as digitizer inches that does not allow the data to be used effectively. To utilize geographic data, it must be converted into a common coordinate system. The coordinate system used was the Universal Transverse Mercator (UTM), Zone 13, NAD83 Coordinate System. All coordinates were in meter units.

A master tic file was created, linking coordinates on the topo-base to the same tic coordinates in the polygon coverages. Since the polygon coverage tic coordinates were taken directly from the topo-base, they are the same and therefore insure an accurate transformation. The four corner coordinates of each topo-base were chosen per coverage and labeled with a tic number ID. The points were then transformed into a real -world coordinates, x and y values only (the topo-base did not a have a z value).

Joining of Attribute and Spatial Data

The Excel code files were converted into INFO files. Once converted they were related to the feature attribute table, by the sequence number found in both files. An INFO item, named "seqno" was added to the feature attribute table. The sequence number for each polygon was calculated to equal its coverage I.D. number. The ARC/INFO command JOINITEM was used to join the code file to the feature attribute table. Each spreadsheet file was joined with its corresponding coverage. Each variable interpreted from the aerial photography was assigned a unique item (field). A total of two coverages were created.

Code Verification

Code verification involved running each coverage attribute file through a series of ARC/INFO commands that checked for invalid codes. These commands produced listings that aided in identifying abnormal codes. The errors were checked against the vegetation delineation and attribute overlays. Corrections were made to the listings and input into the database.

ESRI produced code verification plots of the photo signature code, height, and density attributes. The plots were checked by AIS for coding errors that may have occurred during the polygon attribute encoding step. The plots were overlaid on the manuscript map with attached corresponding code attribute overlay created in the manual rectification step. Code changes were noted on the plot. The corrected plots were delivered back to ESRI for edit of the attribute files.

Edgematching

Since the study area was composed of multiple coverages, the coverages needed to be coordinate edgematched to ensure seamless line across coverage boundaries. The two coverages were edgematched using procedures in the ARC editor linking the nodes from one coverage to the nodes of the adjoining coverage. Adjustments were made when necessary. This procedure was done with the digital orthophoto as a backdrop to the vegetation delineations.

VI. ACCUARACY ASSESSMENT

AIS reviewed the Agate Fossil Beds National Monument Accuracy Assessment point-polygon match/no-match tables provided by ESRI. Materials included a table of AA point number, x and y coordinate location, AA point community code, corresponding polygon number, and corresponding polygon community code. In addition, a plot of AA points/AA IDs and all polygons with polygon IDs was provided. Using the aerial photography, AIS reviewed each no-match situation. The polygon code was found to be either incorrect, or there was an explanation for the difference between the AA point community code and the polygon code.

The accompanying Table summarizes, in Appendix E, the results of the Accuracy Assessment Review by AIS. The accompanying Explanation of Headings provides a brief description of the column headings. The results of the review are described in more detail in the following document. Based on the results there are 292 valid AA points. Of these, 2 are considered incorrect and 290 are considered correct. This results in an accuracy of 99%.

VII. PATTERN

Once the mapping of the association/community classes was completed and the attribute items populated, a final community association plot was created. The plot was compared back to the original natural color photos and photo overlays and reviewed for accuracy and consistency of association class assignments. Corrections to the association assignments were made to the database.

The pattern attribute was mapped by interpreting the pattern of the corresponding life form of each association/community polygon. The units were drafted onto an overlay of the manuscript map. The pattern attribute was then input keypunching the -ID and corresponding pattern attribute code into an Excel file. The Excel file was converted into and added to the existing INFO file.

The final coverage of the vegetation database was delivered to ESRI for input into the final project database structure.

Agate Fossil Beds National Monument
Photo Interpretation Report
Appendices

Appendix A
USGS-NPS VEGETATION AND MAPPING PROGRAM
AGATE FOSSIL BEDS NATIONAL MONUMENT, NEBRASKA
FINAL ASSOCIATION/COMMUNITY CLASSIFICATION
July 29, 1998

01 = *Populus deltoides - (Salix amygdaloides)* / *Salix exigua* Woodland

02 = *Symphoricarpos occidentalis* Shrubland

03 = *Salix exigua* Shrubland

04 = *Stipa comata* - *Bouteloua gracilis* - *Carex filifolia* Herbaceous Vegetation

05 = *Calamovilfa longifolia* - *Andropogon hallii* Herbaceous Vegetation

06 = Upland Disturbance Herbaceous Vegetation

07 = Annual-dominated Floodplain Disturbance Herbaceous Vegetation

08 = *Pascopyrum smithii* Herbaceous Vegetation

09 = *Juncus balticus* Herbaceous Vegetation

10 = *Typha latifolia* Western Herbaceous Vegetation

11 = Seeded Grassland Herbaceous Vegetation

12 = *Stipa comata* - *Bouteloua gracilis* Gravel Herbaceous Vegetation

13 = *Schizachyrium scoparium* - *Bouteloua (curtipendula, gracilis)* - *Carex filifolia* Herbaceous Vegetation

14 = *Stipa comata* - *Bouteloua gracilis* - *Carex filifolia* Herbaceous Vegetation/ *Schizachyrium scoparium* - *Bouteloua (curtipendula, gracilis)* - *Carex filifolia* Herbaceous Vegetation Mosaic

98 = Water

99 = Urban/Built-Up/Maintained/Road/Road Mowed/Cut and Fill

HEIGHT

1 = <0.5 meters
2 = 0.5 - 2 meters
3 = 2 - 5 meters
4 = 5 - 15 meters
5 = 15 - 35 meters
6 = 35 - 50 meters
7 = >50 meters
9 = Not Applicable

ABSOLUTE CROWN DENSITY

1 = Closed/Continuous > 60 %
2 = Discontinuous 40% - 60%
3 = Dispersed 25% - 40%
4 = Sparse 10% - 25%
5 = Rare 2% - 10%
9 = Not Applicable

PATTERN

1 = Evenly Dispersed
2 = Clumped/Bunched
3 = Gradational/Transitional
4 = Alternating
9 = Not Applicable

LAND USE

100 = Urban or Built-Up
110 = Residential
  111 = Cook Homestead
120 = Commercial
130 = Industrial
140 = Transportation, Communication, and Utilities
  141 = Dam
  142 = Ditch, Water, Maintained Area, Cut and Fill
150 = Mixed Commercial and Industrial
160 = Mixed Urban
170 = Under Construction
180 = Open Space and Recreation
190 = Vacant within Urban Context
200 = Agriculture
  210 = Exotic Tree Planting
300 = Mining (Borrow Pit)
400 = National Park/Monument Facilities
  401 = Visitor Center
  402 = Visitor Picnic Parking Area and Driveway
  403 = Ranger Residence Area
  404 = Maintenance Yard
  405 = Bone House
  406 = Ranger Residence by Bone House
  407 = Paved Roads and Associated Disturbance, Cut and Fill Embankments (Highway 29 and River Road)
  408 = Daemonelix Trail Parking Area
  409 = Niobrara River Fishing Parking Area
500 = Water
600 = Vacant

Appendix B
USGS-NPS VEGETATION MAPPING PROGRAM
AGATE FOSSIL BEDS NATIONAL MONUMENT, NEBRASKA
FINAL ASSOCIATION /COMMUNITY PHOTO SIGNATURE KEY
Table Descriptions

The Final Association /Community Photo Signature Key Table is divided into six columns. The column descriptions are as follows:

- **Column 1 - ASSOCIATION/COMMUNITY CODE**

  This column contains the code in the database representing the association /community category.

- **Column 2 - ASSOCIATION /COMMUNITY**

  This column contains the title of the association /community category.

- **Column 3 - PHOTO SIGNATURE**

  This column describes the photo signatures that characterize the life form of the association/community in this park.

  The following subcategories are included:

  Color: Describes the color tone and contrast variations of the photo signature.

  Texture: Describes the relative apparent roughness or smoothness of the signature character. Coarse being a very rough or grainy texture, fine being a very smooth texture. A forest of trees tends to have a coarse texture. Grasslands tend to have a fine texture.

  Crown Size: Describes the relative size of the tree or shrub crown diameter as viewed on the aerial photo. Typically, spreading trees tend to have large crowns while shrubs tend to have smaller crowns.

  Crown Shape: Describes the relative shape of the tree or shrub crown as viewed on the aerial photo.
  Density: Describes the general density characteristic of the association/community.

- **Column 4 - HEIGHT**

  This column describes the relative height range of the life form of the association /community.

- **Column 5 - CONTEXT**

  This column describes the general occurrence of the association/community within the park from a geomorphological, physiographic, topographical, or regional perspective.

- **Column 6 – NOTES**

  This column includes other pertinent information that may be useful in the photointerpretation of the association/community. It may contain examples of occurrences or character of the vegetation within the park.

APPENDIX C
USGS-NPS VEGETATION MAPPING PROGRAM
AGATE FOSSIL BEDS NATIONAL MONUMENT, NEBRASKA
FINAL ASSOCIATION/ COMMUNITY PHOTO SIGNATURE KEY
The Photosignature Key is to be used with Aerial Photographs and Spatial Data
Natural Color Aerial Photography Flown July 1995 1:12,000 Scale
December 15, 1997

Association/ Community Code	Association/Community Name	Photo Signature	Height (Meters)	Context	Notes
01	Populus deltoides – (Salix amygdaloides) / Salix exigua Woodland	COLOR: A) Medium green to dark green; B) Medium to light blue-green TEXTURE: Coarse CROWN SIZE: Large CROWN SHAPE: Round DENSITY: Moderate	30 – 50	Probably planted, no natural occurrences	Cook House farmstead area is the primary occurrence
02	Symphoricarpos occidentalis Shrubland	COLOR: Dark green TEXTURE: Medium CROWN SIZE: Small CROWN SHAPE: Round DENSITY: High	<3	Limited occurrence, primarily in the floodplain	
03	Salix exigua Shrubland	COLOR: Medium green to dark green TEXTURE: Medium CROWN SIZE: Small CROWN SHAPE: Tight rounded DENSITY: Very high	<3	Floodplain adjacent to river	
04	Stipa comata – Bouteloua gracilis – Carex filifolia Herbaceous Vegetation	COLOR: Dark dull green TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High	<.5	Steep upper and middle hillslopes	Carex filifolia lessens as reach steeper upper slopes; Calamovilfa longifolia circles as inclusions
05	Calamovilfa longifolia – Andropogon hallii Herbaceous Vegetation	COLOR: Deep medium green to dull medium green, blue-green patches TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High	<1	Shallow middle and lower hillslopes and canyon bottoms	

Association/ Community Code	Association/Community Name	Photo Signature	Height (Meters)	Context	Notes
06	Upland Disturbance Herbaceous Vegetation	COLOR: A) Yellow, with yellow green, yellow brown, and brown; B) Medium yellow green, with some rusty brown and yellow brown; C) Dull brown to very dark green to black; D) Dull brown to rusty brown to light yellow brown; E) Dull blue green TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High	<2	Valley bottoms, stream floodplains/terraces, hill sideslopes	
07	Annual-dominated Floodplain Distrubance Herbaceous Vegetation	COLOR: Light to neutral medium green TEXTURE: Moderate to smooth, moderate to fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High to moderate	<2	Lower floodplain terrace, dry	
08	Pascopyrum smithii Herbaceous Vegetation	COLOR: Bright to light medium green TEXTURE: Moderate CROWN SIZE: None CROWN SHAPE: None DENSITY: High	<1	Upper floodplain terrace	
09	Juncus balticus Herbaceous Vegetation	COLOR: Medium to dark green TEXTURE: Moderate to smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High	<2	Lower floodplain terrace, wet	
10	Typha latifolia Western Herbaceous Vegetation	COLOR: Very dark green to black, sometimes white to gray inclusions TEXTURE: Moderate to smooth CROWN SIZE: None CROWN SHAPE: None DENSITY: High to very low	<2	Adjacent to river, saturated wet areas	Photos show no vegetation, field shows dense with cattails

Association/ Community Code	Association/Community Name	Photo Signature	Height (Meters)	Context	Notes
11	Seeded Grassland Herbaceous Vegetation	COLOR: Medium green TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: High to moderate	<2	Lower floodplain terrace	Limited to one location
12	Stipa comata – Bouteloua gracilis Gravel Herbaceous Vegetation	COLOR: White to light gray TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: Low	<1	Gravelly channels	Few occurrences, mostly less than mmu
13	Schizachyrium scoparium – Bouteloua curtipendula, gracilis – Carex filifolia Herbaceous Vegetation	COLOR: White to gray TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: Low	<.5	Ridgetops with very little vegetation	
14	Stipa comata – Bouteloua gracilis – Carex filifolia Herbaceous Vegetation / Schizachyrium scoparium – Bouteloua (curtipendula, gracilis) – Carex filifolia Herbaceous Vegetation Mosaic	COLOR: White to gray to gray green, with dull medium green inclusions TEXTURE: Smooth, fine CROWN SIZE: None CROWN SHAPE: None DENSITY: Low to moderate	<.5	Ridgetops	

Appendix D
USGS-NPS VEGETATION MAPPING PROGRAM
AGATE FOSSIL BEDS NATIONAL MONUMENT
Accuracy Assessment Review
Explanation of Headings

Match – The Accuracy Assessment Point community association and the corresponding polygon community association match. The map polygon code is correct.

Boundary – The Accuracy Assessment Point is located very close to the boundary between two community association polygons. The Accuracy Assessment Point community association matches the community association of one of the polygons. The map polygon code is correct.

Near Boundary – The Accuracy Assessment Point is located within approximately 50 feet of the boundary between two community association polygons. The Accuracy Assessment Point community association matches the community association of one of the polygons. The map polygon code is correct.

MMU – The Accuracy Assessment Point community association represents an area of vegetation on the ground that is below the minimum mapping resolution. The map polygon code is correct.

AA Questionable – The community association determined from the Accuracy Assessment Point data is in question. The accuracy of the location of the Accuracy Association Point may also be in question. The map polygon code is correct.

Transitional – The Accuracy Assessment Point is located in an area that is transitional between two classes. The two community associations may intermingle with one another in the transition from one type to the other. The map polygon code is correct.

Mosaic – The vegetation within the polygon is a complex or mosaic of two or more community associations, all units are below minimum mapping resolution. The Accuracy Assessment Point was assigned one community association, while the polygon was assigned another. The map polygon code is correct.

ROW – The Accuracy Assessment Point is located in the mowed or maintained portion of a road right-of-way. The map polygon code is correct.

Ridge Mosaic – In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the Accuracy Assessment Point class.

Disturbed – The Accuracy Assessment Point is located in a highly disturbed area, usually by dry farming. The photo may show the area as mowed or harvested. The native vegetation is not so distinct. The mapped polygon has been determined as correct.

Change code – The community association assigned to the polygon is incorrect. The code of the polygon has been changed to match the Accuracy Assessment Point code.

Add Polygon – The community association assigned to the polygon is not entirely correct. The polygon has been subdivided to add another polygon with the community association matching the Accuracy Assessment Point class.

Out – The AA point is located outside the study area. Therefore there is no corresponding polygon data. This is an invalid Accuracy Assessment Point.

Appendix E
USGS-NPS VEGETATION MAPPING PROGRAM
AGATE FOSSIL BEDS NATIONAL MONUMENT
Accuracy Assessment Results

AA 1 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 2 – Correct (Boundary)

Point	=	8	Pasm
Poly A	=	9	Juba
Poly B	=	8	Pasm

AA 3 – Correct (Mosaic/Disturbed/Transitional)

Point	=	5	Calo-Anhi
Poly	=	9	Juba

This is a highly disturbed area in rangeland native hay (?) farming. The polygon represents a topographic low or relatively wetter area. The photo signature shows a mosaic mixture of very dark green, reddish brown, and light gray-green. The dark green implies wetter vegetation of Juba. This may be a transitional/isolated low within the narrow valley bottom containing a mosaic of Juba, Pasm, and Calo-Anhi. The AA point is located at a boundary with the adjacent Pasm polygon to the north.

AA 4 – Inconclusive (AA Questionable/Disturbed/Transitional)

Point	=	5	Calo-Anhi
Poly	=	8	Pasm

This is a highly disturbed area in rangeland native hay (?) farming. The polygon represents a transitional valley bottom to upper floodplain area. The photo signature shows mainly medium green, with light green, yellow, and reddish brown. More information would be needed to resolve this discrepancy.

AA 5 – Correct (MMU)

Point	=	8	Pasm
Poly	=	9	Juba

The AA point lies on a highly transitional small piece of Pasm that is below minimum mapping resolution within a greater Juba area. There are a few Pasm pieces that are below MMU within the Juba unit. The darker green topographic low signature represents the wetter Juba areas, while the lighter green topographic high signature within the floodplain represents the Pasm areas.

AA 6 – Correct (Match)

Point	=	9	Juba
Poly	=	9	Juba

AA 7 – Correct (Match)

Point	=	99	Urban
Poly	=	99	Urban

AA 8 - Correct (Match)

Point = 99 Urban
Poly = 99 Urban

AA 9 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 10 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 11 – Correct (Near Boundary)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located just east of a Stco-Bogr-Cafi polygon. The photo signature shows the AA point located in an area with signature of medium green, inferring Calamovilfa longifolia. It is possible that there could be a margin of error in the GPS.

AA 12 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 13 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 14 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 15 – Correct (MMU)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The photo signature shows the AA point located in a small patch of medium green representing Calamovilfa longifolia. The patch is surrounded by extensive reddish brown representing Upland Disturbance. The Calo-Anhi is below minimum mapping resolution.

AA 16 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 17 – Correct (Near Boundary)

Point = 1 Pode-Saam-Saex
Poly = 99 Urban

The AA point is located very close to the junction of three polygons, Urban, Pode-Saam-Saex, and Upland Disturbance. It is possible that there could be a margin of error in the GPS.

AA 18 – Correct (AA Questionable)

Point	=	8	Pasm
Poly	=	5	Calo-Anhi

The AA point is located out of sequence within the systematic array of AA points. It is possible that there is an error in the x,y location. The photo signature shows the AA point to be in a highly disturbed farmed area. It does not appear to be near enough to the river to be within the upper floodplain terrace where Pasm would usually occur. It is on the edge of the valley bottom where Calo-Anhi usually occurs. If the AA point were in its proper array location it would be in the floodplain located at or very near Pasm.

AA 19 – Correct (Near Boundary/MMU)

Point	=	9	Juba
Poly	=	10	Tyla

The AA point is located very close to the boundary of the Juba polygon to the north. It is possible that there could be a margin of error in the GPS. The very dark green to black photo signature that the AA point is within definitely indicates Typha latifolia. There could be a very narrow band (<MMU) of Juba between the Tyla on the north and the Pasm on the south, but mapped with the Tyla polygon.

AA 20 – Correct (Match)

Point	=	99	Urban
Poly	=	99	Urban

AA 21 – Correct (Boundary)

Point	=	5	Calo-Anhi
Poly A	=	4	Stco-Bogr-Cafi
Poly B	=	5	Calo-Anhi

AA 22 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 23 – Correct (Near Boundary/Transitional)

Point	=	5	Calo-Anhi
Poly	=	4	Stco-Bogr-Cafi

The AA point is located near the boundary with Stco-Bogr-Cafi. The photo signature shows the area to be transitional between Stco-Bogr-Cafi and Calo-Anhi. The area is highly disturbed by grazing. Stco-Bogr-Cafi is typically located at the upper slopes, with Calo-Anhi below. There is a hint of Calamovilfa longifolia in the area, but it also has a hint of the tan color representing Carex filifolia.

AA 24 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 25 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 26 – Correct (AA Questionable)

Point = 4 Stco-Bogr-Cafi
Poly = 99 Urban

The AA point is located within the highway right-of-way, hence the Urban class for the polygon. Because of its location, it is unlikely that there is Stco-Bogr-Cafi at the AA point location. The non-paved right-of-way is highly disturbed with disturbance grasses and Calamovilfa longifolia. The point is also in a valley bottom location, more likely to be Calo-Anhi. More information would be needed to determine if the AA point is in its correct location. One possibility is that point 26 and 27 were switched. They are located next to each other and out of the array pattern.

AA 27 – Correct (AA Questionable)

Point = 99 Urban
Poly = 4 Stco-Bogr-Cafi

The AA point is definitely not located in an Urban unit. It is on the upper slope of a hill in a Stco-Bogr-Cafi location. The gray green signature and its location indicate Stco-Bogr-Cafi. It is possible that point 26 and 27 were switched. They are located next to each other and out of the array pattern.

AA 28 – Correct (ROW)

Point = 5 Calo-Anhi
Poly = 99 Urban

The AA point is located within the highway right-of-way, hence the Urban class for the polygon. The unpaved portion of the right-of-way contains disturbed grasses and Calamovilfa longifolia. In this case both the AA point and the polygon are correct. In the mapping, disturbed right-of-way is included in with the road polygon.

AA 29 – Correct (Disturbed)

Point = 6 Upland Disturbance
Poly = 99 Urban

The AA point is located within a relatively small fenced area used as improved pasture. The photo signature shows a uniform medium green color indicating some sort of maintenance for uniformity. At the time of the AA data collection, the pasture may have been weedy or contained exotics. The area was mapped as Agriculture in Land Use, hence the Urban class in the vegetation.

AA 30 – Correct (Match)

Point = 1 Pode-Saam-Saex
Poly = 1 Pode-Saam-Saex

AA 31 – Correct (Disturbed/Boundary)

Point = 8 Pasm
Poly = 1 Pode-Saam-Saex

The AA point is located on the boundary line between Pode-Saam-Saex and Urban. The Urban polygon is maintained mowed lawn at the entrance to the Cook Homestead. Geomorphologically, the point is located on the upper floodplain terrace, which would normally contain Pasm. This site was visited during the photointerpretation field verification and was found to contain mowed Indian grass, Poa pratensis, and Panicum virgatum. The polygon is considered correct.

AA 32 – Correct (Match)

Point = 99 Urban
Poly = 99 Urban

AA 33 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 34 – Correct (Near Boundary/Transitional)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located near the boundary of a Calo-Anhi polygon to the south. It is possible that there could be a margin of error in the GPS. The area of the point location is transitional between Upland Disturbance (brown signature indicating Bromus sp. and weeds) and Calo-Anhi (medium green and light gray-green signature indicating Calamovilfa longifolia and Bouteloua gracilis/Stipa comata).

AA 35 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 36 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 37 – Correct (Near Boundary/Transitional)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The AA point is located in a transitional area near the boundary of Calo-Anhi to the east. It is possible that there could be a margin of error in the GPS. The tan-gray-green signature represents Stco-Bogr-Cafi and the medium green signature represents Calo-Anhi.

AA 38 – Correct (Match)

Point = 4 Stco-Bogr-Anhi
Poly = 4 Stco-Bogr-Anhi

AA 39 – Correct (MMU)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The photo signature of the polygon is a tan-gray-green color indicating Bouteloua gracilis and Stipa comata, with some Carex filifolia in a highly disturbed grazed area. There is not much, if any, Calamovilfa longifolia. Any Calamovilfa occurs in isolated clumps that are below minimum mapping resolution.

AA 40 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 41 - Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 42 - Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 43 - Correct (Match)

Point	=	8	Pasm
Poly	=	8	Pasm

AA 44 - Correct (Match)

Point	=	8	Pasm
Poly	=	8	Pasm

AA 45 – Correct (Transitional/MMU)

Point	=	5	Calo-Anhi
Poly	=	8	Pasm

The AA point is located on a small patch of upland type grass (gray green signature, possibly Calamovilfa longifolia and Stipa comata) that is below minimum mapping resolution. The small patch is surrounded by a lowland area that represents the upper floodplain terrace vegetation (brighter deeper green). The area was visited during the photo interpretation field verification, and was determined to be transitional between Pasm and Calo-Anhi vegetation.

AA 46 - Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 47 - Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 48 - Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 49 – Correct (Boundary/ROW)

Point	=	5	Calo-Anhi
Poly	=	99	Urban

The AA point is located on the boundary between Stco-Bogr-Cafi and Urban representing the highway right-of-way. The unpaved portion of the right-of-way contains disturbance grasses and Calamovilfa longifolia. The AA point may be located at the Calamovilfa area. In the mapping, disturbed right-of-way is included with the road polygon.

AA 50 - Correct (Match)

Point = 13 Scsc-Boute-Cafi
Poly = 13 Scsc-Boute-Cafi

AA 51- Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 52 - Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 53 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 54 - Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 55 - Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 56 – Correct (Boundary)

Point = 9 Juba
Poly A = 5 Calo-Anhi
Poly B = 9 Juba
Poly C = 8 Pasm

AA 57 - Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 58 - Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 59 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located at a polygon that contains both Stco-Bogr-Cafi and Scsc-Boute-Cafi as a mosaic. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 60 - Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 61 - Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 62 – Correct (Transitional)

Point	=	4	Stco-Bogr-Cafi
Poly	=	5	Calo-Anhi

The AA point is located near a Stco-Bogr-Cafi polygon to the east. This is a transitional area between the two types that contain both types of vegetation. It is a grazed area, where Stco-Bogr-Cafi contains mainly Bouteloua gracilis and Stipa comata with little Carex filifolia; and Calo-Anhi contains mainly Stipa comata, Bouteloua gracilis, and patches of Calamovilfa longifolia (medium green signature). The two types grade into each other.

AA 63 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 64 - Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 65 - Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 66 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 67 - Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 68 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 69 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 70 – Correct (Match)

Point	=	8	Pasm
Poly	=	8	Pasm

AA 71 – Correct (Boundary/Ridge Mosaic)

Point	=	13	Scsc-Boute-Cafi
Poly A	=	4	Stco-Bogr-Cafi
Poly B	=	4	Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area of Stco-Bogr-Cafi and at the boundary of the adjacent polygon to the east. The adjacent polygon is also coded as Stco-Bogr-Cafi, but should be coded as code 14, Scsc/Stco Mosaic. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 72 – Correct (Match)

Point	=	13	Scsc-Boute-Cafi
Poly	=	13	Scsc-Boute-Cafi

AA 73 – Correct (Ridge Mosaic)

Point	=	13	Scsc-Boute-Cafi
Poly	=	4	Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located on the shoulder of a flat-topped ridge. The shoulder is thin strip of Scsc-Boute-Cafi, which is below minimum mapping resolution. The polygon represents the entire flat-topped ridge and should be coded as code 14 Scsc/Stco Mosaic. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 74 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 75 – Correct (Ridge Mosaic/Near Boundary)

Point	=	13	Scsc-Boute-Cafi
Poly	=	5	Calo-Anhi

The AA point is located very close to the boundary of the Stco-Bogr-Cafi polygon to the north which should be coded as code 14 Scsc/Stco Mosaic. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in including the mosaic class for the categorizing of these situations. The mapping has now been corrected.

Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class. It is possible that there could be a margin of error in the GPS.

AA 76 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 77 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 78 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 79 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 80 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 81 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 6 Upland Disturbance
Poly B = 4 Stco-Bogr-Cafi

AA 82 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 83 – Correct (Boundary/Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located at the boundary of the Stco-Bogr-Cafi polygon to the west that should be coded as 14 Scsc/Stco Mosaic. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class in the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 84 – Correct (AA Questionable)

Point = 7 Floodplain Disturbance
Poly = 6 Upland Disturbance

The reddish brown photo signature shows that the AA point is located in an area of Bromus sp., which is typical of Upland Disturbance vegetation. The signature does not show the texture of tall dense patches of Cyclachaena xanthifolia and Atriplex heterosperma that would indicate Annual-dominated Floodplain Disturbance. The AA data would need to be reviewed.

AA 85 – Correct (Match)
Point = 8 Pasm
Poly = 8 Pasm

AA 86 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 87 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 88 – Correct (Boundary)
Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 89 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 90 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 91 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 92 – Correct (Near Boundary)
Point = 8 Pasm
Poly = 7 Floodplain Disturbance

The AA point is located near a Pasm polygon to the north. This could be a margin of error of the GPS. The polygon in which the point falls contains considerable Floodplain Disturbance, indicated by the signature color and texture (tall, gray-green, smooth, dense) with some Juba (darker green).

AA 93 – Correct (Mosaic)
Point = 9 Juba
Poly = 10 Tyla

The AA point is located in a long linear polygon composed of Tyla with Juba in a mosaic fashion. The Tyla is very dark green to black with some texture and height, and is dense. The Juba is less dark, and forms a matrix around the Typha latifolia. Typha is typically located adjacent to the river. Since Typha occurs in patches along the river, wherever these patches could be mapped together in mosaic with Juba, they were called Tyla so as not to lose this community in the mapping. This particular area where the AA point is located has less Typha.

AA 94 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 95 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 96 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 97 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 98 – Correct (Near Boundary)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located very close to a Stco-Bogr-Cafi polygon to the southeast. It is possible that there could be a margin of error in the GPS. The photo signature at the AA point location shows a medium green signature indicating Calamovilfa longtifolia, hence Calo-Anhi.

AA 99 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 100 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 101 – Correct (MMU)

Point = 7 Floodplain Disturbance
Poly = 9 Juba

The photo signature shows that there are small patches of Floodplain Disturbance (tall, smooth, dense gray green) within a greater Juba area (dark green to black, lowland). The Floodplain Disturbance is patchy or thin and linear, and for the most part is below minimum mapping resolution.

AA 102 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 103 - Correct (Near Boundary/Mosaic)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located near the boundary of a Calo-Anhi polygon to the north and to the south. It is possible that there could be a margin of error in the GPS. The polygon in which the point lies is a mosaic of Upland Disturbance and Calo-Anhi, but predominantly Upland Disturbance.

AA 104 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 105 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 106 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 107 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 108 – Correct (Boundary)

Point = 5 Calo-Anhi
Poly A = 4 Stco-Bogr-Cafi
Poly B = 5 Calo-Anhi

AA 109 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 110 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 111 – Correct (Match)

Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 112 – Correct (Match)

Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 113 – Correct (Match)

Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 114 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 115 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 116 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 117 – Correct (Match)
Point = 9 Juba
Poly = 9 Juba

AA 118 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 119 – Correct (Near Boundary/MMU)
Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located nearby a Calo-Anhi polygon to the southwest. It is possible that there could be a margin of error in the GPS. The polygon in which the AA point lies contains Calo-Anhi patches that are below minimum mapping resolution.

AA 120 – Correct (Match)
Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 121 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 122 – Correct (Near Boundary/MMU)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located nearby a Stco-Bogr-Cafi polygon to the northeast. It is possible that there could be a margin of error in the GPS. The polygon in which the AA point lies also contains a patch of Stco-Bogr-Cafi that is below minimum mapping resolution.

AA 123 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 124 - Correct (Near Boundary/Transitional/MMU)
Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The AA point is located nearby a Calo-Anhi polygon to the north. It is possible that there could be a margin of error in the GPS. The area of the polygon in which the point lies is transitional from Stco-Bogr-Cafi to Calo-Anhi. The point appear to lie in a small patch of Calamovilfa longifolia (medium green signature) that is below minimum mapping resolution.

AA 125 – Correct (Near Boundary)

Point = 6 Upland Disturbance
Poly = 5 Calo-Anhi

The AA point is located very close to the boundary of the Upland Disturbance polygon to the east. It is possible that there could be a margin of error in the GPS.

AA 126 – Correct (Match)

Point = 7 Floodplain Disturbance
Poly = 7 Floodplain Disturbance

AA 127 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 128 – Correct (Boundary)

Point = 5 Calo-Anhi
Poly A = 6 Upland Disturbance
Poly B = 5 Calo-Anhi

AA 129 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 130 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 131 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 132 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 133 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 134 – Correct (Match)

Point = 10 Tyla
Poly = 10 Tyla

AA 135 – Incorrect (Add polygon)

Point = 9 Juba
Poly = 8 Pasm

The polygon in which the AA point lies was visited during the photointerpretation field reconnaissance and was found to be Pasm with Juba. Upon review, it was determined that a large enough area of Juba can be delineated within the Pasm area. The remaining Pasm is still a mosaic. The polygon has been added.

AA 136 – Correct (Near Boundary/AA Questionable)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

On the AA review plot the AA point clearly falls within the Calo-Anhi polygon. There is an Upland Disturbance polygon nearby to the east. It is possible that there could be a margin of error in the GPS.

AA 137 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 138 – Correct (Near Boundary)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located very close to a Stco-Bogr Cafi polygon to the north. It is possible that there could be a margin of error in the GPS.

AA 139 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 140 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 141 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located at a polygon that contains a mosaic of both Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 142 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 143 – Correct (Near Boundary/Transitional)

Point = 8 Pasm
Poly = 5 Calo-Anhi

The AA point is located near the boundary of a Pasm polygon to the north. It is possible that there could be a margin of error in the GPS. This is also an area of transition between Calo-Anhi and Pasm. The valley bottom starts to grade down to upper floodplain terrace.

AA 144 – Correct (Near Boundary)

Point = 10 Tyla
Poly = 3 Saex

The AA point is located very close to the boundary of a Tyla polygon to the southwest. It is possible that there could be a margin of error in the GPS. The polygon in which the AA point lies is definitely not Tyla (very dark green to black signature), but Saex (medium green with some texture and height).

AA 145 – Correct (Boundary)

Point = 5 Calo-Anhi
Poly A = 6 Upland Disturbance
Poly B = 5 Calo-Anhi

AA 146 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 147 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 148 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 149 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 150 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 151 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 152 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 153 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 154 – Correct (Boundary)

Point = 3 Saex
Poly A = 8 Pasm
Poly B = 3 Saex

AA 155 – Correct (MMU)

Point = 6 Upland Disturbance
Poly = 5 Calo-Anhi

The photo signature shows the AA point definitely located within Calo-Anhi. There are small patches of Upland Disturbance, but they are below minimum mapping resolution.

AA 156 – Correct (Match)

Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 157 – Correct (Near Boundary/MMU)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located close to a Calo-Anhi polygon. It is possible that there could be a margin of error in the GPS. The AA point is definitely located in Upland Disturbance, however there are small linear patches of Calamovilfa longifolia in the AA point area that are below minimum mapping resolution.

AA 158 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area containing a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 159 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 160 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 161 – Correct (Match)

Point = 13 Scsc-Boute-Cafi
Poly = 13 Scsc-Boute-Cafi

AA 162 – Correct (Match)

Point = 4 Stco-Bogr-Cafi

Poly = 4 Stco-Bogr-Cafi

AA 163 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 164 – Correct (Match)
Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 165 – Correct (AA Questionable)
Point = 8 Pasm
Poly = 9 Juba

The photo signature shows that the Juba polygon contain a bright yellow color that represents Hordeum sp., indicating a Juba community. The polygon also contains medium green and some dark green color also indicating Juba. It is possible that there may be some patches of Pasm within the polygon. The polygon is in the middle of the floodplain rather than toward the edge where Pasm is typically located. It also does not appear to have height above the rest of the floodplain, which Pasm upper floodplain terrace would have. More AA data is needed to make a determination, but the signature leans toward Juba.

AA 166 – Correct (Match)
Point = 8 Pasm
Poly = 8 Pasm

AA 167 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 168 – Correct (Transitional)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located in an area that is highly disturbed by gopher mounds and transitional between Calo-Anhi and Stco-Bogr-Cafi. Most gopher disturbance is located within the upper limit of Calo-Anhi, at the edge of Stco-Bogr-Cafi. These areas tend to contain mainly Stipa comata and forbs. Per guidance given, when in doubt, they are mostly mapped within Calo-Anhi.

AA 169 - Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 170 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 171 - Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 172 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 173 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 174 - Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 175– Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 176 – Correct (AA Questionable)

Point = 4 Stco-Bogr-Cafi
Poly = 6 Upland Disturbance

The photo signature shows the AA point located in what is definitely a pure cover of Upland Disturbance. The signature is red-brown indicative of Bromus sp. The AA point data would need to be reviewed.

AA 177 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 178 – Correct (Match)

Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 179 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 180 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 181 – Correct (Match)

Point = 8 Pasm
Poly = 8 Pasm

AA 182 – Correct (Match)

Point = 10 Tyla
Poly = 10 Tyla

AA 183 – Correct (Boundary)

Point = 5 Calo-Anhi

Poly A = 6 Upland Disturbance
Poly B = 5 Calo-Anhi

AA 184 – Correct (AA Questionable/MMU)

Point = 4 Stco-Bogr-Cafi
Poly = 6 Upland Disturbance

The photo signature shows the AA point located in what is definitely a pure cover of Upland Disturbance. The signature is red-brown indicative of Bromus sp. It is possible that the AA point is located at a small patch of Stco-Bogr-Cafi that is below minimum mapping resolution. The AA point data would need to be reviewed.

AA 185 – Correct (AA Questionable/MMU/Near Boundary)

Point = 4 Stco-Bogr-Cafi
Poly = 6 Upland Disturbance

The photo signature shows the AA point located in what is definitely a pure cover of Upland Disturbance. The signature is red-brown indicative of Bromus sp. The AA data may need to be reviewed. There are very small inclusions of Stco-Bogr-Cafi within the Upland Disturbance, but they are below minimum mapping resolution. The nearby polygon to the west is Stco-Bogr-Cafi. It is possible that there could be a margin of error in the GPS.

AA 186 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 187 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 188– Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 189 – Out

Point = 4 Stco-Bogr-Cafi
Poly = OUT

AA 190– Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 191 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 192 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 193 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 194 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 195 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 196 - Out
Point = 5 Calo-Anhi
Poly = OUT

AA 197 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 198 – Correct (Match)
Point = 9 Juba
Poly = 9 Juba

AA 199 – Correct (Near Boundary/MMU)
Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located very close to the Calo-Anhi polygon boundary to the south. It is possible that there could be a margin of error in the GPS. The Upland Disturbance also contains inclusions of Calo-Anhi that are below miminum mapping resolution.

AA 200 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 201 – Correct (Match)
Point = 6 Upland Disturbance
Poly = 6 Upland Disturbance

AA 202 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 203– Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 204– Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 205 – Correct (MMU/Mosaic)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located in a polygon predominantly composed of Upland Disturbance with a number of Calo-Anhi inclusions that are below minimum mapping resolution. The southern part of the polygon is a mosaic of both types.

AA 206 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 207 – Correct (AA Questionable/MMU)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The medium green photo signature shows that the AA point is located in an area of Calamovilfa longifolia indicating Calo-Anhi. There may be small inclusions of Stco-Bogr-Cafi in the area, but they are below minimum mapping resolution. The AA data would need to be reviewed

AA 208 – Correct (Transitional/Near Boundary)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The AA point is located in a transitional area between Calo-Anhi and Stco-Bogr-Cafi. The point is also very close to the boundary of a Calo-Anhi polygon to the south. It is possible that there could be a margin of error in the GPS.

AA 209 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 210 – Correct (Transitional)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The AA point is located in a transitional area between Calo-Anhi and Stco-Bogr-Cafi. The Calo-Anhi is medium green to blue green. The Stco-Bogr-Cafi is tan green and is located on steeper slopes.

AA 211 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 212 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 213 – Correct (Match)

Point = 5 Calo-Anhi

Poly = 5 Calo-Anhi

AA 214 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 215 – Correct (Match)
Point = 9 Juba
Poly = 9 Juba

AA 216 – Correct (Match)
Point = 9 Juba
Poly = 9 Juba

AA 217 – Correct (Match)
Point = 99 Urban
Poly = 99 Urban

AA 218 – Correct (Match)
Point = 99 Urban
Poly = 99 Urban

AA 219 – Correct (Match)
Point = 13 Scsc-Boute-Cafi
Poly = 13 Scsc-Boute-Cafi

AA 220– Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 221– Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 222 – Correct (Transitional)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located in an area transitional between Stco-Bogr-Cafi and Calo-Anhi. The lower slope is Calo-Anhi composed of Bouteloua gracilis, Stipa comata, and some Calamovilfa longifolia. The upper, steeper slopes contain more Carex filifolia. Being a grazed area, there is less Carex than normal, and more Bouteloua.

AA 223 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 224 – Correct (Match)
Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 225 – Correct (Transitional/MMU)

Point	=	4	Stco-Bogr-Cafi
Poly	=	5	Calo-Anhi

The AA point is located in a transitional area between Stco-Bogr-Cafi and Calo-Anhi. Any Stco-Bogr-Cafi present is below minimum mapping resolution.

AA 226 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 227 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 228 – Correct (MMU)

Point	=	13	Scsc-Boute-Cafi
Poly	=	4	Stco-Bogr-Cafi

The AA point is located in a small area of Scsc-Boute-Cafi that is below minimum mapping resolution. It is surrounded by Stco-Bogr-Cafi.

AA 229 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 230 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 231 – Correct (Match)

Point	=	5	Calo-Anhi
Poly	=	5	Calo-Anhi

AA 232 - Correct (Match)

Point	=	10	Tyla
Poly	=	10	Tyla

AA 233 – Correct (Boundary)

Point	=	9	Juba
Poly A	=	10	Tyla
Poly B	=	9	Juba

AA 234 – Correct (Match)

Point	=	99	Urban
Poly	=	99	Urban

AA 235 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 236 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 237 – Correct (AA Questionable/Near Boundary)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi

The AA point is located on a ridge sideslope that is covered by Stco-Bogr-Cafi. Nearby to the northwest and southeast are two polygons coded as Stco-Bogr-Cafi that should be a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. It is possible that there could be a margin of error in the GPS.

AA 238 - Out

Point = 4 Stco-Bogr-Cafi
Poly = OUT

AA 239 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 240 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area containing a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 241 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 242 – Correct (Boundary)

Point = 5 Calo-Anhi
Poly A = 4 Stco-Bogr-Cafi
Poly B = 5 Calo-Anhi

AA 243 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 244 – Correct (Match)

Point = 5 Calo-Anhi

Poly = 5 Calo-Anhi

AA 245 – Correct (Transitional/Mosaic)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located in a transitional area between Stco-Bogr-Cafi and Calo-Anhi that is a mosaic of both types.

AA 246 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 247 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 248 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 249 – Correct (AA Questionable)

Point = 9 Juba
Poly = 8 Pasm

The AA point is located on the upper floodplain terrace in an area with variable degree of wetness. The photo signature shows a light yellow green color more typical of Pasm situations. There may be patches of Juba within the area. The AA data would need to be reviewed.

AA 250 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 251 – Correct (Match)

Point = 99 Urban
Poly = 99 Urban

AA 252 – Correct (AA Questionable)

Point = 5 Calo-Anhi
Poly = 99 Urban

The photo signature shows the AA point is located in what is definitely an agricultural area. The photo shows that the area has been disked. There is a uniform signature color implying a homogeneous crop use. The AA data would need to be reviewed.

AA 253 – Correct (Match)

Point = 99 Urban
Poly = 99 Urban

AA 254 – Correct (MMU)

Point = 4 Stco-Bogr-Cafi

Poly = 5 Calo-Anhi

The AA point is located on the lower slopes of a canyon that has been grazed. The signature is light medium green indicative of Bouteloua gracilis, Stipa comata, and some Calamovilfa longifolia. Brighter mediium green is indicative of Calamovilfa longifolia. There are a few inclusions of Stco-Bogr-Cafi, but they are below minimum mapping resolution.

AA 255 - Out

Point = 5 Calo-Anhi
Poly = OUT

AA 256 – Correct (MMU/Transitional)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located in a grazed, transitional area between Stco-Bogr-Cafi and Calo-Anhi. The area is mainly composed of Calo-Anhi with small inclusions of Stco-Bogr-Cafi that are below minimum mapping resolution. The medium green signature is Calamovilfa longifolia.

AA 257 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 258 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 259 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 260 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 261 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 262 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 263 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA A264 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 265 – Correct (MMU)

Point = 5 Calo-Anhi
Poly = 6 Upland Disturbance

The AA point is located in a polygon that is predominantly Upland Disturbance (red brown signature). There are inclusions of Calo-Anhi (light gray green signature) that are below minimum mapping resolution.

AA 266 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 267 – Correct (Near Boundary/Transitional)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located near the boundary with a Stco-Bogr-Cafi polygon to the west. It is possible that there could be a margin of error in the GPS. In addition, there is a transition from Stco-Bogr-Cafi to Calo-Anhi in the area. The signature color for Calo-Anhi is medium to bright medium green, Stco-Bogr-Cafi is tan green to olive green.

AA 268 – Correct (Match)

Point = 5 Calo-Anhi
Poly = 5 Calo-Anhi

AA 269 – Incorrect (Change Code)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The AA point is located in a grazed area that contains Bouteloua gracilis and Stipa comata. There appears to be little or no Calamovilfa longifolia. The location is the mouth of a canyon that is not steeply sloping. This information implies Calo-Anhi. The code has been changed.

AA 270 – Correct (MMU)

Point = 5 Calo-Anhi
Poly = 4 Stco-Bogr-Cafi

The photo signature shows the AA point to be located in an area of tan green to olive green indicating Stco-Bogr-Cafi. There are small inclusions of medium green Calomovilfa implying Calo-Anhi, but they are below minimum mapping resolution.

AA 271 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 272 – Correct (Near Boundary/Transitional)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located near the boundary of a Stco-Bogr-Cafi polygon to the south. It is possible there could be a margin of error in the GPS. The area is also transitional from Stco-Bogr-Cafi to Calo-Anhi.

AA 273 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 274 – Correct (AA Questionable)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

On the AA review plot the AA point clearly fallis in a Stco-Bogr-Cafi polygon. The AA data needs to be reviewed.

AA 275 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area containing a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 276 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area containing a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 277 - Out

Point = 4 Stco-Bogr-Cafi
Poly = OUT

AA 278 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 279 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 280 – Correct (Match)

Point = 5 Calo-Anhi

Poly = 5 Calo-Anhi

AA 281 – Correct (Ridge Mosaic)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi (14 Scsc/Stco Mosaic)

The AA point is located in an area containing a mosaic of Stco-Bogr-Cafi and Scsc-Boute-Cafi. In the original mapping of the vegetation a mosaic class was not available. The final classification, however, does allow for a mosaic of Stco-Bogr-Cafi with Scsc-Boute-Cafi. There was an oversight in the final mapping in using the mosaic class for the categorizing of these situations. The mapping has now been corrected. Since Scsc-Boute-Cafi is a component of the mosaic, the mosaic polygon class now passes with the AA point class.

AA 282 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 283 - Out

Point = 4 Stco-Bogr-Cafi
Poly = OUT

AA 284 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 285 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 286 – Correct (Boundary)

Point = 4 Stco-Bogr-Cafi
Poly A = 5 Calo-Anhi
Poly B = 4 Stco-Bogr-Cafi

AA 287 – Correct (Near Boundary)

Point = 13 Scsc-Boute-Cafi
Poly = 4 Stco-Bogr-Cafi

The AA point is located in just south of the boundary between Stco-Bogr-Cafi and Scsc-Boute-Cafi. It is possible that there could be a margin of error in the GPS.

AA 288 – Correct (Match)

Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 289 - Out

Point = 4 Stco-Bogr-Cafi
Poly = OUT

AA 290 – Correct (AA Questionable)

Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located in an area that is definitely grazed Calo-Anhi. The signature is light gray green and is located in a valley or canyon bottom, a typical location for Calo-Anhi. Stco-Bogr-Cafi is usually located on the upper steeper slopes of canyons. The AA point may need to be reviewed.

AA 291 – Correct (AA Questionable/Near Boundary)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The bright medium green photo signature shows the AA point located in Calamovilfa longifolia, indicative of Calo-Anhi. The point is located to the north of the boundary with Stco-Bogr-Cafi. It is possible that there could be a margin of error in the GPS.

AA 292 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 293 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 294 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 295 - Out
Point = 5 Calo-Anhi
Poly = OUT

AA 296 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 297 – Correct (Match)
Point = 4 Stco-Bogr-Cafi
Poly = 4 Stco-Bogr-Cafi

AA 298 – Correct (Near Boundary)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The AA point is located very close to a Stco-Bogr-Cafi polygon to the south. It is possible that there could be a margin of error in the GPS.

AA 299 – Correct (AA Questionable)
Point = 4 Stco-Bogr-Cafi
Poly = 5 Calo-Anhi

The photo signature shows the AA point located within Calo-Anhi (bright medium green). There may be small patches of Stco-Bogr-Cafi, but they are below minimum mapping resolution. The AA data may need to be reviewed.

AA 300 – Correct (Match)

Point	=	4	Stco-Bogr-Cafi
Poly	=	4	Stco-Bogr-Cafi

AA 301 - Out

Point	=	4	Stco-Bogr-Cafi
Poly	=		OUT

Appendix F
Original Matrix

			Observation Points															User
																	Total	Acc
Mapped		1	2	3	4	5	6	7	8	9	10	11	12	13	14	99		
Points	1	1							1								2	50%
	2																0	NA
	3										1						1	0%
	4				63	11								12		1	87	72%
	5				25	90	2		2	1				2			122	74%
	6				4	12	8	1									25	32%
	7							1	1								2	50%
	8			1		2			13	2							18	72%
	9					1		1	3	5							10	50%
	10									3	3						6	50%
	11																0	NA
	12																0	NA
	13													4			4	100%
	14																0	NA
	99	1			1	3	1									9	15	60%
Total		2	0	1	93	119	11	3	20	11	4	0	0	18	0	10	292	
Prod Acc		50%	NA	0%	68%	76%	73%	33%	65%	45%	75%	NA	NA	22%	NA	90%		

Abbreviations:

1 Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland
2 Symphoricarpos occidentalis Shrubland
3 Salix exigua Shrubland
4 Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation
5 Calamovilfa longifolia - Andropogon hallii Herbaceous Vegetation
6 Upland Disturbance Herbaceous Vegetation
7 Annual-dominated Floodplain Disturbance Herbaceous Vegetation
8 Pascopyrum smithii Herbaceous Vegetation
9 Juncus balticus Herbaceous Vegetation
10 Typha latifolia Western Herbaceous Vegetation
11 Seeded Grassland Herbaceous Vegetation
12 Stipa comata - Bouteloua gracilis Gravel Herbaceous Vegetation
13 Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation
14 Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation/ Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation Mosaic
99 Urban/Built-Up/Maintained/Road/Road Mowed/Cut and Fill

Appendix G
Revised Matrix

			Observation Points															User
																	Total	Acc
Mapped		1	2	3	4	5	6	7	8	9	10	11	12	13	14	99		
Points	1	2															2	100%
	2																0	NA
	3			1													1	100%
	4				72	2								2			76	95%
	5				3	118											121	98%
	6				1	3	20										24	83%
	7							2									2	100%
	8			1					16	1							18	89%
	9									9							9	100%
	10									1	5						6	83%
	11																0	NA
	12																0	NA
	13													4			4	100%
	14				6									7			13	0%
	99	1														13	14	93%
Total		3	0	2	82	123	20	2	16	11	5	0	0	13	0	13	290	
Prod Acc		67%	NA	50%	89%	71%	100%	100%	100%	82%	100%	0%	0%	31%	0%	100%		

Abbreviations:

1 Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland
2 Symphoricarpos occidentalis Shrubland
3 Salix exigua Shrubland
4 Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation
5 Calamovilfa longifolia - Andropogon hallii Herbaceous Vegetation
6 Upland Disturbance Herbaceous Vegetation
7 Annual-dominated Floodplain Disturbance Herbaceous Vegetation
8 Pascopyrum smithii Herbaceous Vegetation
9 Juncus balticus Herbaceous Vegetation
10 Typha latifolia Western Herbaceous Vegetation
11 Seeded Grassland Herbaceous Vegetation
12 Stipa comata - Bouteloua gracilis Gravel Herbaceous Vegetation
13 Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation
14 Stipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation/ Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation Mosaic
99 Urban/Built-Up/Maintained/Road/Road Mowed/Cut and Fill