APPENDIX E

E. Field Key for the Wupatki National Monument Vegetation Community Descriptions and Map Classes

How to Use this Key---

On the following pages, associations, alliances, and/or map classes are arranged in dichotomous couplets with corresponding field descriptions of the associations, alliances, and/or map classes. Starting with "1.1" read the statements and choose the best fit subheading that is demarked by bold and capital letters such as "1.a **LAND USES**". Follow this subheading to "1.a.1" and continue to follow the key to select the "best fit" association occurring at the bottom of the description demarked by italicized species names such as "*Ephedra torreyana – Achnatherum hymenoides* Hummock Shrubland" and map classes demarked by bolded lower case letters such as "**Mormon Tea Cinder Dune Shrubland**". In some cases it may be necessary to read through several couplets before reaching the best answer.

In many cases, the map classes and the vegetation associations do not have 100% correspondence. This may be due to difficultly in photointerpretation of the vegetation class and/or high variability in the vegetation community. If the map class consists of a group of associations or alliances, the map class will appear twice in the key because two separate vegetation descriptions represent the same map class. In other cases, the association description located in Appendix F will not match the map class description in which the association occurs due to differences in the ability to photointerpret the photosignature and the vegetation descriptions for the association as standardized by NatureServe. However, the key will lead you to the correct map class; but, it may be possible that it will not lead to the same association defining characteristics depending on the range of variability in the vegetation descriptions. For a full description of each association please read Appendix F. It is important when using this key that the vegetation types are surveyed larger or equal to the minimum mapping unit (≥ 0.5 ha). If smaller scales are used it is likely that the community types will not correspond with the map classes or vegetation descriptions recorded in the key.

Sites characterized by land uses, non-vegetated areas, substrate, or exotic invasive species:

1.a Land use (human infrastructure) or prairie dog colonies **LAND USES (1.a.1)**
1.b No or sparse vegetation (< 5%) **UNVEGETATED (1.b.1)**
1.c Diagnostic substrate characterized by cinder, basalt, river cobbles, sand dunes, sandstone, or badlands with vegetation ranging from sparse to low vegetation (2-20%) **SUBSTRATE (1.c.1)**
1.d Dominance of an invasive species (saltcedar, Russian thistle, camel thorn) **EXOTIC INVASIVE SPECIES (1.d.1)**

Sites not characterized by land uses, non-vegetated areas, substrate, or exotic invasive species:

2.1 Vegetation cover generally greater than 10% and herbs and grasses the dominant lifeform. (Or vegetation has a 'steppe-like' expression with shrub cover occasionally higher or equal in cover to the herbaceous species. In these cases shrub cover must be less than two times the herbaceous cover.)
- 2.a Shrub cover less than 10% **HERBACEOUS VEGETATION**
- 2.b Shrub cover greater than 10% and is 'steppe-like' in its expression **SHRUB HERBACEOUS VEGETATION**

3.1 Vegetation cover generally greater than 10% with shrub or dwarf-shrub cover greater than 10% and the dominant lifeform
SHRUBLAND

4.1 Vegetation cover generally greater than 10% with tree cover greater than 10% (trees includes large shrubs such as saltcedar and one-seed juniper that may be treated elsewhere as shrubs)
WOODLAND

LAND USES

1.a.1 Site characterized by land use
1. **Commercial Development**
2. **Corrals**
3. **Strip Mines, Quarries and Gravel Pits**
4. **Facilities**
5. **Residential Land**
6. **Stock Tanks and Dams**
7. **Transportation Route (paved roads)**

(if dirt roads or tracks, continue key to vegetation association)

UNVEGETATED

1.b.1 Site characterized by a diagnostic substrate.
1. **Cinder Barren**
2. Sandstone, shale, basalt, or other diagnostic substrate continue key to **SUBSTRATE** (1.c.1)

1.b.1 Site characterized by river channel. **Active River Channel**

SUBSTRATE

1.c.1 Sites characterized by cinder. (1.c.4)
1.c.1 Sites characterized by other geologic substrates. (1.c.2)

1.c.2 Sites characterized by basalt. (1.c.7)
1.c.2 Sites characterized by other geologic substrates. (1.c.3)

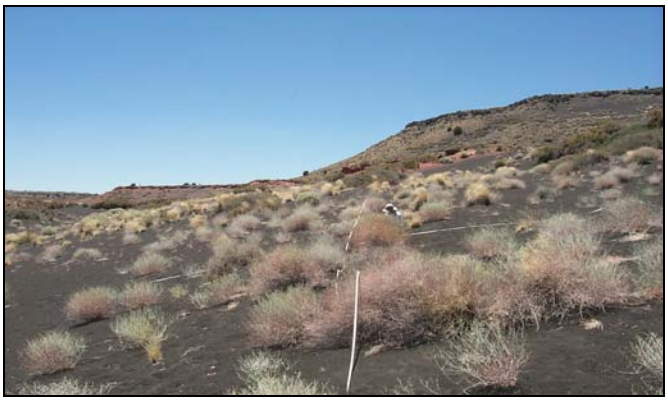
1.c.3 Sites characterized by sandstone or sand dunes. (1.c.8)
1.c.3 Sites characterized by badlands or river cobbles. (1.c.9)

1.c.4 Sites characterized by dunes/hummocks often with Torrey's joint-fir or Apache plume dominant or co-dominant shrubs. *Ephedra torreyana – Achnatherum hymenoides* Hummock Shrubland (see picture below).
(MAP CLASS: **Mormon Tea Cinder Dune Shrubland**)

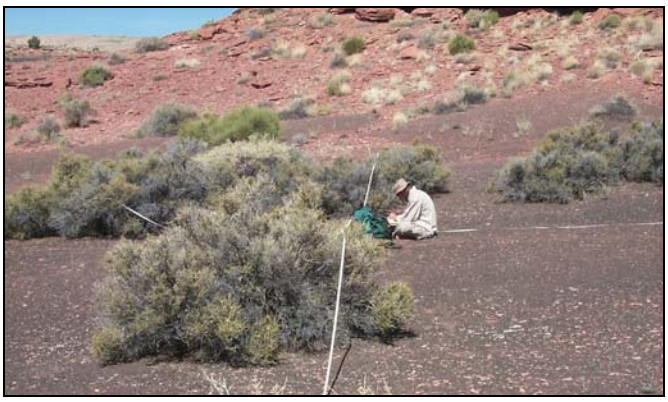
1.c.4 Sites characterized by flat areas or slopes. (1.c.5)

1.c.5 Sites dominated by shrubs other than oneseed juniper. (1.c.6)
1.c.5 Sites dominated by oneseed juniper with sparse to moderate cover. Grasses such as black grama and galleta may be present depending on cinder dept. Locally grasses may have higher cover than oneseed juniper but vegetation is characterized by overall presence of oneseed juniper on cinder. *Juniperus monosperma* Cinder Wooded Herbaceous Vegetation (see picture below).
(MAP CLASS: **Oneseed Juniper Woodland**)

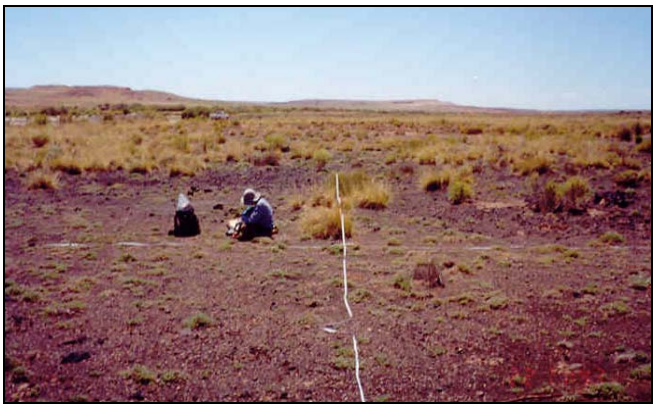
1.c.6 Crispleaf buckwheat is an indicator for this type. Apache plume, brickelbush, and other shrubs may be present at higher cover; however, crispleaf buckwheat must be present with at least 2% absolute cover on cinder. *Eriogonum corymbosum* Cinder Sparse Vegetation (see picture below). (MAP CLASS: **Crispleaf Buckwheat Cinder Shrubland**)



1.c.6 Apache Plume is the characteristic dominant species although rabbitbrush, fourwing saltbush, or Torrey's joint-fir may dominate in smaller patches. Occurs on black and red cinder substrate. *Fallugia paradoxa – (Atriplex canescens – Ephedra torreyana)* Cinder Shrubland (see picture below).
(MAP CLASS: **Apache Plume Cinder Shrubland** or MAP CLASS: **Wupatki Wash System** (if occurring in washes))



1.c.7 Sites characterized by basalt pebble/cobble plains near the Little Colorado River. Crinklemat is an indicator for this type with the grass alkali sacaton often occurring in these areas. *Tiquilia latior / Sporobolus airoides* Dwarf-Shrubland (see picture below).
(MAP CLASS: **Crinklemat / Alkali Sacaton Dwarf Shrubland**)



1.c.7 Sites characterized by basalt outcrops, sometimes containing brickelbush or skunkbush. *Brickellia californica – Rhus trilobata* Shrubland (see picture below).
(MAP CLASS: **Basalt Outcrop Shrubland**)

1.c.8 Sites characterized by sandstone bluffs and outcrops. Vegetation often includes shrubs such as fourwing saltbush, Mormon tea, and snakeweed and sometimes the bush Muhly grass. *Atriplex canescens – (Ephedra viridis) / (Muhlenbergia porteri)* Sandstone Sparse Vegetation (see picture below).
(MAP CLASS: **Moenkopi Sandstone Sparse Vegetation**)

1.c.8 Sites dominated by sand dunes and sand sheets. Frosted mint is an indicator for this type although shrubs such as Whiting's dalea, snakeweed, or sand sagebrush may occur in higher abundance. Galleta grass is often present in this type. *Poliomintha incana – (Pleuraphis jamesii)* Shrubland (see picture below).
(MAP CLASS: **Frosted Mint Shrubland**)

1.c.9 Sites characterized by clay badland soils. Vegetation is sparse to low with either mound saltbush or Russian thistle present often even in very low cover. Since Russian thistle is an annual its presence could be masked due to seasonal variation. *Atriplex obovata* Badland Sparse Vegetation (see picture below).
(MAP CLASS: **Mound Saltbush Badlands Sparse Vegetation**)

1.c.9 Sites characterized by Moenkopi shale badlands or areas with Pleistocene river cobbles. Basalt, clay, and sandstone soils may occur in smaller patches in this type. Torrey's joint-fir is an indicator for this type and is always present even at very low cover (<1%). Other shrubs may occur in higher cover such as fourwing saltbush, shadscale, and crispleaf buckwheat. In areas where Pleistocene river cobbles dominant the substrate, grass cover may occasionally be >10% with black grama, three-awn, or galleta dominating. *Ephedra torreyana – (Atriplex canescens, confertifolia)* Sparse Vegetation (see picture below).
(MAP CLASS: **Moenkopi Shale Sparse Vegetation**)

EXOTIC INVASIVE SPECIES

1.d.1 Dominant species is saltcedar and/or camel thorn and often forms monocultures with >90% of the total tree and/or shrub cover. *Tamarix spp.* Temporarily Flooded Shrubland or *Alhagi maurorum* Semi-natural Shrubland (see picture below).
(MAP CLASS: **Little Colorado River Invasive Riparian Shrubland**)

1.d.1 Dominant species may be Russian thistle depending on its seasonal variation due to its annual lifeform. Mound saltbush is an indicator for this type and must be present in very low cover. *Atriplex obovata* Badland Sparse Vegetation (see picture below).
(MAP CLASS: **Mound Saltbush Badlands Sparse Vegetation**)

HERBACEOUS VEGETATION

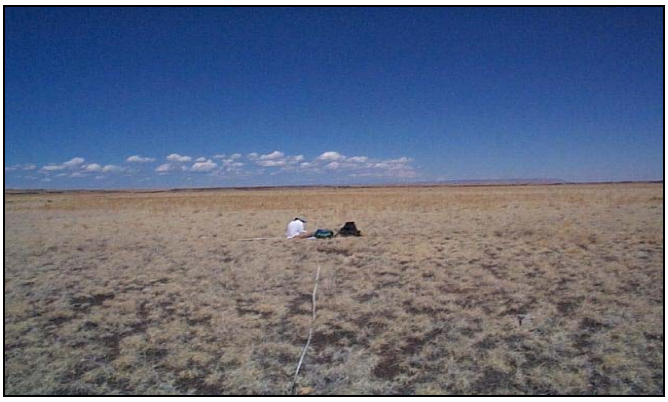
2.a.1 Sand bluestem is the dominant grass (>50% of total herbaceous cover) and often occurs in small patches (<0.5 ha). *Andropogon hallii* Colorado Plateau Herbaceous Vegetation (see picture below).
(MAP CLASS: **Sand Bluestem Grassland**)

2.a.1 Dominant grass not as above. (2.a.2)

2.a.2 Galleta is dominant (>50% of total herbaceous cover) or co-dominant (>25% of total herbaceous cover). (2.a.3)

2.a.2 Dominant grass not as above. (2.a.6)

2.a.3 Galleta >50% of total herbaceous cover. *Pleuraphis jamesii* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Galleta Grassland**)



2.a.3 Presence >25% of the total herbaceous cover other herbaceous species. (2.a.4)

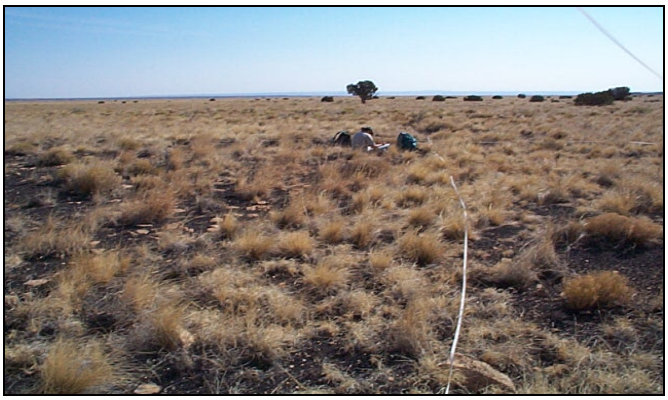
2.a.4 Alkali sacaton is the main other herbaceous species and may have greater cover than galleta. *Pleuraphis jamesii-Sporobolus airoides* Herbaceous Vegetation (see picture below).

(MAP CLASS: **Galleta Mixed Grasslands**)

2.a.4 Other main herbaceous species not as above. (2.a.5)

2.a.5 Black grama is the main other herbaceous species. *Bouteloua eriopoda-Pleuraphis jamesii* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Galleta Mixed Grasslands**)

2.a.5 Needle-and-thread is the main other herbaceous species. *Hesperostipa comata-(Bouteloua eriopoda-Pleuraphis jamesii)* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Needle-and-Thread Grassland**)



2.a.6 Alkali sacaton is the dominant grass (>50% of total herbaceous cover). This type occurs in washes and upland areas with frequent occurrence of sheetflow as evidenced by areas where water flows seasonally over gentle to low-slope areas to form an eroded open fan-like pattern of low gradient channels. *Sporobolus airoides* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Wupatki Wash System**)

2.a.6 Dominant grass not as above. (2.a.7)

2.a.7 Black grama is the dominant grass (>50% of total herbaceous cover). *Bouteloua eriopoda* Coconino Plateau Shrub Herbaceous Vegetation (no picture available; this map class was defined only through the aerial photography interpretation).
(MAP CLASS: **Black Grama Grassland**)

2.a.7 Needle-and-thread is the dominant grass (>50% of total herbaceous cover). *Hesperostipa comata-(Bouteloua eriopoda-Pleuraphis jamesii)* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Needle-and-Thread Grassland**)

SHRUB HERBACEOUS VEGETATION

2.b.1 Black grama is the dominant grass and shrub cover may include, but is not limited to shadscale, fourwing saltbush, rabbitbrush, Mormon tea or snakeweed. *Bouteloua eriopoda* Coconino Plateau Shrub Herbaceous Vegetation (see picture below).
(MAP CLASS: **Black Grama Coconino Plateau Mixed Shrubland**)

2.b.1 Dominant grass not as above. (2.b.2)

2.b.2 Alkali sacaton is the dominant grass and shrubs such as Mormon tea, salt bush, and snakeweed may be present. This type occurs in washes or sheetflow runoff areas (as evidenced by areas where water flows seasonally over gentle to low-slope areas to form an eroded open fan-like pattern of low gradient channels). *Sporobolus airoides* Herbaceous Vegetation (see picture below).
(MAP CLASS: **Wupatki Wash System**)

2.b.2 Galleta is the dominant grass or is co-dominated by alkali sacaton. (2.b.3)

2.b.3 Galleta is the dominant grass and rabbitbrush is the dominant shrub. Shadscale in smaller areas may also occasionally be the dominant shrub with galleta as the dominant grass. Needle-and-thread grass can be present, but with low cover. *Ericameria nauseosa / Pleuraphis jamesii – (Hesperostipa comata)* Shrub Herbaceous Vegetation (see picture below).
(MAP CLASS: **Rabbitbrush Shrubland**)

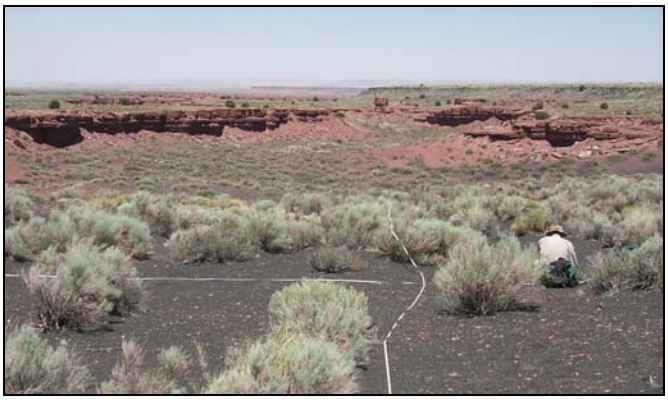
2.b.3 Rabbitbrush is not the dominant shrub. (2.b.4)

2.b.4 Galleta is the dominant grass and alkali sacaton may occur and be equally co-dominant. Snakeweed is the dominant shrub. *Gutierrezia sarothrae / Sporobolus airoides – (Pleuraphis jamesii)* Shrub Herbaceous Vegetation (see picture below).
(MAP CLASS: **Snakeweed / Galleta Grassland**)

2.b.4 Dominant shrubs not as above and may include species like Mormon tea, wolf berry, or fourwing saltbush. *Pleuraphis jamesii* Shrub Herbaceous Alliance (see picture below). (MAP CLASS: **Galleta Mixed Shrublands**)

SHRUBLANDS

3.1.Sand sagebrush is an indicator for this type and may also be dominant must always be present even in very low cover. Other shrubs may be more dominant including Torrey's joint-fir, Mormon tea, fourwing saltbush, or rabbitbrush, and at least one of these other shrubs must be present to be classified as this type. *Artemisia filifolia – Ephedra (torreyana, viridis)* Shrubland (see picture below).
(MAP CLASS: **Sand Sagebrush Shrubland** or MAP CLASS: **Wupatki Wash System** (if occurring in washes))



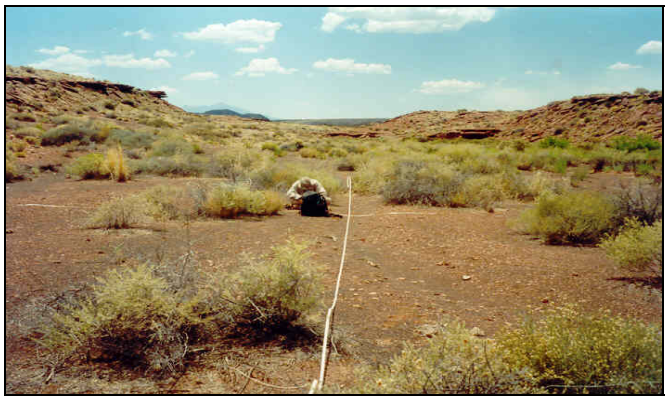
3.1. Dominant shrub not sand sagebrush or combination of above species. (3.2.)

3.2. Dominant shrub fourwing saltbush. Occurring in washes, floodplains, or upland drainageway areas as evidenced by areas with seasonal water flow that lacks a defined channel. (3.3.)

3.2.Dominant shrub not as above. (3.4)

3.3 Alkali sacaton is the characteristic grass. *Atriplex canescens / Sporobolus airoides* Shrubland (see picture below).
(MAP CLASS: **Wupatki Wash System**)

3.3. Dominant grass not alkali sacaton. *Atriplex canescens* Desert Wash Shrubland (Provisional) (see picture below).
(MAP CLASS: **Wupatki Wash System** (circle if occurring in washes) or **Fourwing Saltbush Upland Drainageways** (circle if occurring in upland drainageway areas))



3.4 Dominant shrub Apache plume and/or rabbitbrush, often occurring in deep cinder soils. *Fallugia paradoxa – (Atriplex canescens – Ephedra torreyana)* Cinder Shrubland (see picture below).
(MAP CLASS: **Apache Plume Cinder Shrubland**)

3.4. Dominant shrubs not as above. (3.5.)

3.5.Dominant shrubs skunkbush, desert olive, or brickelbush, and occurring on basalt outcrops. *Brickellia californica – Rhus trilobata* Shrubland (see picture below).
(MAP CLASS: **Basalt Outcrop Shrubland**)

3.5. Dominant shrubs not as above.

3.6. Occurring in washes or in the Little Colorado River Corridor. (3.7.)
3.6. Dominant shrubs not as above. (3.8.)

3.7. Sandbar willow dominant or co-dominant. *Salix exigua* / Barren Shrubland (see picture below).
(MAP CLASS: **Sandbar Willow Shrubland**)

3.7. Camelthorn dominant or co-dominant. *Alhagi maurorum* Semi-natural Shrubland (see picture below).
(MAP CLASS: **Little Colorado River Invasive Riparian Shrubland**)

3.8. Snakeweed dominant with twice as much cover as the herbaceous species. *Gutierrezia sarothrae* Dwarf-Shrub Alliance (see picture below).
(MAP CLASS: **Snakeweed / Galleta Grassland**)

Dominant shrubs not as above. Unclassified Mixed Shrubland (no picture available; this map class was defined only through the aerial photography interpretation).
(MAP CLASS: **Unclassified Mixed Shrubland**)

WOODLANDS

4.1. One-seed juniper dominates the woody layer with sparse to moderate cover. Grasses such as black grama and galleta may be present depending on the cinder depth. Locally grasses may have higher cover than oneseed juniper, but the vegetation is characterized by overall presence of oneseed juniper on cinder. *Juniperus monosperma* Cinder Wooded Herbaceous Vegetation (see picture below).
(MAP CLASS: **Oneseed Juniper Cinder Woodland**)

4.1. Sites occurring the in washes or in the Little Colorado River corridor. (4.2.)

4.2. Fremont's cottonwood is the dominant tree. Sandbar willow occurs in the understory and is an indicator to the association. The non-native exotic saltcedar may occur up to 15% of the total cover. *Populus fremontii / Salix exigua* Forest (see picture below).
(MAP CLASS: **Fremont Cottonwood Woodland**)

4.2. Saltcedar is dominant (>90% of the total tree cover) and forms a monoculture with no other tree or shrub species co-dominating. *Tamarix spp.* Temporarily Flooded Shrubland (see picture below).
(MAP CLASS: **Little Colorado River Invasive Riparian Shrubland**)