



Gradsect and Field Sampling Plan for Amistad National Recreation Area

Natural Resource Report NPS/CHDN/NRR—2011/298



ON THE COVER

Photograph within Amistad National Recreation Area
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Executive Summary

Amistad National Recreation Area (AMIS, NRA) occupies approximately 57,292 acres in and around the Amistad Reservoir and along the Rio Grande in south Texas. In 2009 the NRA began a vegetation mapping project under the National Park Service (NPS) Vegetation Inventory Program (NVIP) by preparing a detailed Study Plan. One of the first tasks in the study plan is the development of a field-based sampling approach using a gradient oriented transect (gradsect) consisting of biophysical units (BPUs). The purpose of this task is to create spatial databases and supporting materials that can assist field crews in economically accessing and sampling representative stands of vegetation in AMIS.

In 2010 Cogan Technology, Inc. (CTI) was contracted to create the gradsect and sampling approach using existing data layers. Following careful examination and review, CTI created a BPU layer based on four parameters, the parameters include:

1) Two Reservoir Contours (i.e. Water Levels)

1080 feet above sea level = Base or Low Pool

1118 feet about sea level = Conservation Pool and Current Level (2010)

2) Val Verde County General Soils Database and Spatial Data (SSURGO) – 18 Types:

- | | |
|--|---|
| 1) Acuna silty clay, | 10) Olmos very gravelly loam, |
| 2) Amistad flaggy clay loam, | 11) Pits, |
| 3) Dev soils, | 12) Rio Grande soils, frequently flooded, |
| 4) Felipe and Zorra soils, | 13) Riverwash, |
| 5) Jimenez-Quemado complex, | 14) Valverde silty clay loam, |
| 6) Langtry cobbly silt loam, very rocky, | 15) Zapata-Vinegarroon complex, |
| 7) Langtry-Rock outcrop association, very steep, | 16) Zorra-Rock outcrop association, |
| 8) Lozier-Shumla association, undulating, | 17) Zorra-Rock outcrop association-steep, |
| 9) Mariscal-Lozier association, | 18) Unknown = Water and Unlabeled |
-

3) Five Texas Vegetation Cover Types (derived from the The Vegetation Types of Texas):

- 1) Ceniza-Blackbrush-Creosotebush Brush,
 - 2) Mesquite-Blackbrush Brush
 - 3) Mesquite-Juniper-Live Oak Brush
 - 4) Mixed Vegetation
 - 5) Submerged
-

4) General Topology and Vegetation Types (manually delineated from 2010 imagery):

Topology

Draw-down

Riparian

Upland

Vegetation

Annual Herbaceous Vegetation

Upland Herbaceous Vegetation

Upland Shrubs

Upland Trees and Tall Shrubs

Riparian Herbaceous Vegetation

Riparian Shrubs

Riparian Trees and Tall Shrubs

Mixed Shrubs

In addition to the BPU layer, potential sampling target sites were created for each BPU polygon. Potential sampling points contain the X-Y coordinates (Universal Transverse Mercator (UTM) coordinates) and unique BPU codes relating to the soil type, topology, and likely vegetation at each site. Since most of AMIS can be assessed by boat, canoe, or on foot no cost estimate for travel to each unique site was estimated. Together, the BPU polygons and sample target points were summarized and these findings were incorporated into field maps and manuals. This report summarizes the gradsect concept, describes the variables used to model the vegetation distribution at AMIS, summarizes the methods, and presents the results.

Introduction

The National Vegetation Inventory Program (NVIP) consists of multi-stage projects for all NPS natural resource sites that use vegetation plot data to create plant association and vegetation alliance lists based on parameters specified by the National Vegetation Classification System (NVCS). The vegetation alliance list and supporting descriptions ultimately are used in the preparation of a vegetation geo-database (i.e. map) using geographic information system (GIS) software. Accessing and sampling classification plots is a time-consuming and therefore expensive task and field crews benefit from previous analysis of the landscape to be sampled. An effective way to analyze a large and diverse landscape (such as AMIS) is to prepare a gradient-oriented transect (gradsect) using environmental drivers to define biophysical unit (BPU) polygons. The BPU polygons can then be overlaid with facilities, roads, trails, and slope layers to help the field crews with the logistics of accessing each polygon. Using the BPU and gradsect data provides an effective field sampling plan that helps insure all unique vegetation stands are sampled in an economical manner.

Gradsects were originally designed as simple, large transects (up to one-kilometer-wide) that run across the landscape crossing many environmental gradients. By walking and sampling within the gradsect it is assumed that most of the vegetation diversity can be sampled within a reasonable time frame and with low expense (Austin and Heyligers 1989). Recently this approach has been modified by the NVIP and contributors due in part to the availability of powerful GIS and spatial analysis software. As a result, the new, modified gradsects are commonly a GIS-derived, non-linear model that documents the distribution of vegetation patterns along many environmental gradients. The results of this analysis are BPU polygons. The BPUs are discrete, spatial polygons that have a unique suite of biotic and abiotic conditions that influence the vegetation. These polygons can be used as guides to help field crews visit and collect classification plot data throughout large, diverse areas.

By combining BPUs with logistical aides (roads, trails, facilities, etc...), a powerful tool is created enabling field crews to sample the full range of vegetation diversity in an efficient manner (e.g., if the field crews visit the full spectrum of physical environments at easy to moderately difficult access sites, then most of the vegetation types will be sampled). Derivatives of these methods have been statistically shown to capture more information than standard designs based on systematic grids or random points (Gillison and Brewer 1985, Gillison and Anderson 1981, Helman 1983, and Austin and Heyligers 1989, 1991).

Following NVIP Study Plan preparation in June 2010 (Von Loh and Cogan 2010), Cogan Technology, Inc. (CTI) was tasked under separate contract to create a digital gradsect analysis covering the AMIS project area. Funding for the Gradsect Analysis and Field Sampling Plan was provided through an interagency agreement between the NPS and the U.S. Bureau of Reclamation and a sub-contract to CTI through a standing contract with Northwinds Corporation in July 2010.

Amistad National Recreation Area

Amistad National Recreation Area (AMIS) was authorized by an act of Congress on November 28, 1990 (Public Law [PL] 101-628), to administer all lands and surface waters of Amistad Reservoir totaling 57,292 acres (AMIS-GMP 2006). Amistad Reservoir was formed by the impounding of the Rio Grande by Amistad Dam constructed 13 miles northwest of Del Rio, Texas (IBWC 2009). The impounded reservoir extends approximately 75 miles upriver on the Rio Grande and includes reaches of the Pecos and Devils rivers. The surface area of the reservoir is approximately 65,000 acres. AMIS occurs entirely in Val Verde County, Texas and shares 83 miles of the international border with Mexico. Most of AMIS is only accessible by boat due to a combination of cliffs and the proximity to adjacent private land. The AMIS boundary generally is defined as the reservoir surface and shore area up to the 1,144.3 ft elevation contour above mean sea level, with some land above the 1,144.3 elevation managed by the NRA (e.g., campgrounds, parking lots, and hunting areas) with a conservation pool level of 1,117 ft above mean sea level.

AMIS occupies approximately 57,292 acres in the United States and includes examples of thornscrub ecosystems on rocky uplands and riparian habitats along the shoreline and riverbanks. The vegetated river, shoreline, desert, thornscrub, and canyon landscapes occupy approximately 14,042 acres. It is estimated that approximately 70% of the NRA is represented by water surface, 25% by desert plant communities and unvegetated geologic exposures, and 5% supports woodland and forest vegetation. Reaches of the Rio Grande, Pecos River, and Devils River that have not been inundated support most of the woodland and forest vegetation types. A broad draw-down zone can occur on the reservoir shoreline that may be unvegetated or may support annual and perennial vegetation if the drawdown occurs over several growing seasons.

Gradsect and Biophysical Units

Gradsect development for this project was addressed in the AMIS Final Study Plan (Von Loh and Cogan 2010) and was subsequently revisited by Chris Lea, NVIP Plant Ecologist, who suggested finding the floristic gradient as efficiently as possible using existing vegetation maps, physical location of legacy vegetation plots, and environmental variables. One of the challenges to this approach is recognizing when the spatial and taxonomic resolution of the environmental data is good, where it is lacking, and where it is superfluous (Lea 2006). For example, because blackbrush (*Coleogyne ramosissima*) occurs on different geologic substrates at Arches National Park, the gradsect approach there (based on geology) led field crews to sample 65 classification plots when a much smaller number, perhaps 10–15 classification plots would have been sufficient (Von Loh, et al. 2009).

With a working understanding of all the challenges at AMIS, CTI began the gradsect development by reviewing the existing spatial datasets provided by the NRA and the NPS Chihuahuan Desert Inventory and Monitoring Network (CHDN). After a careful review CTI identified the reservoir surface contours, The Vegetation Types of Texas (McMahan et al. 1984), the Val Verde General Soils database (SSURGO), and the 2010 National Agricultural Imagery Program (NAIP) ortho-photography as the four important elements for gradsect development.

Methods and Results

To guide vegetation sampling in AMIS, the gradsect methodology of Austin and Heyligers (1989) was modified to identify BPUs that better relate to the vegetation. BPU polygons were created based on a combination of existing data provided to CTI on digital video disks (DVDs) by AMIS staff and public data. The supplied AMIS boundary layer (Figure 1) was used on the gradsect and BPU analyses to insure that the results only occurred within the United States. All general gradsect methods were based on, and adapted from similar strategies created for Big Bend, Zion, and Grand Canyon National Parks and other NPS vegetation mapping projects (Cogan et al. 2004).

Reservoir Contours

Based on previous discussions with AMIS staff and by examining older ortho-photography, two reservoir contours were chosen to help delineate the general topology. The first elevation is the 1080 ft above sea level contour and the second elevation is the 1118 feet above sea level contour. The 1080 contour appeared to best represent the base pool or the average lowest reservoir level in the past 20 years. Also the spillway crests at about 1086 feet and the 1080 foot level represents the best model for calculating the lower limits of vegetation likely to grow in the draw-down zone. The 1118 ft contour matches closely the 1117 conservation pool elevation and also corresponds to the current reservoir level (1117.27 ft).

The two contour layers were joined to the AMIS boundary layer creating a temporary topology layer. All lands occurring above the 1118 ft elevation were labeled Upland. Lands located in-between the two contours were labeled as Draw-down and lands below the 1080 ft elevation were removed from further analysis due to permanent inundation.

Soils

Soils have a direct effect on vegetation distribution; therefore the latest digital soil survey database (SSURGO data) was downloaded from the U.S. Department of Agriculture (USDA) Geospatial Data Gateway website (<http://datagateway.nrcs.usda.gov/>). The spatial component was clipped to the AMIS boundary layer and the soil codes were attributed with the actual soil names as referenced in the Val Verde Soil Survey manual (Golden et. al 1982). Seventeen soil types were classified in AMIS, these include: 1) Acuna silty clay, 2) Amistad flaggy clay loam, 3) Dev soils, 4) Felipe and Zorra soils, 5) Jimenez-Quemado complex, 6) Langtry cobbly silt loam, very rocky, 7) Langtry-Rock outcrop association, very steep, 8) Lozier-Shumla association, undulating, 9) Mariscal-Lozier association, 10) Olmos very gravelly loam, 11) Pits, 12) Rio Grande soils, frequently flooded, 13) Riverwash, 14) Valverde silty clay loam, 15) Zapata-Vinegarroon complex, 16) Zorra-Rock outcrop association, and 17) Zorra-Rock outcrop association-steep types. In addition most of the soils occurring underneath the reservoir were labeled as water and some sites did not have a soil label, both of these areas were re-labeled as "Unknown". Once the soil layer was clipped and attributed it was joined to the temporary topology layer. The resulting polygons were edited and cleaned to remove small polygons (Figure 2)..

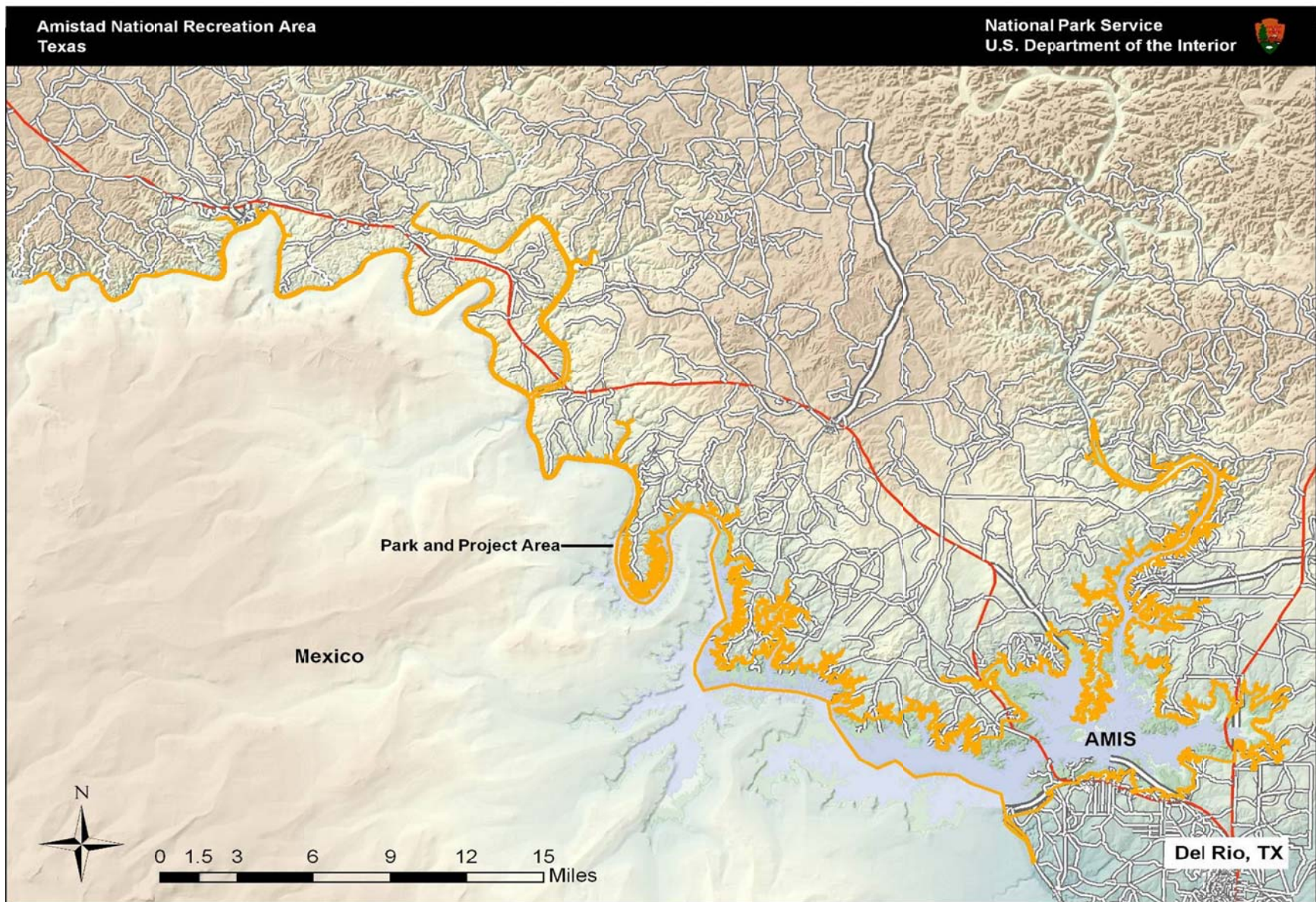


Figure 1. Park and Project Boundaries for Amistad National Recreation Area.

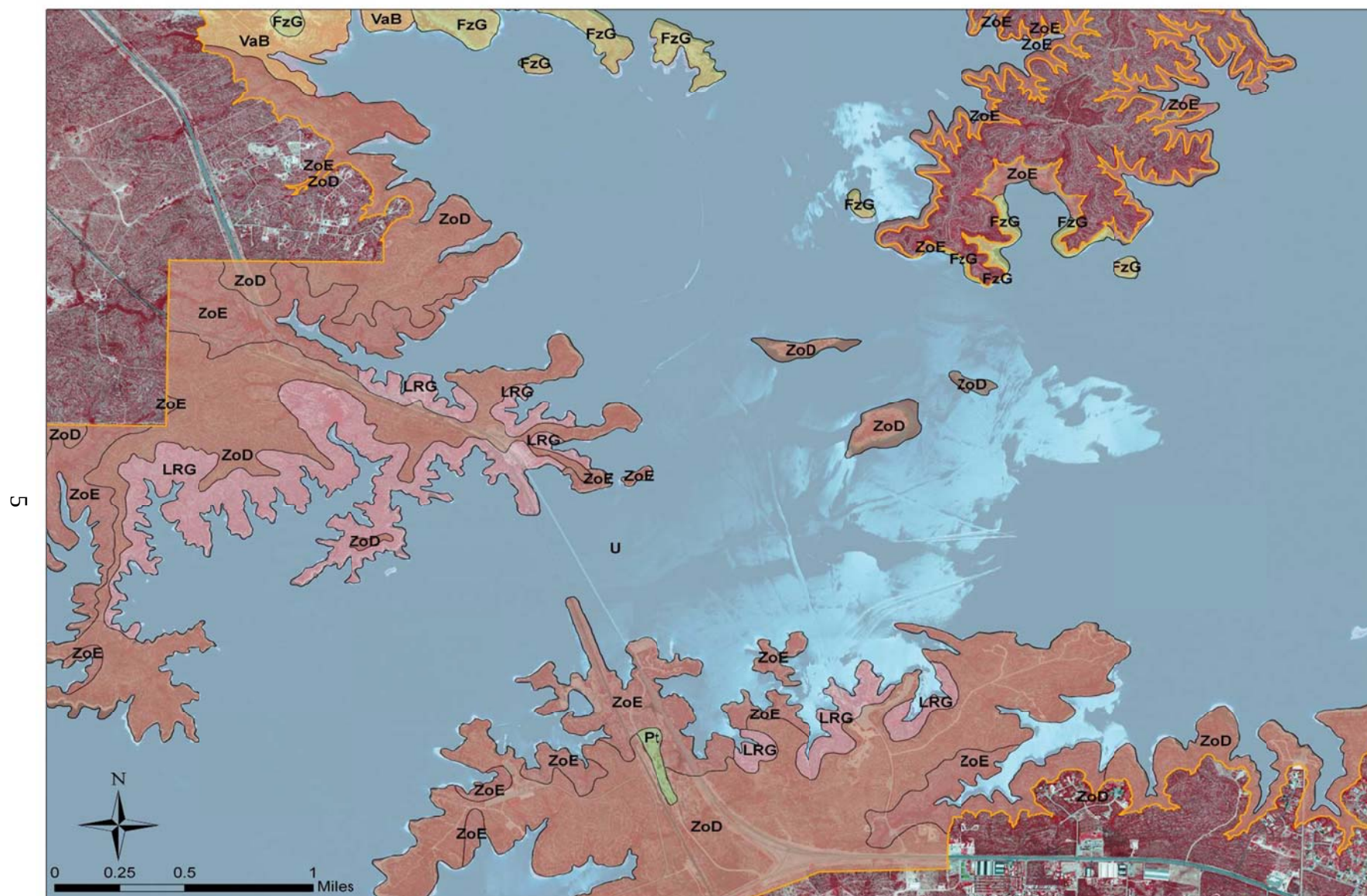


Figure 2. Example of the General Soils Map for AMIS.

Vegetation Cover

Based on The Vegetation Types of Texas (McMahan et al. 1984) three general vegetation cover types occur within AMIS (Figure 2) they are: 1) Ceniza-Blackbrush-Creosotebush Brush, 2) Mesquite-Blackbrush Brush, and 3) Mesquite-Juniper-Live Oak Brush. Two additional classes were added to this layer based on field observations during study plan preparation, they include: 1) the Mixed Vegetation type (added to account for areas where more than one vegetation type occurred in close proximity) and 2) the Submerged category (added to account for vegetation within the draw-down zone of the reservoir). The final vegetation cover layer for AMIS was joined to both the soils and topology creating a draft gradsect layer.

2010 NAIP Imagery

The 2010 NAIP ortho-imagery for Val Verde County was also downloaded from the USDA Geospatial Data Gateway website and was used to edit and revise the final BPU and gradsect layer for AMIS. Editing consisted of manually digitizing and removing lines to better match obvious vegetation patterns. At this time, additional vegetation and topology attributes were added to the final BPU layer (Figure 3). A Riparian topology category was added for sites that occurred along rivers, streams, drainages, or wet areas adjacent to the reservoir. A general vegetation type category was also added consisting of eight possible classes presented herein:

1) Annual Herbaceous Vegetation: Almost bare ground with no shrubs or trees and evidence of disturbance. This type was also used to attribute the draw-down zones.

2) Upland Herbaceous Vegetation: Almost bare upland ground with no shrubs or trees. No evidence of disturbance.

3) Upland Shrubs: Apparent short shrubs and brush occurring in upland locations away from the reservoir, varying in density and pattern

4) Upland Trees and Tall Shrubs: Upland sites containing larger shrubs or short trees.

5) Riparian Herbaceous Vegetation: Thick, lush vegetation occurring in floodplains, streambanks or wet areas next to the reservoir.

6) Riparian Shrubs: Riparian shrub stands located in floodplains, on streambanks, or wet areas, often thick.

7) Riparian Trees and Tall Shrubs: Tall shrubs and/or short trees occurring in riparian areas.

8) Mixed Shrubs: Stands supporting a mix of riparian and upland shrubs or upland sites supporting a mix of shrubs and brush.

Table 1 presents the complete list of the final BPU attributes for the AMIS gradsect layer.

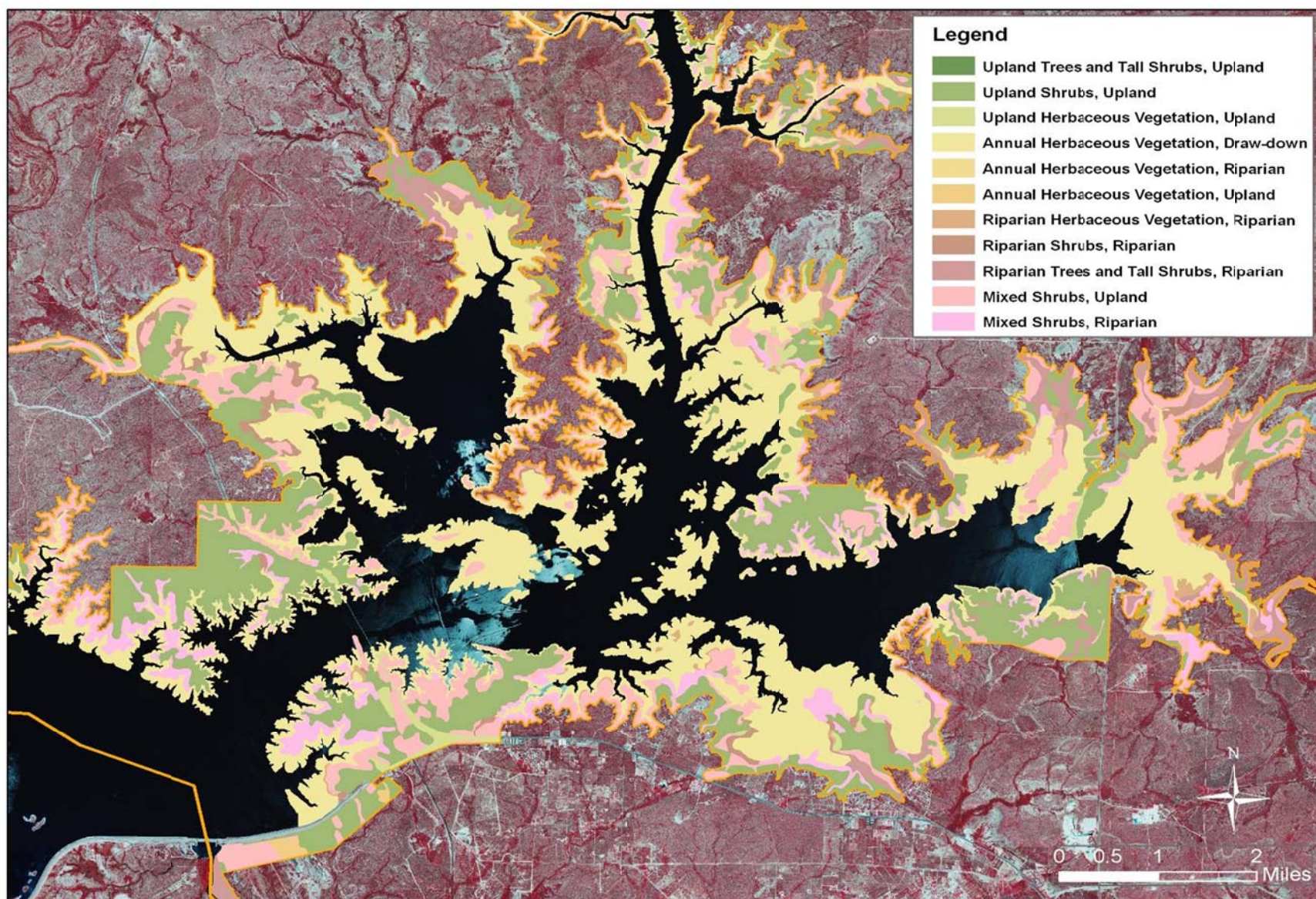


Figure 3. Example of the General Vegetation and Topology Map for AMIS

Table 1. AMIS BPU Attributes and Categories in the Gradsect GIS Layer.

Attribute Items / Categories

Topology	Veg Code	Vegetation	Soil Code	Soil Type
Draw-down	AHV	Annual Herbaceous Vegetation	AcB	Acuna silty clay
Riparian	UHV	Upland Herbaceous Vegetation	AsD	Amistad flaggy clay loam
Upland	US	Upland Shrubs	De	Dev soils
	UT	Upland Trees and Tall Shrubs	FzG	Felipe and Zorra soils
	RHV	Riparian Herbaceous Vegetation	JmD	Jimenez-Quemado complex
	RS	Riparian Shrubs	LRG	Langtry cobbly silt loam, very rocky
	RT	Riparian Trees and Tall Shrubs	LZD	Langtry-Rock outcrop association, very steep
	MS	Mixed Shrubs	LnD	Lozier-Shumla association, undulating
			MLG	Mariscal-Lozier association
			OmD	Olmos very gravelly loam
			Pt	Pits
			Ro	Rio Grande soils, frequently flooded
			Rv	Riverwash
			U	Unknown
			VaB	Valverde silty clay loam
			ZaC	Zapata-Vinegarroon complex
			ZoD	Zorra-Rock outcrop association, steep
			ZoE	Zorra-Rock outcrop complex
ID = Unique Polygon Identifier (1-1739)			Cover Code	Cover
Area = Polygon Size (sq. meters)			CEN	Ceniza-Blackbrush-Creosotebush Brush
Acres = Polygon Size (acres)			MES	Mesquite-Blackbrush Brush
			JUN	Mesquite-Juniper-Live Oak Brush
			MIX	Mixed Vegetation
			SUB	Submerged
<u>BPU = BPU Code (Veg Code + Soil Code + Cover Code)</u>				
BPU Example:				
MSZoDCEN = Mixed Shrubs + Zorra-Rock outcrop complex + Ceniza-Blackbrush-Creosotebush Brush				

Potential Sampling Target Sites

After editing the final gradsect and BPU layer, centroids were created for all polygons (Figure 3). The centroids were then attributed with the BPU codes, an unique identifier, and the X-Y coordinates (Projection = UTM NAD83, Zone 14 Meters). Since most of AMIS can be reached via boat, canoe, or on foot no logistical information such as distance from roads and slope steepness were added at this time. Instead, logistical information can be easily determined during the field work planning stage by overlaying the points on digital topographic quadrangles. All of the resulting centroids were considered potential sampling target sites or rallying points that could aid in navigation (Figure 4). A shapefile of these points was created and a summary of these points is presented in Appendix 1.

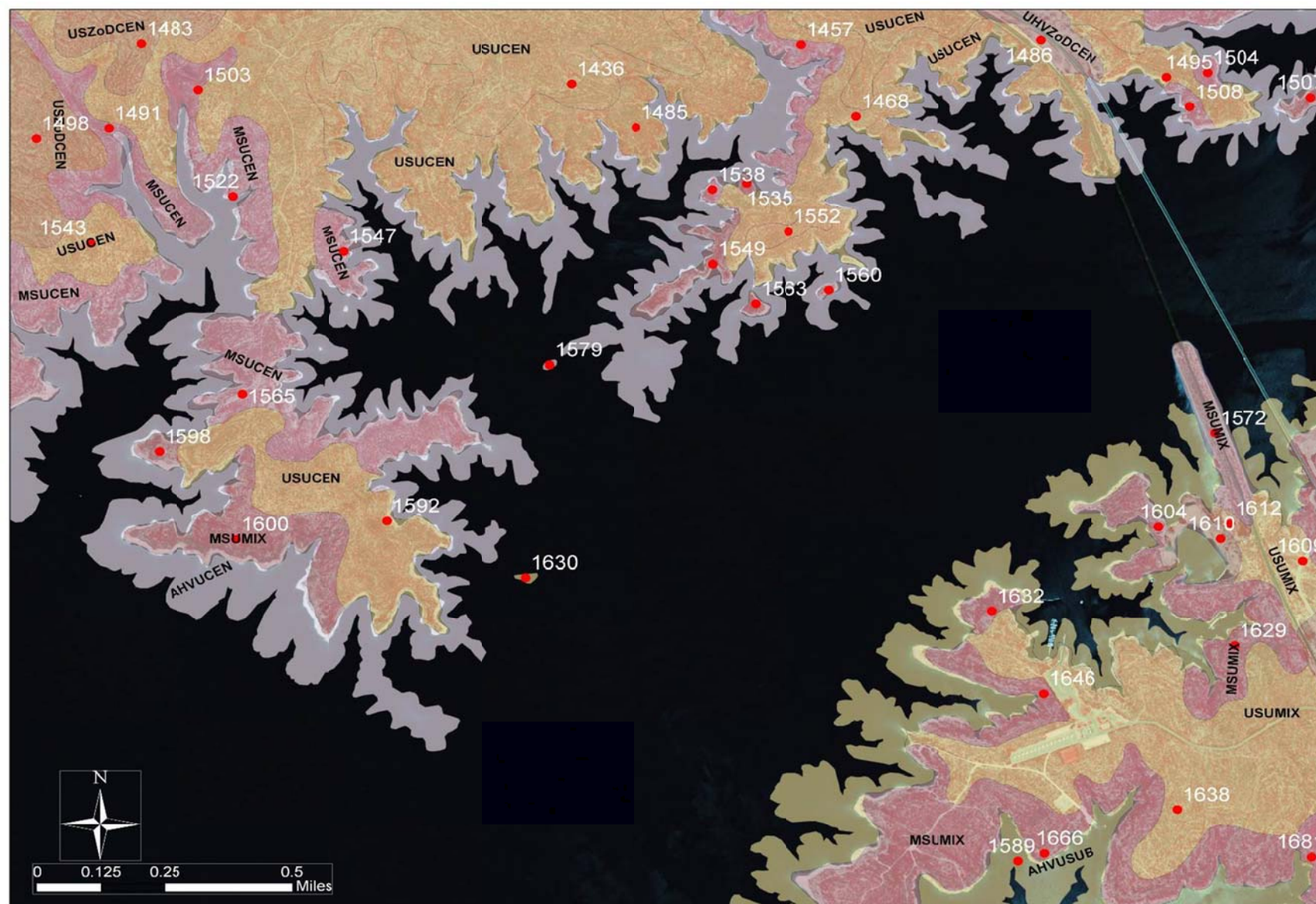


Figure 4. Example of the Final BPU map and potential sampling target sites for AMIS.

Discussion

Shapefiles containing the BPU polygons and potential sampling target sites were electronically distributed to NVIP, CHDN, and AMIS staff for review. The BPU polygons and target point shapefiles were also used to create field maps containing both aerial photography and digital topographic layers as backgrounds (Figures 5 and 6). Once the BPU and potential target sites were approved, copies of the field forms, field manuals (based on the data presented here), and hard-copy field maps will be delivered to AMIS prior to the start of the 2011 field season. In addition to the maps the following products can be supplied to the field crews as hardcopy reports: 1) tables that contain x y coordinates for each target site (Appendix 1), 2) a classification plot field instruction manual (Appendix 2), 3) a list of potential plant associations based on legacy data review (Appendix 3), and a list of known plant species that occur in AMIS (Appendix 4).

It is important to understand that the target locations and BPU polygons are meant to be used as guides or act as orienteering or rallying points. The actual determination of where to place the classification plot is solely dependent on field crew judgment. The purpose of this sampling strategy is to guide field crews into diverse environments that might contain representative and/or unique plant associations.

Since AMIS contains a large reservoir with fluctuating water levels, it is important to consider the draw-down zone when sampling. For the purposes of this analysis a rather large draw-done zone was incorporated into the sampling scheme. It was also assumed that most of the vegetation that would likely occur in this zone would be comprised of annual herbaceous species. It is likely that most, if not all of the draw-down zone will be inundated during sampling. If the reservoir is at or above the 1118 ft elevation during sampling any potential target sampling sites occurring in the draw-done zone should be removed from consideration.

Most of the decisions on how to use the gradsect and BPU data are the responsibility of field crew leaders. However based on similar studies, it is anticipated that AMIS sampling will be approached in a systematic, step-wise fashion. As logistics allow, it is recommended that the entire project area be evaluated relying on a combination of the BPUs, known access points and local knowledge of the vegetation. This evaluation can be accomplished in part by reviewing the data presented in this report, examining the field maps, using established access points (boat ramps, trails, roads, utility corridors, etc.) and by referencing the target point attributes.

The following example might be an applicable approach to sample the vegetation at AMIS:

Step	Description	Method
1	Create and Rank Sampling Areas	Split AMIS into smaller sampling areas based on boat ramps, road access, river miles etc.
2	Pick Potential Target Points	Evaluate targets in sampling area for accessibility and diversity
3	Determine Sampling Route	String points based on distance from one another
4	Navigate Through Use Areas	Work through area collecting data in representative stands
5	Tally Points and Use Areas	Cross-off vegetation types and sampling areas after data collection
6	Repeat as Necessary	----
7	Select Unique Areas to Sample	After sampling the common types focus on rare stands (e.g., riparian trees and tall shrubs)

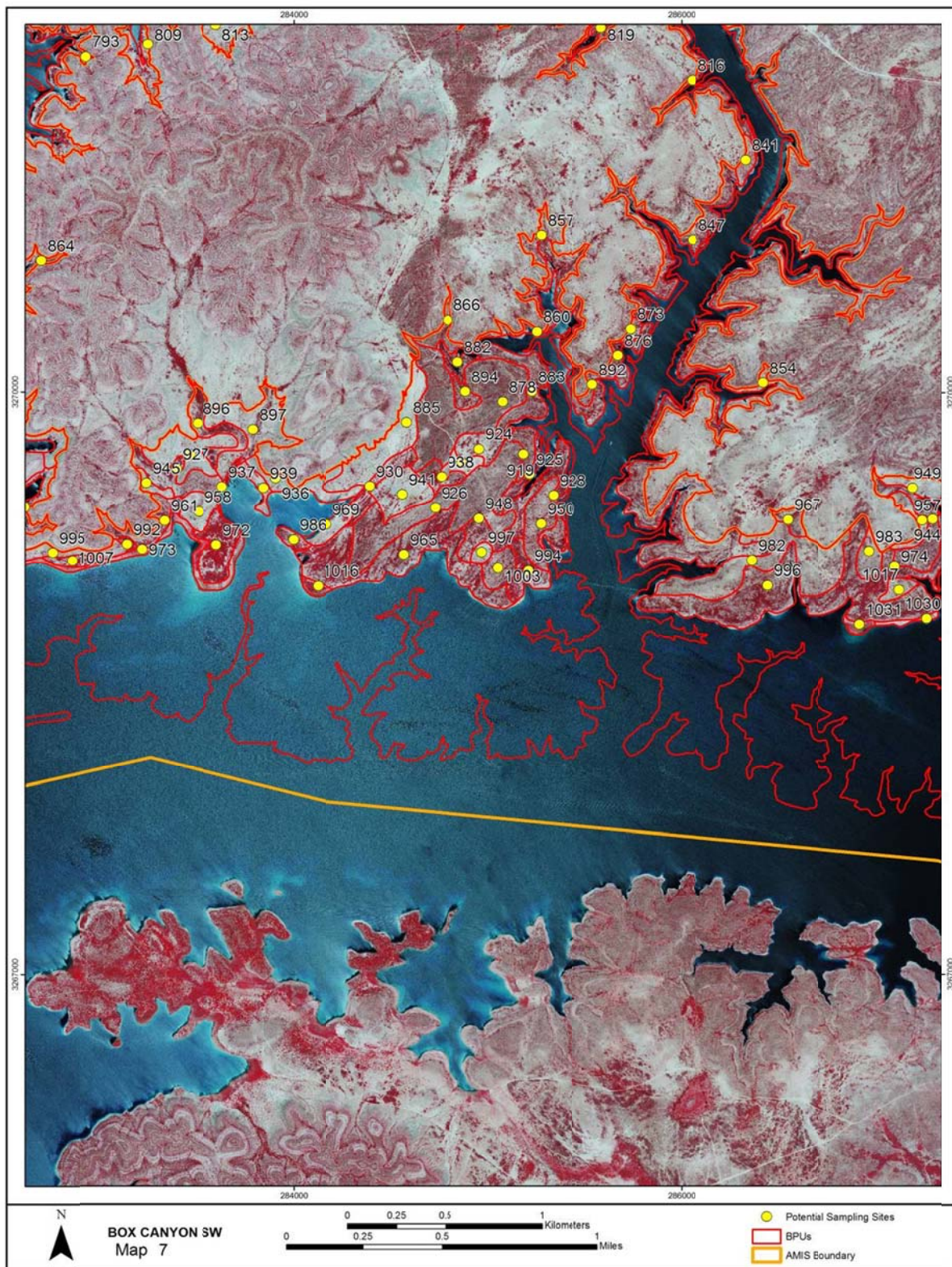


Figure 5. Field Map Example for AMIS with 2010 NAIP Image Background.

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Appendix 1: Potential Sampling Target Points

ID	BPU Code	X	Y
1	AHVLRCEN	253311	3300686
2	RHVLRCEN	254036	3300712
3	RSLRCEN	254756	3299727
4	RSLRCEN	253376	3300538
5	RSUCEN	254379	3300396
6	RSLRGMIX	253429	3300130
7	RHVLRCEN	263313	3300370
8	RHVLRCEN	270690	3300313
9	RHVLRCEN	263088	3300096
10	RHVUCEN	251314	3300221
11	AHVLRCEN	271487	3299967
12	RSUCEN	251741	3299866
13	AHVUCEN	251629	3300055
14	AHVLRCEN	250855	3300152
15	MSLRCEN	270276	3299881
16	RSLRCEN	271326	3299939
17	MSLRCEN	270395	3299825
18	RSUCEN	251641	3299105
19	RHVLRCEN	264223	3299385
20	RHVLRCEN	269995	3299588
21	MSLRCEN	271633	3299602
22	AHVLRCEN	263305	3299636
23	AHVUSUB	252600	3299596
24	RHVLRCEN	263510	3299492
25	MSLRCEN	271968	3298914
26	AHVLRCEN	269812	3299397
27	RSUMIX	251920	3299306
28	AHVLRCEN	264138	3299368
29	RHVLRCEN	264547	3299126
30	RSLRCEN	269675	3299239
31	RSUCEN	254923	3298935
32	RSUMIX	251478	3298973
33	RSLRCEN	269656	3299033
34	RSLRCEN	272177	3299134
35	AHVLRCEN	269471	3298989
36	AHVUSUB	251437	3298817
37	AHVLRCEN	266036	3298845
38	RSLRCEN	265283	3298934
39	AHVLRCEN	265421	3298913
40	AHVLRCEN	265018	3298898
41	RHVLRCEN	265599	3298887
42	AHVLRCEN	265725	3298847
43	RSLRCEN	268988	3298421
44	RHVLRCEN	265908	3298820
45	AHVLRCEN	266500	3298660
46	RHVLRCEN	266611	3298720
47	RSMLGMIX	251200	3298515
48	RSLRCEN	269195	3298508
49	RHVLRCEN	266744	3298650
50	RHVUCEN	254764	3298275
51	RHVLRCEN	267220	3298403
52	UHVLRGCEN	272237	3298276
53	RHVUMIX	251208	3298143
54	RHVLRCEN	267423	3298284
55	RHVUCEN	254661	3296532
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59	RSUCEN	261188	3297869
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61	RHVLRCEN	267782	3298011
62	RHVUCEN	251143	3297590
63	AHVLRCEN	267922	3298036
64	AHVUCEN	262369	3298027
65	RSLRGMIX	261335	3297994
66	RHVUCEN	262855	3297459
67	AHVUCEN	262750	3297745
68	AHVLRCEN	274273	3297514
69	MSLRGCEN	260524	3297795
70	RSMLGCEN	250970	3297703
71	MSLRGCEN	274312	3297585
72	AHVUCEN	254654	3297554
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75	AHVUSUB	260258	3297456
76	RSLRGCEN	262938	3297513
77	RSUCEN	251204	3297182
78	AHVUCEN	262897	3297108
79	MSLRGCEN	262887	3296963
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82	RSLRGCEN	272838	3297018
83	MSLRGCEN	273693	3297163
84	RHVLRCEN	273143	3297083
85	RHVUMIX	251268	3297001
86	AHVLRCEN	273110	3296721
87	RSUCEN	262754	3296609
88	RHVUCEN	251174	3296425
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91	MSLRGCEN	272915	3296603
92	AHVUCEN	248024	3296620
93	RHVUMIX	247429	3296397
94	RHVUCEN	249192	3296394
95	RHVUMIX	248207	3296582
96	RSLRGCEN	273200	3296507
97	RSLRGMIX	246939	3296421
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99	RHVLRCEN	272861	3295920
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101	AHVLRCEN	272318	3294659
102	RSUCEN	249553	3296339
103	RSUCEN	242644	3296435
104	AHVLRCEN	272707	3295529
105	RSUMIX	262791	3295613
106	AHVUCEN	242669	3296332
107	RHVUCEN	242425	3296346
108	AHVUSUB	249533	3296296
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111	RSUCEN	242841	3296157
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117	RHVUMIX	259034	3295991
118	RSUCEN	241528	3296019
119	RHVUCEN	250221	3296061
120	RHVUMIX	258567	3295733
121	AHVUSUB	250923	3296070
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123	RSUMIX	240374	3295966
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125	RSUCEN	265482	3294844
126	RSUCEN	254533	3295394
127	RSUCEN	239172	3295934
128	RSUCEN	245605	3295974
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131	AHVUCEN	245549	3295862
132	MSUCEN	241347	3295767
133	RSUCEN	243177	3295843
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153	RHVUMIX	262998	3294372
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157	MSLRGCEN	272266	3294825
158	RSLRGCEN	272296	3294572
159	AHVUMIX	254697	3294860
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161	RSUMIX	244490	3294626
162	AHVLRCEN	271890	3294238
163	MSUMIX	244380	3294616
164	UHVLRCEN	267995	3294569
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166	RSLRGCEN	267968	3294464
167	RSLRGCEN	271819	3294176
168	RSUCEN	266433	3293435

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172	AHVUMIX	264380	3293841
173	RSLRGCEN	271502	3293797
174	MSUMIX	263213	3293814
175	MSUCEN	266489	3293172
176	AHVLRCEN	271324	3293748
177	MSUMIX	264065	3293743
178	AHVLRCEN	271244	3292723
179	AHVUMIX	263446	3293672
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181	AHVLRCEN	271125	3293183
182	MSLRGCEN	271086	3293025
183	MSLRGCEN	271253	3292930
184	RSLRGCEN	271571	3292911
185	AHVUCEN	266928	3292673
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188	AHVLRCEN	271680	3292412
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190	MSUCEN	267561	3292426
191	AHVUCEN	268098	3292069
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215	UHVLRGCEN	272565	3289421
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218	AHVUCEN	272515	3289196
219	RSLRGCEN	272438	3289113
220	MSLRGCEN	272266	3288853
221	RSUMIX	269163	3288811
222	RSLRGCEN	271601	3288642
223	MSLRGCEN	271322	3288535
224	RSUCEN	270974	3288465

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229	RSLRGMIX	270678	3287140
230	RSLRGMIX	270613	3286747
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232	RSUCEN	276746	3286128
233	AHVUCEN	276083	3286118
234	AHVLRCEN	276781	3286132
235	USRVJUN	306005	3286137
236	RSUJUN	306085	3285805
237	MSUCEN	276678	3286052
238	AHVUCEN	276720	3285578
239	AHVUCEN	276712	3285878
240	MSLRGJUN	306055	3284875
241	RSUCEN	276784	3285499
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243	AHVRvJUN	306005	3285272
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245	RSUJUN	306165	3284401
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248	MSLRGMIX	270897	3284982
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250	AHVUCEN	276478	3284970
251	MSDeJUN	306310	3284763
252	AHVUJUN	306384	3284325
253	MSUJUN	306600	3283741
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255	MSLRGJUN	305921	3283788
256	RSUJUN	311880	3283598
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258	MSDeJUN	309846	3283559
259	RSUCEN	272917	3283846
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261	AHVUJUN	306487	3283564
262	RTLRCEN	275418	3283812
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266	AHVUCEN	274318	3283635
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268	AHVUMIX	274847	3283577
269	RTUMIX	275130	3283564
270	AHVUMIX	275429	3283523
271	AHVUMIX	275185	3283559
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273	MSUMIX	275851	3283432
274	MSUJUN	313488	3282521
275	RSUJUN	311816	3283158
276	RTUJUN	310816	3283232
277	RHVUJUN	309836	3283198
278	RSUJUN	306419	3283313
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291	RSUMIX	277314	3282020
292	RSUJUN	307338	3282613
293	RSUJUN	307631	3282073
294	AHVUSUB	271821	3282394
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319	MSUCEN	283384	3279733
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326	RHVUMIX	281684	3279848
327	USUJUN	311729	3278740
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332	RSUMIX	282265	3279537
333	MSUMIX	282875	3279523
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344	UHVZoDMIX	282593	3279116
345	USZoDMIX	282664	3279082
346	USVaBCEN	279296	3279081
347	RSUMIX	313023	3278907
348	USUJUN	311404	3278752
349	RSUJUN	313492	3279081
350	MSUJUN	313199	3278670
351	RSUMIX	313293	3279067
352	MSUMIX	276438	3278659
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354	RTLRGJUN	313527	3278977
355	UHVZoDMIX	282596	3278781
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357	RSUMIX	312274	3278495
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363	USUCEN	278685	3278571
364	USVaBMIX	276411	3278515
365	AHVUCEN	279232	3276896
366	MSFzGCEN	278150	3278581
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371	UHVUCEN	278302	3278526
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373	RSUCEN	278310	3278478
374	UHVfzGCEN	278290	3278443
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376	MSUMIX	282713	3278447
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379	USUJUN	311235	3278344
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382	USUCEN	278331	3278266
383	USUMIX	282978	3278177
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388	USUCEN	278455	3278197
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391	MSUCEN	278661	3278127
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395	MSUMIX	312502	3278034
396	RSUMIX	282733	3277583
397	RSUCEN	278777	3278066
398	MSLZDMIX	283037	3277885
399	USUCEN	278368	3278007
400	USUCEN	309375	3277409
401	USUCEN	278252	3277954
402	USUCEN	278607	3277924
403	RSUCEN	278795	3277938
404	RSUCEN	278295	3277983
405	USAcBMIX	282901	3277798
406	RSUMIX	311652	3277446
407	RSUCEN	278465	3277934
408	MSUMIX	276563	3277897
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410	RSUCEN	278626	3277855
411	MSUCEN	278362	3277792
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413	MSUMIX	276425	3277845
414	AHVUJUN	310868	3277651
415	MSUMIX	276722	3277788
416	MSUMIX	276392	3277683
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419	MSUCEN	279131	3277703
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421	RHVUCEN	278098	3277636
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425	MSUCEN	278830	3277586
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429	USUCEN	278779	3277421
430	USUCEN	278616	3277353
431	RSUCEN	278306	3277466
432	USUCEN	278322	3277403
433	AHVUSUB	311620	3277247
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435	USLRGCEN	278243	3277405
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459	RSUMIX	276322	3276721
460	MSLRGCEN	278234	3276969
461	MSLRGCEN	278281	3276933
462	MSUCEN	279250	3276944
463	USUCEN	283160	3276638
464	MSLRGCEN	278394	3276887
465	USUMIX	282757	3276817
466	USUMIX	282378	3276707
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469	MSFzGCEN	278781	3276795
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471	MSUMIX	282677	3276670
472	USLZDCEN	284044	3276731
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474	MSLRGJUN	308352	3276450
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476	AHVUCEN	283599	3276621
477	MSUCEN	278442	3276592
478	MSUMIX	283436	3276564
479	RSUCEN	283987	3276609
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483	MSUCEN	278576	3276578
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485	MSZoEJUN	307948	3276465
486	MSLRGCEN	278300	3276382
487	RSUCEN	283784	3276462
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493	RSUCEN	278650	3276430
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496	RSUCEN	278440	3276389
497	RSUMIX	276403	3276376
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504	RSUJUN	308056	3276243

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508	MSUJUN	308014	3276202
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511	RSLRGCEN	278505	3276298
512	RSUCEN	279054	3276242
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516	MSUMIX	283678	3276091
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518	USUJUN	308628	3275971
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521	RSUCEN	307452	3275626
522	MSUCEN	279088	3276070
523	RSLRGCEN	279018	3276095
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525	MSLRGCEN	278386	3275952
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527	USUMIX	276693	3275971
528	USUCEN	278494	3275817
529	MSUMIX	283261	3275848
530	MSUMIX	276553	3275907
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536	RSUCEN	278348	3275746
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543	MSUMIX	283125	3275671
544	MSUCEN	307252	3275083
545	MSUMIX	282830	3275650
546	RSUCEN	278768	3275538
547	USLRGCEN	278245	3275627
548	MSUMIX	276844	3275437
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551	MSLRGCEN	278598	3275524
552	RSUCEN	278117	3275375
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554	USUMIX	283096	3275276
555	RSUMIX	276559	3275512
556	MSUMIX	282656	3275416
557	MSUCEN	278943	3275476
558	RSUCEN	307280	3275372
559	RSUCEN	278869	3275415
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565	RSUCEN	278272	3275266
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568	MSUCEN	278390	3275266
569	USUMIX	282894	3275184
570	MSUCEN	278351	3275141
571	USUMIX	283979	3275124
572	RSUMIX	308401	3275208
573	MSUCEN	286682	3274598
574	AHVUMIX	277188	3275113
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576	USUCEN	277959	3274866
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580	RSUMIX	277265	3275087
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593	RSLRGMIX	276994	3274932
594	MSUJUN	307926	3274813
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615	RSUMIX	283647	3274395
616	MSUCEN	306975	3274516

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622	RSLnDMIX	277727	3274412
623	MSUMIX	277934	3274313
624	USLRGMIX	283847	3274350
625	RSUMIX	308817	3274288
626	AHVUCEN	303239	3269132
627	MSUMIX	283337	3274054
628	MSUMIX	283223	3274226
629	AHVUCEN	286630	3274130
630	RSUJUN	309885	3274205
631	MSUCEN	286328	3273725
632	USUJUN	307414	3274163
633	MSUJUN	307457	3274208
634	RSUMIX	277634	3274194
635	RSUMIX	277230	3274248
636	MSUMIX	277193	3274203
637	RSUCEN	306113	3274194
638	MSUMIX	277524	3274172
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643	USUJUN	309574	3274076
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646	MSUMIX	308734	3274023
647	AHVUMIX	277795	3274060
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649	USZoEJUN	309732	3273890
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652	USUJUN	309527	3273969
653	MSUJUN	307324	3273950
654	MSUCEN	286382	3273844
655	USUJUN	307553	3273823
656	MSUMIX	308545	3273740
657	USUJUN	309468	3273847
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660	MSLRGJUN	309308	3273850
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662	USZoEMES	312988	3273781
663	RSUMIX	283724	3273798
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666	USUMIX	283303	3273747
667	RTUMES	312347	3273466
668	UHVUMIX	308620	3273629
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671	USUJUN	309459	3273608
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675	RSUCEN	285372	3273673
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677	MSUJUN	307863	3273241
678	RSZoEMES	312564	3273630
679	MSUMIX	283355	3273363
680	RTUCEN	285943	3273417
681	MSOmDMES	312469	3273531
682	AHVUCEN	286108	3273515
683	RSUCEN	285374	3273536
684	MSUMES	311350	3273447
685	MSZoEJUN	310063	3273458
686	USOmDMES	312414	3273371
687	MSUMIX	308308	3273440
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689	MSUJUN	310360	3273260
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691	RSUCEN	286049	3273407
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694	USLRGCEN	287142	3273419
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716	USUMES	311446	3272985
717	USLRGCEN	283994	3273194
718	MSUMIX	308805	3273154
719	USUCEN	286953	3273075
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723	RHVUMES	311298	3273124
724	MSUCEN	286975	3272776
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726	USDeCEN	287896	3272997
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739	RHVUCEN	286885	3272949
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741	MSUMES	310339	3272963
742	RSUCEN	286782	3272979
743	MSUMES	311045	3272892
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754	MSUCEN	306792	3272494
755	MSUMIX	308623	3272662
756	MSUCEN	307868	3272612
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758	MSZoDMIX	309801	3272744
759	MSUMIX	309874	3272554
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774	UHVLRGCEN	285650	3272370
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783	MSUMIX	283151	3272135
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794	USUMES	310493	3272086
795	AHVUCEN	285916	3272222
796	MSUCEN	307598	3272125
797	MSUMIX	310388	3272186
798	MSUCEN	286388	3272082
799	UHVomDMIX	310821	3272153
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814	USUCEN	307173	3271850
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823	MSUCEN	306895	3271621
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828	USUCEN	304861	3271255
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834	RHVUMIX	308027	3271426
835	MSUMIX	282020	3271334
836	MSUMIX	282275	3271382
837	MSVaBCEN	304409	3271243
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846	RTUCEN	304669	3271068
847	MSUCEN	286058	3270780
848	USUCEN	307117	3271069
849	RSUCEN	304340	3271059
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851	MSUCEN	306936	3271018
852	RSUCEN	304424	3270920
853	RSUCEN	305460	3270765
854	MSUCEN	286422	3270046
855	MSUCEN	304943	3270846
856	USUCEN	305555	3270588
857	MSLRGCEN	285279	3270805
858	USUCEN	306597	3270125
859	USUCEN	308075	3270520
860	MSUCEN	285256	3270310
861	MSUCEN	307865	3270366
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863	MSUCEN	307955	3270461
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868	MSUMIX	282330	3269953
869	MSUCEN	289214	3269467
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871	RSUMIX	305927	3270294
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873	USLRGCEN	285740	3270324
874	USUCEN	289044	3269689
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876	MSUCEN	285675	3270187
877	USUMIX	308488	3270114
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879	MSOmDMIX	308506	3270225
880	MSUCEN	308137	3270168
881	MSUCEN	306779	3269637
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883	MSUCEN	285230	3270000
884	MSUMES	309353	3269938
885	UHVfzGCEN	284583	3269841
886	UHVZoDCEN	306564	3270139
887	RHVUMIX	305883	3270021
888	RHVUMIX	308396	3270068
889	MSUCEN	289147	3270126
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892	USUCEN	285545	3270037
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896	MSFzGCEN	283504	3269835

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902	UHVUMIX	305607	3269889
903	USOmDMIX	308741	3269864
904	MSUCEN	308080	3269911
905	MSUCEN	304506	3269947
906	RHVUMES	309490	3269606
907	UHVfzGMES	310079	3269694
908	MSUCEN	287549	3269656
909	USZoDMIX	308519	3269466
910	RSUCEN	307169	3269795
911	AHVUSUB	281716	3269850
912	USUCEN	307097	3269728
913	MSUMES	309761	3269543
914	MSVaBMES	310572	3269575
915	MSUCEN	307961	3269622
916	USUCEN	307953	3269720
917	UHVfzGCEN	283467	3269677
918	USUMES	309103	3269484
919	USUCEN	285185	3269678
920	USZoDCEN	308133	3269597
921	RSUMIX	305500	3269758
922	USOmDMES	309053	3269615
923	RHVUMES	310380	3269619
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925	MSUCEN	285218	3269576
926	USLRGCEN	284730	3269401
927	USUCEN	283396	3269603
928	MSUCEN	285341	3269465
929	RSUMIX	305789	3269574
930	MSUCEN	284396	3269513
931	USFzGMIX	305940	3269549
932	UHVomDCEN	284870	3269633
933	USZoDMIX	308300	3269600
934	RSUCEN	300110	3269666
935	USUMIX	282593	3269559
936	UHVUCEN	283906	3269553
937	MSUCEN	283633	3269510
938	MSOmDCEN	284763	3269561
939	RHVUCEN	283845	3269503
940	RHVUMES	309133	3269396
941	USVaBCEN	284562	3269470
942	RSUMIX	282615	3269406
943	RTUMES	310414	3269511
944	USZoECEN	287292	3269344
945	UHVfzGCEN	283243	3269530
946	UHVZoDCEN	306464	3269452
947	RHVUCEN	301305	3269364
948	USLRGCEN	284959	3269347
949	UHVUCEN	287190	3269503
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951	MSUMES	310106	3269484
952	MSUMIX	308346	3269397

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954	MSUCEN	307314	3269368
955	USUCEN	307033	3269134
956	USUCEN	303079	3269444
957	UHVZoECEN	287238	3269338
958	UHVUCEN	283511	3269381
959	USUCEN	288044	3269333
960	MSUCEN	287592	3269334
961	MSUCEN	283336	3269335
962	MSUCEN	308092	3269295
963	RHVFzGMIX	305674	3269349
964	RHVUMES	310334	3269158
965	MSUCEN	284569	3269159
966	AHVUCEN	288667	3268027
967	MSOmDMIX	286551	3269341
968	RHVUMES	310029	3269330
969	RHVUCEN	284173	3269316
970	RHVUMIX	308643	3269111
971	UHVfzGMES	310530	3269328
972	MSUCEN	283604	3269210
973	RHVUCEN	283222	3269187
974	MSUCEN	287099	3269100
975	RHVUMIX	308283	3269288
976	UHVUMIX	305678	3269283
977	MSVaBMES	310691	3269158
978	RTUMES	310453	3269218
979	MSUCEN	299914	3269116
980	UHVZoDCEN	306508	3269258
981	RHVUCEN	299668	3269220
982	UHVUCEN	286366	3269131
983	UHVomDCEN	286969	3269176
984	UHVUCEN	288027	3269189
985	USUMIX	282279	3269215
986	MSUCEN	283998	3269236
987	MSUCEN	287975	3269047
988	MSUMIX	305762	3269059
989	USUCEN	288164	3269192
990	MSUMIX	308324	3269143
991	USZoDCEN	306558	3269144
992	MSUMIX	283145	3269212
993	RSUMIX	282362	3269206
994	RSUCEN	285212	3269078
995	AHVUMIX	282760	3269168
996	MSUCEN	286445	3269004
997	UHVomDCEN	284972	3269170
998	RSUCEN	300036	3269151
999	USUCEN	288264	3269149
1000	UHVUCEN	287899	3269031
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1002	MSUCEN	307388	3269066
1003	USOmDCEN	285056	3269092
1004	USUCEN	301695	3268982
1005	USUCEN	302262	3269107
1006	USUCEN	288323	3268989
1007	MSUMIX	282861	3269127
1008	RSUCEN	299277	3268688

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1013	UHVZoDCEN	306665	3269039
1014	RHVUCEN	307117	3268988
1015	MSUCEN	288132	3268840
1016	RSUMIX	284123	3269002
1017	UHVomDCEN	287121	3268983
1018	MSUMIX	305885	3268868
1019	MSUCEN	288551	3268881
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1021	RHVUCEN	307063	3268435
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1023	MSUMIX	309096	3268713
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1027	AHVUCEN	299893	3268688
1028	RHVUMIX	305683	3268801
1029	MSOmDCEN	299376	3268749
1030	AHVUCEN	287261	3268835
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1032	RSUCEN	300003	3268745
1033	UHVUMIX	309583	3268718
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1035	MSUMIX	305905	3268571
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1037	RHVUMIX	305943	3268733
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1039	MSUMIX	309439	3268653
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1042	RHVDeCEN	296508	3268516
1043	MSUMIX	309734	3268508
1044	AHVUSUB	302871	3268620
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1047	UHVUMIX	288873	3268498
1048	USUCEN	290773	3268371
1049	MSUMIX	309322	3268320
1050	USLRGCEN	291353	3268449
1051	MSUCEN	290297	3268345
1052	RSUCEN	299890	3268303
1053	MSVaBMIX	310056	3268539
1054	UHVVaBMES	310253	3268530
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1056	UHVomDMIX	309479	3268382
1057	RHVUMIX	305482	3267998
1058	MSUCEN	298374	3268493
1059	MSUCEN	298593	3268156
1060	USOmDCEN	299686	3268426
1061	UHVVaBMIX	309759	3268300
1062	MSUMIX	288857	3268374
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1064	RHVUMIX	309291	3268274

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1066	RSUCEN	291123	3268329
1067	USZoDCEN	298516	3268292
1068	RTUMES	313941	3267795
1069	RTUMES	315519	3267898
1070	MSDeMES	313896	3268165
1071	USUCEN	290582	3268111
1072	MSUCEN	300468	3268210
1073	MSVaBMES	309939	3268149
1074	MSFzGMES	310240	3268174
1075	RSUCEN	301835	3267966
1076	RTOmDMES	316332	3267978
1077	USOmDCEN	298939	3268151
1078	MSUCEN	301380	3268056
1079	MSDeMES	313751	3267837
1080	USUMIX	308989	3268162
1081	MSOmDMES	315629	3267752
1082	UHVVaBMIX	309614	3268080
1083	USOmDCEN	301198	3267885
1084	MSUCEN	298796	3268071
1085	RHVUMES	310019	3268036
1086	RSZoDCEN	299305	3268055
1087	UHVfzGMES	310119	3268056
1088	MSUCEN	300760	3267877
1089	RTUMES	314335	3267312
1090	MSUCEN	301492	3267764
1091	RHVUMIX	309581	3268027
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1093	USUCEN	300295	3268039
1094	AHVUSUB	305177	3268070
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1096	RTOmDMES	316853	3267707
1097	USDeMES	314150	3267880
1098	MSZoDCEN	300083	3267933
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1103	MSUCEN	300546	3267826
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1110	USOmDMES	314382	3267627
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1112	MSUMES	315524	3267522
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1114	USZoDCEN	300180	3267797
1115	UHVZoDMIX	290378	3267837
1116	AHVUSUB	305206	3267818
1117	RHVUMIX	290317	3267767
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1128	USDeMES	314088	3267532
1129	USUCEN	302801	3267391
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1140	RSUMES	316096	3267344
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1142	USDeMES	317644	3267346
1143	RTOmDMES	317358	3267195
1144	USVaBCEN	301202	3267329
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1146	MSUMIX	289859	3267479
1147	MSUMIX	289542	3267204
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1154	USUCEN	301649	3267364
1155	USUCEN	300830	3267082
1156	USFzGMES	313717	3267382
1157	USLRGMIX	290124	3267411
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1159	RHVUMES	314127	3267285
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1162	RTUMES	315655	3267123
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1164	MSUMIX	290432	3267294
1165	MSUCEN	301676	3267302
1166	MSUCEN	303506	3267068
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1168	MSUMES	310203	3267275
1169	USUCEN	303501	3267164
1170	MSUMES	316819	3266714
1171	USUMES	313829	3267173
1172	USOmDMES	315461	3266931
1173	RSUMES	314302	3267196
1174	AHVUSUB	289208	3267216
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1176	MSLRGMIX	289903	3267192

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1181	USLRGMIX	289642	3267070
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1183	MSZoEMES	311936	3267041
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1185	MSAcBMES	317889	3266814
1186	MSUCEN	291031	3267029
1187	RHVAcBMES	318249	3267024
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1189	RSUCEN	291234	3267040
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1192	USOmDMES	314903	3266973
1193	MSUMES	314090	3266960
1194	RHVUMES	313738	3266923
1195	RHVomDMES	314161	3266948
1196	USAcBMES	318030	3266918
1197	MSUMIX	289482	3266926
1198	AHVUSUB	303965	3266847
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1203	MSUCEN	295274	3266506
1204	USUMIX	290591	3266852
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1207	AHVUSUB	305135	3266833
1208	RSOmDMES	317038	3266829
1209	MSUCEN	295867	3266271
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1227	RHVUMES	313672	3266643
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1229	AHVUCEN	307403	3266737
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1237	USUMES	315335	3266578
1238	RTUMES	312330	3266373
1239	RSUMES	316783	3266422
1240	MSUMIX	305211	3266606
1241	USUMIX	309787	3266604
1242	MSUMIX	305053	3266076
1243	MSFzGMES	313121	3266580
1244	AHVUSUB	290017	3266585
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1249	MSUMES	316450	3266452
1250	RHVUMES	312281	3266524
1251	MSZoEMIX	305172	3266499
1252	UHVfzGMES	312955	3266558
1253	UHVZoECEN	295514	3266539
1254	UHVZoECEN	295729	3266409
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1256	RHVUCEN	294601	3266506
1257	AHVUCEN	293860	3264873
1258	MSUMES	313397	3266438
1259	MSUMES	314780	3266480
1260	MSLRGMIX	290360	3266457
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1263	USUMIX	309523	3266291
1264	USAcBMES	317312	3266260
1265	USOmDMES	316089	3266328
1266	USUMES	314657	3266105
1267	RHVUCEN	295016	3266392
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1272	UHVOmDMES	314771	3266336
1273	RSUMES	317099	3266051
1274	MSUMES	315218	3266113
1275	MSOmDMES	316171	3266350
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1278	MSUCEN	301579	3266266
1279	USZoDCEN	301589	3266154
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1281	MSZoEMIX	305427	3266214
1282	RHVUMES	317023	3266140
1283	AHVUCEN	307225	3265973
1284	UHVZoECEN	294902	3266273
1285	MSOmDMIX	289782	3266255
1286	UHVOmDMES	313952	3266142
1287	AHVUCEN	292670	3266240
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1293	RSUMES	314695	3266231
1294	USUCEN	294216	3266014
1295	MSUCEN	292982	3266016
1296	USUMES	316457	3266145
1297	MSUCEN	295010	3266140
1298	MSOmDMIX	289943	3266121
1299	MSUCEN	294036	3265780
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1301	USUCEN	301793	3266078
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1303	USUMIX	309791	3266130
1304	RHVZoEMIX	305856	3266123
1305	UHVOMDMIX	290430	3266068
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1307	USUMES	310303	3265411
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1313	MSUMIX	305941	3265897
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1316	RHVZoEMIX	305478	3266006
1317	MSUCEN	296030	3266037
1318	MSUCEN	297719	3265170
1319	USOmDCEN	291745	3266039
1320	MSUCEN	295160	3265813
1321	MSUMES	311797	3265561
1322	RHVUCEN	294163	3265898
1323	MSVaBCEN	293851	3265892
1324	MSFzGMES	317119	3265837
1325	MSOmDCEN	291435	3265573
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1327	MSUMES	310123	3265856
1328	AHVUSUB	308280	3265755
1329	AHVUMIX	289767	3265977
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1332	AHVUSUB	304677	3266022
1333	USUCEN	291814	3265596
1334	AHVUSUB	308366	3265972
1335	USUCEN	301743	3265585
1336	MSUCEN	295817	3265934
1337	MSUCEN	296096	3265859
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1341	AHVUCEN	306607	3265915
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1348	AHVUMIX	289879	3265844
1349	RHVUCEN	294495	3265644
1350	UHVomDMIX	290656	3265819
1351	USUMES	309116	3265319
1352	MSUCEN	293631	3265755
1353	RTUMES	311037	3265822
1354	RSFzGMIX	305363	3265735
1355	USUCEN	293263	3265616
1356	AHVUCEN	302475	3265715
1357	MSUMES	316083	3265654
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1359	USUCEN	293031	3265621
1360	MSUMES	316613	3265639
1361	MSUMES	312547	3265596
1362	MSZoDCEN	292458	3265677
1363	MSZoDCEN	290990	3265730
1364	USUCEN	293608	3265466
1365	AHVUCEN	306759	3265717
1366	RHVUMES	316237	3265685
1367	USFzGMES	316611	3265715
1368	MSUCEN	301976	3265620
1369	MSUCEN	295795	3265510
1370	UHVZoDCEN	293173	3265684
1371	UHVfzGMES	316966	3265664
1372	USUCEN	294590	3265474
1373	MSUCEN	293520	3265656
1374	RSUMIX	313764	3265668
1375	MSUCEN	306249	3265607
1376	MSZoDCEN	294458	3265552
1377	USUCEN	293145	3265533
1378	MSUMES	311324	3265266
1379	MSUMIX	314165	3265273
1380	USZoDCEN	300601	3265302
1381	USZoDCEN	300685	3265504
1382	UHVZoDCEN	300777	3265485
1383	USZoDCEN	300873	3265485
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1385	MSUMES	313701	3265542
1386	MSOmDCEN	291279	3265556
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1391	AHVUSUB	306670	3265562
1392	MSUCEN	301943	3265189
1393	USZoDMES	311593	3265494
1394	AHVUCEN	294282	3265284
1395	MSUCEN	292986	3265309
1396	MSZoDCEN	292487	3265509
1397	RSUCEN	298198	3265487
1398	USZoECEN	300391	3265446
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1405	RSUCEN	298024	3265427
1406	AHVUCEN	292214	3265133
1407	AHVUCEN	291720	3265170
1408	MSUMIX	308958	3265379
1409	AHVUSUB	306808	3265443
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1411	MSUMES	310838	3264988
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1413	RSUMES	312433	3265311
1414	USUCEN	294110	3265232
1415	AHVUCEN	295476	3265299
1416	UHVZoDCEN	292537	3265359
1417	MSUCEN	296245	3265172
1418	MSUMIX	313582	3265361
1419	AHVUSUB	304685	3264702
1420	USOmDMIX	291402	3265134
1421	MSUMES	316206	3265089
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1423	AHVUSUB	308421	3265290
1424	MSZoECEN	300807	3265190
1425	USUCEN	293476	3265078
1426	UHVUCEN	292453	3265050
1427	AHVUSUB	308067	3264544
1428	RSUCEN	294854	3265156
1429	USUCEN	292721	3265108
1430	MSUCEN	294539	3265122
1431	RHVUCEN	294335	3265064
1432	USUCEN	294973	3265114
1433	USUCEN	294465	3265019
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1435	MSUMES	312200	3265141
1436	USUCEN	300853	3264168
1437	AHVUMES	312530	3265084
1438	UHVZoDCEN	293347	3265038
1439	MSUMES	312493	3265086
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1443	MSUMIX	295858	3264565
1444	MSUCEN	295089	3264546
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1446	MSUCEN	294471	3264680
1447	MSUMIX	309390	3264770
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1451	MSUCEN	301782	3264707
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1453	MSUMIX	309181	3264772
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1460	USUCEN	302381	3264523
1461	UHVZoDCEN	301852	3264688
1462	USZoDCEN	300861	3264706
1463	RSUCEN	301294	3264570
1464	RHVUMIX	294069	3264679
1465	USLRGCEN	301165	3264595
1466	USUCEN	294909	3264486
1467	AHVUSUB	306335	3264603
1468	USUCEN	301756	3264052
1469	AHVUMIX	294171	3264507
1470	MSUCEN	303108	3264496
1471	MSUCEN	302140	3264568
1472	MSZoDMIX	304726	3264459
1473	AHVUSUB	307622	3264555
1474	USUCEN	297443	3264441
1475	AHVUMES	309592	3262738
1476	RTZoDMES	317239	3264324
1477	USFzGMES	317059	3264361
1478	MSUMIX	294632	3264273
1479	AHVUSUB	309922	3264437
1480	MSUMIX	309882	3264439
1481	RTUMES	315048	3264262
1482	AHVUSUB	309566	3264452
1483	USZoDCEN	299488	3264307
1484	AHVUSUB	309148	3264376
1485	USUCEN	301058	3264013
1486	UHVZoDCEN	302341	3264320
1487	AHVUSUB	315765	3264455
1488	MSUMIX	314547	3264342
1489	USUMES	314211	3263853
1490	MSUMIX	309191	3264395
1491	MSUCEN	299387	3264010
1492	AHVUSUB	315482	3264420
1493	RHVUMES	316225	3264157
1494	AHVUMES	315423	3264363
1495	USUCEN	302740	3264191
1496	USZoEMES	314591	3263918
1497	AHVUSUB	306258	3264313
1498	USZoDCEN	299159	3263973
1499	MSUMES	316318	3263817
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1501	RTZoDMES	317642	3263960
1502	AHVUSUB	307366	3264266
1503	MSUCEN	299672	3264146
1504	MSUCEN	302870	3264207
1505	AHVUSUB	306284	3264152
1506	MSUCEN	298490	3263555
1507	MSUMIX	303195	3264120
1508	MSUCEN	302813	3264086
1509	RHVDeMES	317785	3264036
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1511	USUMES	312863	3263635
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1514	USZoEMES	314968	3263496
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1516	AHVUSUB	305392	3263968
1517	MSUMES	313746	3263650
1518	RTUMES	315362	3263849
1519	USZoEMES	313267	3263583
1520	RTUMES	317154	3263872
1521	USZoDMES	315660	3263988
1522	MSUCEN	299781	3263771
1523	AHVUSUB	307216	3263796
1524	MSUMES	315934	3263681
1525	RTVaBMES	316309	3263953
1526	AHVUSUB	304768	3263996
1527	USDeMES	317085	3263715
1528	MSUMES	312383	3263697
1529	MSUCEN	297907	3263691
1530	AHVUSUB	304388	3263905
1531	USZoDMES	317427	3263849
1532	MSDeMES	317626	3263802
1533	RTUMES	317451	3263620
1534	MSUMES	314568	3263739
1535	MSUMIX	301409	3263817
1536	RTUMES	312954	3263822
1537	USUMES	314014	3263349
1538	MSUCEN	301301	3263795
1539	MSUMIX	311999	3263437
1540	USZoDMES	315561	3263696
1541	MSZoEMES	312587	3263456
1542	MSOmDMES	317782	3263628
1543	USUCEN	299330	3263607
1544	RHVUMES	317323	3263488
1545	RTUMES	312811	3263598
1546	MSUMES	317273	3263474
1547	MSUCEN	300134	3263578
1548	MSZoDMES	314855	3263699
1549	MSUMIX	301302	3263535
1550	MSZoDMES	317511	3263583
1551	AHVUCEN	297243	3263705
1552	USLRGMIX	301542	3263648
1553	RTUMES	314763	3263248
1554	MSZoDMES	317598	3263475
1555	RTUMES	315521	3263348
1556	MSUMES	313837	3263505
1557	MSZoEMES	314879	3263330
1558	RHVUMIX	308237	3263482
1559	USUMES	312455	3263109
1560	MSUMIX	301671	3263444
1561	USZoEMES	313842	3263299
1562	USUMES	316313	3263348
1563	MSUMIX	301437	3263396
1564	USZoEMES	314292	3263279
1565	MSUCEN	299811	3263079
1566	RHVUMIX	307993	3263252
1567	AHVUSUB	294207	3263216
1568	RTUMIX	311657	3263200

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1570	MSUMIX	311596	3263145
1571	RTUMES	312537	3263146
1572	MSUMIX	302893	3262941
1573	MSZoEMES	313952	3263040
1574	USUMES	316076	3263106
1575	AHVUSUB	311320	3263184
1576	AHVUSUB	304040	3262657
1577	USZoEMIX	312049	3262987
1578	AHVUSUB	304342	3263193
1579	AHVUCEN	300784	3263181
1580	MSUMES	316200	3263036
1581	USZoEMIX	311715	3263084
1582	USAcBMES	314522	3262985
1583	USAsDMES	314735	3262985
1584	AHVUSUB	304366	3263085
1585	USUMIX	305270	3262287
1586	MSUMIX	305190	3262941
1587	RHVUMIX	307725	3263005
1588	MSUMES	316557	3262953
1589	AHVUSUB	302270	3261439
1590	RHVUMIX	308559	3262849
1591	MSUMIX	308829	3262618
1592	USUCEN	300269	3262633
1593	MSUMIX	306068	3262753
1594	MSUMIX	304093	3262825
1595	UHVUMIX	303657	3261887
1596	USUMES	316223	3262791
1597	MSUMIX	303290	3262816
1598	MSUMIX	299546	3262876
1599	MSUMES	311581	3262743
1600	MSUMIX	299791	3262568
1601	MSZoDMIX	308704	3262751
1602	MSUCEN	304505	3262390
1603	MSUMIX	305095	3262522
1604	MSUMIX	302715	3262612
1605	MSUMES	316291	3262626
1606	MSUCEN	306083	3262679
1607	MSUMIX	303245	3262590
1608	RHVUMIX	308332	3262695
1609	USUMIX	303171	3262492
1610	RHVUMIX	302910	3262569
1611	USZoDMIX	308705	3262615
1612	RSUMIX	302941	3262622
1613	MSUMIX	303415	3262432
1614	RHVUCEN	306200	3262614
1615	MSUCEN	305778	3262517
1616	MSUMIX	308235	3262402
1617	MSUMES	316139	3262526
1618	MSUCEN	304008	3262435
1619	MSUCEN	304084	3262533
1620	MSUMIX	308081	3262474
1621	RHVUMES	311776	3262527
1622	USZoDMIX	308699	3262047
1623	MSUMES	312122	3262242
1624	RHVUMIX	306727	3262412

ID	BPU Code	X	Y
1625	MSUMIX	308665	3262247
1626	MSUMIX	306929	3262340
1627	MSUMES	316286	3262393
1628	MSUMIX	307624	3261950
1629	MSUMIX	302955	3262194
1630	AHVUSUB	300708	3262432
1631	MSUCEN	304038	3262221
1632	MSUMIX	302187	3262315
1633	USZoDCEN	307878	3262180
1634	MSZoECEN	303431	3262169
1635	MSUMIX	306524	3262050
1636	UHVZoEMIX	303304	3262063
1637	MSUCEN	305568	3262217
1638	USUMIX	302774	3261620
1639	MSUCEN	310144	3262003
1640	MSUCEN	303663	3262157
1641	RHVUCEN	306423	3262110
1642	RTUMES	312096	3261590
1643	MSUCEN	305570	3261913
1644	MSZoDCEN	304155	3261971
1645	USUCEN	310987	3261974
1646	MSUMIX	302350	3262027
1647	MSZoDCEN	307973	3262025
1648	MSZoECEN	305699	3262020
1649	MSUCEN	307055	3262020
1650	MSOmDCEN	311105	3261941
1651	MSUCEN	309148	3261889
1652	MSUMES	311908	3262078
1653	MSOmDCEN	310431	3261938
1654	MSUCEN	305290	3261956
1655	RHVUCEN	311120	3261954
1656	MSZoECEN	303502	3261853
1657	MSFzGMES	312291	3261964
1658	MSUCEN	308679	3261762
1659	MSZoDCEN	303872	3261860
1660	USZoDCEN	308689	3261426
1661	UHVomDCEN	310981	3261767
1662	MSFzGMES	312284	3261835
1663	RSUCEN	304852	3261666
1664	USOmDMES	311129	3261302
1665	MSUMES	311373	3261759
1666	MSUMIX	302352	3261466
1667	MSZoDCEN	303600	3261652
1668	MSFzGMES	312215	3261512
1669	MSUCEN	304939	3261631
1670	RSUCEN	310871	3261697
1671	USVaBMES	312203	3261652
1672	RSUCEN	309186	3261706
1673	UHVomDCEN	311260	3261731
1674	RSUCEN	310494	3261649
1675	RSUMES	311467	3261442
1676	MSZoDCEN	304718	3261596
1677	MSUCEN	310634	3261609
1678	USZoDCEN	303655	3261476
1679	MSOmDCEN	310970	3261569
1680	UHVfzGMES	312245	3261514

ID	BPU Code	X	Y
1681	MSUCEN	303199	3261454
1682	RSUCEN	308856	3261267
1683	RHVUCEN	310522	3261426
1684	UHVZoDCEN	309041	3261506
1685	UHVUCEN	310597	3261362
1686	RTUMES	312033	3261322
1687	MSZoDCEN	303780	3261310
1688	MSZoDCEN	308741	3261336
1689	MSZoDCEN	303557	3261262
1690	RSUCEN	310505	3261335
1691	USVaBMES	312147	3261317
1692	MSZoDCEN	304608	3261346
1693	MSZoDCEN	304791	3261349
1694	UHVZoDCEN	304992	3261350
1695	MSZoDCEN	304417	3261338
1696	UHVZoDCEN	304067	3261210
1697	UHVfzGMES	312292	3261194
1698	MSUCEN	303263	3261224
1699	MSUCEN	303059	3261101
1700	RTUCEN	310853	3260983
1701	MSUCEN	311657	3261108
1702	MSVaBMES	312235	3261138
1703	MSUCEN	311031	3261048
1704	MSUCEN	310196	3261115
1705	MSUCEN	308990	3260974
1706	UHVVaBMES	312058	3261022
1707	MSUCEN	310036	3261035
1708	USUCEN	310621	3260704
1709	MSFzGMES	312286	3261007
1710	MSUCEN	309809	3261060
1711	MSUCEN	309534	3261021
1712	MSUCEN	310842	3260755
1713	USZoDMIX	302708	3260260
1714	MSUMIX	302445	3260706
1715	MSOmDMES	311861	3260815
1716	USOmDMES	311953	3260811
1717	RHVUMIX	302308	3260667
1718	MSUCEN	311374	3260668
1719	MSZaCCEN	308651	3260751
1720	RTZoDCEN	311447	3260511
1721	USZoDCEN	311226	3260599
1722	USZoDCEN	303399	3260510
1723	AHVZoDCEN	303260	3260441
1724	USZoDCEN	303055	3260282
1725	MSZoDCEN	303058	3260517
1726	RSUMIX	302597	3260359
1727	MSZoDCEN	302876	3260109
1728	USZoDCEN	302745	3259869
1729	MSZoDCEN	302510	3259919
1730	USZoDCEN	302144	3259616
1731	MSZoDCEN	302545	3259639
1732	MSZoDCEN	301767	3259630
1733	AHVZoDCEN	301712	3259443
1734	MSPtCEN	301082	3259301
1735	RTJmDMIX	300617	3258740
1736	USJmDMIX	300656	3259096

ID	BPU Code	X	Y
1737	RSUCEN	301908	3257178
1738	RHVRoCEN	301365	3257952
1739	MSRoCEN	302193	3256325

Appendix 2: 2010 Field Sampling Instructions

This document is intended to assist you in conducting vegetation inventory to produce an accurate map for Amistad National Recreation Area (AMIS) during the 2011-2012 field seasons. Detailed, field-by-field instructions for data collection are provided for standard classification plot and observation point forms. The instructions are abbreviated on a ‘cheat sheet’ at the end of this document. This project is being directed by the Chihuahuan Desert Network (CHDN) Inventory and Monitoring Program with assistance from Cogan Technology, Inc. (CTI).

VEGETATION DATA COLLECTION INSTRUCTIONS

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NAVIGATING TO CLASSIFICATION PLOT

You will navigate towards each selected Biophysical Unit (BPU) using a combination of aids that may include: BPU maps, park maps, topographic maps, handheld GPS receivers, and aerial photos. In general:

- BPU maps will identify the location, size and shape, and centroid of the polygon.
- Topographic (Topo) maps are useful in identifying the landscape through which you will be navigating, and in determining the elevation of a plot. You will find them useful with the BPU maps in providing the names of landscape features, as well.
- GPS receivers indicate the direction and the distance (as the crow flies) to the centroid, the center of the BPU. The centroid is the center of the measured area of a given BPU, but that center does not always land in what appears to be the center of oddly shaped polygons. Regardless of where the centroid is within the polygon, it is an important navigational guide to locate the vegetative stand you need to sample. **Note:** *In very homogenous terrain, you may want to obtain UTM coordinates for the location of your vehicle or track your route using your GPS receiver, which allows you to locate your parking site and is also useful in writing the directions to your plot.*
- Aerial photos aid in navigating through the landscape, and are essential in determining where to establish a plot (this use will be explained below in more detail). **Please** record

the vegetation (and its condition), that you walk through and sample on the photo. Feel free to write comments regarding unique features, as well.

Along the way...look around. Context is everything – you will have a much better sense of how your classification plots represent the landscape if you are always in analysis mode. Keep in mind that the goal of this field work is to sample **all** the different vegetation types that occur at the park. If, on the way to a BPU or plot, you see an assemblage of plants that seems unique and that is not included on the list of vegetation types, **please** sample if time allows, or at least complete an observation form. With these instructions a list of potential vegetation alliances and plant associations for the parks are provided. As the season progresses, this list will be updated if necessary and you will be better able to recognize new (unsampled) alliances and associations more easily.

Park Special Features...in the process of navigating to plots you will encounter unique features or vegetative stands too small to sample, obtain UTM coordinates using your GPS receiver and note them on aerial photos and maps. These UTM coordinates will be added to the final production map as “Park Special Features” (examples include springs, seeps, hanging gardens, a small patch of trees, shrubs, cattails, etc). It is possible that we may be asked to help document Archeological sites for the park. In particular, field crews are requested to document locations (UTM coordinates) of springs, seeps and hanging gardens and record very general descriptive information on the Park Special Features Form. In addition the park may request that general locations of significant weed occurrences (highly invasive species that pose a big threat) and large areas of infestation also be documented (sample these with classification plots). Finally all CHDN parks are working on documenting with specimen vouchers all vascular plants in each park. Field crews are supplied with a working vascular plant species list for each park with this instruction manual. Another list provided by the parks will indicate which plants are presently vouchered. Field crews are requested to collect herbarium quality specimens of vascular plant species presently not represented in the collection. Please be careful not to collect extremely rare plants. In this case a photographic voucher would be in order.

ESTABLISHING A CLASSIFICATION PLOT

1. PLACEMENT OF PLOT

Figuring out where to place your classification plot is a subjective process. You should place your plots in areas that seem to be both relatively **homogenous** and **representative** of the vegetation of the polygon as a whole. In other words, avoid areas where the vegetation appears to be transitioning from one type to another (ecotones) and areas with anomalous or heterogeneous structure or species composition. The aerial photos will help you identify the different vegetation types available in each BPU to sample – similar color, pattern and texture usually indicate similar vegetation. Take some time and perform this step, because some of the plots you set up may be re-sampled over time in order to determine responses to management and other useful information. Look at *all* the vegetation layers to determine if the area is structurally and floristically uniform and generally try to place your plots **at least** 30 m (100 feet) from what you see as the ‘boundary’ between this vegetation type and neighboring, different types. The exception to this rule is when you are sampling a unique type that is always going to occur in

small patches and usually has sharp boundaries, such as a spring or seep. **Note:** In cases where a polygon is very heterogeneous, more than one plot may be needed. Again, look around; use your acquired knowledge and judgment.

2. SIZE AND SHAPE OF PLOT

The chart below indicates what size classification plots should be for each vegetation type. Circular plots are the standard plot shape employed in this project, but check with the parks staff to verify. In very limited circumstances where vegetation occurs in linear patterns, a rectangular plot may be required. For example, rectangles are ideal for ridgelines, hillsides, and riparian zones, or communities where the vegetation has a patchy or irregular distribution. Circles are well suited to very large, homogenous vegetative stands. Selecting the shape of the plot to fit it into a given sample area is fine, but please try not to make a plot smaller than the sizes listed below. **Make sure the type you are describing occupies an area of at least 0.5 hectare** (a circle approximately 80m in diameter!!). This area is necessary because the standard plot is about the size of a pencil point to the photo interpreter – even 0.5 hectare is only the size of a pea. Vegetative communities too small for a plot should be sampled as an Observation Point (instructions for points are after plots in this packet).

If you're in a ...	Circular Plot, Homogenous Vegetation	Rectangular Plot, Heterogenous Vegetation
Forest (i.e., trees have their crowns overlapping, usually 60-100% total cover)	400 m ² 22.6 m diameter	400 m ² 10 x 40 m 5 x 80 m, etc.
Woodland (i.e., stands of trees with crowns usually not touching. Canopy tree cover is 10-60% or exceeds total shrub, dwarf-shrub, herb, and nonvascular cover).	400 m ² 22.6 m diameter	400 m ² 10 x 40 m 5 x 80 m, etc.
Shrubland (i.e., shrubs greater than 0.5 m tall are dominant, usually with more than 25% cover or exceeding tree, dwarf-shrub, herb, and nonvascular cover).	400 m ² 22.6 m diameter	400 m ² 10 x 40 m 5 x 80 m, etc.
Dwarf-shrubland (i.e., shrubs less than 0.5 m tall are dominant, usually with more than 25% cover OR exceeding tree, shrub, herb, and nonvascular cover).	100 m ² 11.3 m diameter	100 m ² 5 x 20 m 2 x 50 m, etc.
Shrub Herbaceous (i.e., forb and/or grass cover roughly equal to shrubs or dwarf shrubs).	100 m ² 11.3 m diameter	100 m ² 5 x 20 m 2 x 50 m, etc.
Herbaceous (i.e., herbs or grasses dominant, usually forming more than 25 percent cover).	100 m ² 11.3 m diameter	100 m ² 5 x 20 m 2 x 50 m, etc.
Nonvascular (i.e., lichen or moss cover dominant, usually forming more than 10% cover).	25 m ² 5.65 m diameter	25 m ² 1 x 25 m 2.5 x 10 m, etc.
Sparsely Vegetated (i.e. less than 10% cover).	1000 m ²	400 or 1000 m ²

VEGETATION PLOT SURVEY FORM INSTRUCTIONS - 2010

These instructions discuss the 2010 version of the plot data sheet, field by field. [Please note that these data must be recorded for later entry into the plots v3 ms access database prepared for all NPS - National Vegetation Inventory Program projects.] [Please note that the CHDN is in the process of developing a GPS Data Dictionary for recording several fields associated with the Vegetation Plot Survey Form. Also note that all data entered into the GPS receiver will also be entered manually on the paper forms.]

■ IDENTIFIERS/LOCATORS SECTION

Plot Code

This is a unique identifier you give each sample plot using the format "PARK.XXX". Each field crew will be assigned a set of numbers to use (e.g., 100-299, 300-499, etc.). Circle the appropriate park acronym, and write the plot number on the blank line. The same numbering convention will be used for observation points, except that the number of the observation point is four digits, the first of which is always "9". For example, the crew using the numbers 101 through 199 would call their first plot "AMIS.0101" and their first observation point "AMIS.9101". **Please record the plot code on every side of every form in the provided field.**

BPU CODE

The biophysical unit identified is the polygon identifier on the DRG map. If you have encountered a unique or new vegetation community that is not in a designated BPU, enter "None". Find the BPU number on your BPU list and write the number of the plot or observation point in the "Comments" box.

COUNTY

This field is already completed as "Val Verde" on all data sheets.

STATE

This field is already completed as 'TX' on all data sheets.

SITE NAME

This name is best determined from a topo map. Select a nearby feature that an obvious waypoint, such as the name of a canyon, hill, road, or drainage (e.g., Rough Canyon). This name does not need to be unique. If you sample a number of plots in a small area, you can use the same site name for all of them.

LOCATION

This field identifies whether or not the plot is within the park boundary or in the environs. Circle the appropriate location.

QUAD NAME

Record the **full name** of the 7.5-minute quadrangle, such as “Del Rio NW”. Locate your plot on the map, and mark your location with a dot in a circle and the plot number.

AERIAL PHOTO OR ORTHOPHOTO NUMBER

The photo or orthophoto number is in the upper right hand corner of the image in the format FLIGHTLINE-FRAME # or the orthophoto number. Record this number on the form. Locate your plot on the photo/orthophoto, and mark your location with a dot in a circle and the plot number. Again, please draw and comment on the photo/orthophoto regarding the vegetation of the plot and the surroundings.

GPS FILE NAME

This is the name you give to the waypoint when you mark the plot location in your GPS receiver. The GPS receiver reading should be taken from the center of the classification plot. Please give the waypoint the same number as the plot, and the prefix “AP” for an Amistad plot (e.g., AP241 for classification plot #241). If sampling an observation point, the file name would be “AO” and the number (e.g., AO9101 for point #101). Mark the plot location on the BPU map using the same method that you marked the aerial photo/orthophoto (a dot with a circle around it and the plot number, “AP241”).

GPS RECEIVER:

Record the name and model of the GPS receiver being used to record data for the classification plot. If a GPS receiver was not used to determine UTM coordinates record ‘none’ here and be sure to complete the ‘GPS Comments’ field below.

DATUM

ALWAYS check this field on your GPS receiver. It should **always** be NAD83. Datum information is **CRITICAL** for correctly applying your waypoints to the final vegetation map. If it is anything other than NAD83, **please, please, please** record this change on the form; this step will keep your work from being wasted.

UTM ZONE

This value is already entered on the datasheet and will remain the same throughout the project.

GPS COMMENTS:

VERY IMPORTANT: If you resorted to estimating the plot location UTM's on the topo map (see below), note that in this field. If your usual GPS receiver croaked and you had to borrow an old Garmin from a friend, note that. Also, if you left the plot to obtain a reading from a high point, record that here, along with the compass bearing and distance of the UTM coordinate location from the plot center.

FIELD UTM X, FIELD UTM Y

Record the UTM easting and northing you saved as a waypoint in your GPS receiver. Please double-check to make sure that the easting is six digits and the northing is seven digits. If recorded incorrectly, your plot will show up in Venezuela or the middle of the Caribbean.

In deep canyon country it is sometimes difficult to obtain UTM coordinates from a GPS receiver (your unit must acquire at least three or four satellites). If you are unable to obtain UTM coordinates in the plot, or if the EPE is greater than $\pm 50\text{m}$, first try to acquire a signal from a higher point outside (but still close to) the classification plot. If that fails, you will need to estimate the UTM coordinates from the topo map, and manually enter them into the GPS receiver.

However, the topo maps you have use the NAD27 datum, while the project standard is (and your GPS units are in) the NAD83 datum. The difference is that the NAD83 grid is shifted about 60m west and 200m north of NAD27. To ensure that all your plots show up in the right place, please use this procedure when estimating UTM coordinates from the topo map:

1. Locate your plot as accurately as possible on the topo map, using triangulation or climbing to a high point.
2. Use the topo map, straightedge, pencil and a transparent overlay grid to obtain UTM coordinates in NAD27 (performed carefully, you should be able to record to the nearest 10m). Write these coordinates in the GPS Comments Field with the note "UTM coordinates derived from topo map". DO NOT enter these in the UTM X and UTM Y fields.
3. Update the settings in your GPS receiver to the NAD27 datum.
4. Create a new waypoint, give it the name of your plot, and enter the UTM coordinates you wrote down.
5. Update the settings in your GPS receiver back to the NAD83 datum. This action will convert the NAD27 coordinates to NAD83 without screwing up the coordinates you already had in your machine (there may be rounding error). Enter the converted coordinates (now in NAD 83) into the UTM X and UTM Y fields.
6. Try to perform this conversion only once per field trip, because the more often you do it, the more likely it is that the rounding error will change the coordinates of your other (non-topo-derived) classification plots. You can perform this conversion in the office during datasheet cleanup and entry time.

GPS RECEIVER ERROR

Note the "Estimated Position Error" (EPE) displayed on your GPS receiver. The longer you wait to mark the waypoint, the longer the GPS receiver has to gather satellite information and determine your location more accurately (using the antenna will also help acquire more accurate readings). The lower the EPE number - the more accurate your reading; also, 3D Differential is the most accurate level of reading - you may have to resort to 3D GPS or 2D GPS in canyons or other landforms. If that is the case, please note "3D GPS" or "2D GPS" in the GPS Comments field.

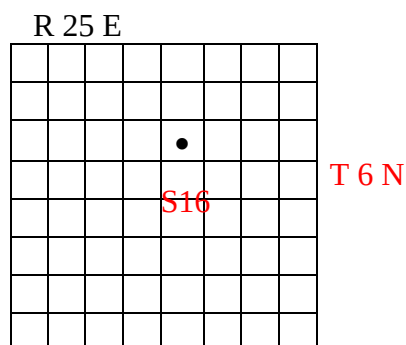
3D DIFFERENTIAL?

Circle Y or N accordingly. 3D differential is obtained when your GPS receiver can acquire a satellite that does nothing but correct the tiny errors in the positioning or clocks of other GPS satellites. This satellite broadcasts a real-time differential correction so that your location coordinates are as accurate as possible. It is in geosynchronous orbit in the southern sky, so if you can see the southern sky, you will generally be able to acquire 3D differential. This system is

known as the Wide-Area Augmentation System, or WAAS. The Garmin and Trimble GPS receivers have a field in their setup pages for turning WAAS on or off. Please make sure that WAAS is **always** on.

DIRECTIONS TO PLOT

Give precise directions to the classification plot beginning with a landmark (e.g., a named point on the topo map, a major highway, marked trailhead, etc.) readily locatable on a 7.5 minute topo map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances and use compass directions. Be aware of the ambiguity of words like "above", "near", "beyond", "on the back side of", "past". Again, using the GPS receiver to give distances can be very helpful. If classification plot locations lack major landmark features as guides, use township, range and sections (TRS) from the topo maps. If there are no features within a reasonable distance of your classification plot and writing directions is taking an inordinately long time, you can use a TRS description to the nearest quarter-quarter-quarter section. TRS directions are extremely error prone, so please have your field partner check it before you leave the plot. The TRS for the plot in the section below is "NW4SW4NE4 Sec. 16, T 6 N, R 25 E".



Note: Although the classification plots will not be permanently marked, park staff would very much like to relocate them for long-term vegetation monitoring purposes. Careful documentation of the stand characteristics, access route, obvious landmarks and vegetation is therefore extremely important. DO NOT use one classification plot to reference the location of another; TRS is preferable to this form of reference.

SURVEY DATE

Date the classification plot was sampled. Please use this format: Month - Day - Year.

SURVEYORS

List the last names of the field team members present.

PLOT DIAMETER, LENGTH, WIDTH AND AZIMUTH,

Enter diameter for circular plots (5.65m, 11.3m or 22.6m etc.) OR width and length dimensions for rectangular plots. Record the azimuth for the long side of rectangular plots.

PHOTOS TAKEN?

Circle Y or N accordingly for classification plot digital photographs and for landscape or other photographs.

CAMERA NAME AND MODEL

Record name and model of camera.

PHOTOS: TYPE/FRAME NUMBER/PHOTOGRAPHER/DIRECTION AND COMMENTS

For each digital photograph taken at the classification plot record the following: *Photo type*: indicate whether photo is a 'plot', 'landscape' or 'other' photo. *Number*: record digital photograph number from camera. *Photographer*: record last name of person taking photograph. *Directions/Comments*: record the direction the photographs were taken from and towards (e.g. SE→NW) and any other comments to clarify the contents of the photograph (especially landscape/scenery photos). Also, representativeness of the biological crust photograph (if one is acquired) can be commented on here.

TAKING PHOTOGRAPHS

Take a minimum of two digital photographs of each classification plot. The purpose is to obtain good representation of the vegetation within the classification plot, not individual species. Try to include a little sky (approximately 10%) for perspective. For circular plots, please take the two photographs from adjacent cardinal points around the plot (e.g., south and east or north and west). Photographs obtained at rectangular plots should be taken from opposite ends of the long side. Use a chalkboard to record the plot number and the direction the photo is taken. Thus, for BIBE rectangular plot 241, the board in the photograph taken from the SE edge of the plot, facing NW will read "BP.241, SE→NW". Take the photograph looking across the contour if plot is on a steep slope. In addition, you may want to keep a photograph log for all photographs, most importantly for scenic photographs not taken at classification plots.

BP.241 SE→NW

If you are in a particularly nice, rare or representative stand of vegetation, please take a third digital photograph without the signboard in it and from any position as long as it illustrates the plant community well.

PLOT REPRESENTATIVENESS

Representativeness of plot in stand: Does this sample represent the vegetation community within the surrounding area or polygon? If not, were additional classification plots sampled? Note additional species occurring outside the classification plot but characteristic of the stand.

1. An example could be: "This BPU is relatively large and very homogenous in species composition, although species density varies slightly. Redberry junipers are sparsely scattered throughout BPU but none are located inside the plot."
2. Another example: "This polygon encompasses a variety of elevations and aspects, but similar slopes. Multiple classification plots were sampled in this stand. This plot represents a predominantly herbaceous community on a northern aspect."

Note: Sometimes variation within a polygon is not large enough to sample, in which case you would describe surrounding communities in the "Other Comments" field on the back of the first data sheet.

ENVIRONMENTAL DESCRIPTION SECTION

ELEVATION

Elevation of the classification plot: record this measurement from the GPS receiver typically using the meters scale. Specify whether elevation is recorded in feet or meters.

SLOPE

Measure the slope in degrees using a clinometer. The degree scale is the left-hand scale as you look through the clinometer.

ASPECT

Measure the classification plot aspect in degrees using a compass (set for local magnetic declination).

TOPOGRAPHIC POSITION

This is the position of the classification plot on its related landform. Determining topographic position requires you to think of the landform in cross-section, which is roughly diagramed on the back of your cheat sheet. You **must** use the terms listed below:

Interfluve (crest, summit, ridge): linear top of ridge, hill, or mountain; the elevated area between two drainages that sheds water to the drainages.

High slope (shoulder slope, upper slope, convex creep slope): the uppermost inclined surface at the top of a slope; includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

High level (mesa, summit): level top of a plateau.

Midslope (transportational midslope): intermediate slope position.

Backslope (dipslope): subset of midslopes that are steep, linear, and may include cliff segments.

Step in slope (ledge, terracette): nearly level shelf interrupting a steep slope, rock wall, or cliff face.

Lowslope (lower slope, foot slope, colluvial footslope): inner gently inclined surface at the base of a slope; surface profile is generally concave and a transition between midslope or backslope, and toeslope.

Toeslope (alluvial toeslope): outermost gently inclined surface at base of a slope; in profile, usually gentle, linear and characterized by alluvial deposition.

Low level (terrace): valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

LANDFORM

Enter the landform(s) that describe(s) the site where the classification plot was sampled. Referring to the topographic map for the landscape context may help you decide what landform(s) to choose. Note that the landform choices may describe different scales, or that a landform feature can be described by more than one term. For example, your classification plot may be located on a ledge on the rim of a canyon. A suggested list of landforms and definitions is provided in **APPENDIX 1**.

Note: The topographic position selected above should relate to the scale of the landform chosen here.

SURFICIAL GEOLOGY

Note the geologic substrate where plant community occurs. The geology map should help, but if you can't tell the geology at all or you do not have the geology map with you at the classification plot, write a general description (e.g., coarse sandstone, green shale, aeolian sands, or obscured by soils).

Cowardin System

The majority of the classification plots you will be sampling will be "Uplands" in AMI; most wetland plots will be classified in the Riverine and Palustrine categories. This classification includes riparian, hanging garden, and vernal pool wetlands. They are all fed by surface and/or groundwater and support vascular plant communities.

HYDROLOGY

This field will mostly be completed if you are sampling a wetland, however, some areas considered uplands may be subject to intermittent flooding. Select from the following definitions (from Cowardin et al. 1979):

Permanently flooded: water covers the land surface at all times of the year in all years.

Semipermanently flooded: the surface water persists throughout the growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below the soil surface.

Seasonally flooded: Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface.

Saturated: Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season.

Temporarily flooded: the surface water is present for brief periods during the growing season but the water table usually lies well below soil surface; it often characterizes flood-plain wetlands.

Intermittently flooded: the substrate is usually exposed but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and non-wetland situations.

Unknown: The water regime of the area is not known. The unit is labeled a non-tidal wetland.

ENVIRONMENTAL COMMENTS

Enter any additional noteworthy comments on the environmental setting and its effect on the vegetation. Examples include: "stunted trees due to shallow soils", "vegetation only where pockets of soil occur", or "large colluvial boulders and small rocks litter surface of soil". This field can also be used to describe site history such as fire events. This is an extremely important

field for crews to document so please take the time to respond thoroughly. Information from this field will be used to prepare local descriptions of the plant community and for imagery interpretation.

GROUND COVER

Estimate the approximate percentage of the *total* surface area covered by each category. A helpful hint in making ocular estimates is that in a 100 square meter plot, one square meter is equal to 1%. The sum of the cover values should equal 100%. *Notes:* For estimating live litter and live wood, visualize cutting the vegetation off at ground level. The percent ground cover is how much space the stems take up. Estimating lichens, dark cyanobacteria and moss also take an extra step in visualization. Also note that it is possible to have bare soil and sand in a plot if sand has blown in, or to have sand on the surface of the plot but the soil test results in a texture other than sand because you are sampling below the surface. If a category is present but covers less than 1% of the ground, enter a "T" on the line next to it.

SOIL TEXTURE

Use a trowel to dig a hole a few inches deep (depth will vary with soil depth, of course) to expose the soil at root level, from where you will take a small handful of soil to key.

APPENDIX 2 is a key to use when sampling soil texture and an abbreviated version is presented on the cheat sheet.

SOIL DRAINAGE

Soil drainage classes are defined in terms of: (1) actual moisture content in excess of field moisture capacity and (2) the extent of the period during which excess water is present in the plant-root zone. Permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these factors are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. Use the following definitions to determine soil drainage at your classification plot:

Rapidly drained: the soil moisture content seldom exceeds field capacity in any horizon except immediately after precipitation. Nearly all of the soils outside of wetlands, springs, and floodplains will fall into this category. Rapidly drained soils are commonly coarse textured or soils on steep slopes located well above the water table. ***These soils are characterized by strictly upland species.***

Well drained: the soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 3 feet, but may be mottled below this depth. B horizons, if present, are reddish, brownish, or yellowish. ***Look for plant species that indicate periodic saturation.***

Moderately well drained: the soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are commonly mottled (chroma < 2) in the lower B and C horizons or below a depth of 2 feet. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the solum. In grassland soils the B and C horizons may be only faintly mottled and the A horizon may be relatively thick and dark. ***Soils in this category and the next three will typically support wetland plants.***

Somewhat poorly drained: the soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year. Soils are commonly mottled in the B and C horizons; the Ae horizon, if present, may be mottled. The matrix generally has a lower chroma than in the well-drained soil on similar parent material.

Poorly drained: the soil moisture in excess of field capacity remains in all horizons for a large part of the year. The soils are usually very strongly gleyed. Except in high-chroma parent materials the B, if present, and upper C horizons usually have matrix colors of low chroma. Faint mottling may occur throughout.

Very poorly drained: free water remains at or within 12 inches of the surface most of the year. The soils are usually very strongly gleyed. Subsurface horizons usually are of low chroma and yellowish to bluish hues. Mottling may be present but at the depth in the profile. Very poorly drained soils usually have a mucky or peaty surface horizon.

Animal Use Evidence

Comment on any evidence of use of the classification plot and BPU by non-domestic animals (i.e., tracks, scat, burrows, etc.). Notes on domestic animals should be made in the next field.

Natural and Anthropogenic Disturbance

Comment on any evidence of natural or anthropogenic disturbance and specify the source, severity and effects on the vegetation. Common disturbances in Amistad classification plots are gullies carved by water, colluvial deposition of rocks on slopes, flash flooding, and sometimes old tin cans left by cowboys or miners. Other disturbances you may encounter include off-road vehicle use, fire, or mass-wasting among others.

OTHER COMMENTS

Record any other comments. What is the extent of the community you sampled? Describe the landscape context of the community. Describe the adjacent plant communities and their relationship to the classification plot. Are there any other landscape features or processes influencing this community? Is there an important species that occurs in the BPU but is not within your classification plot? Is there a large amount of a dead plant material present?

VEGETATION DESCRIPTION SECTION

Leaf Phenology

Select the best description for the leaf phenology of the **dominant** stratum. The dominant stratum is the tallest stratum that contains at least 10% cover. Leave blank for non-vascular plots.

Evergreen. Greater than 75% of the total woody cover is never without green foliage.

Cold deciduous. Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

Mixed evergreen - cold deciduous. Evergreen and deciduous species are mixed within the type and generally contribute 25-75% of the total woody cover.

Perennial. Herbaceous vegetation composed of more than 50% perennial species.

Annual. Herbaceous vegetation composed of more than 50% annual species.

Leaf Type

Select the best description for the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% total plot coverage. Within that dominant stratum, the species that makes up greater than 50% of cover defines the leaf type.

Broad-leaved. Woody vegetation that is primarily broad-leaved (creosotebush, cenizo, oak).

Needle-leaved. Woody vegetation that is primarily needle-leaved (Juniper).

Microphyllous. Woody cover that is primarily microphyllous (Mormon-tea).

Graminoid. Herbaceous vegetation composed of more than 50 percent graminoid species (grasses, sedges, rushes, etc).

Forb (broad-leaf-herbaceous). Herbaceous vegetation composed of more than 50% broad-leaf forb species (American water-willow, smartweed, bladderpod, etc).

Pteridophyte. Herbaceous vegetation composed of more than 50 percent ferns or fern allies (scouring rushes, southern maidenhair fern, etc.).

Non-vascular. Dominated by lichens or mosses.

Mixed. As with leaf phenology, the dominant stratum may be composed approximately equally of species with several different leaf types. Describe the mix briefly or circle leaf types that apply.

Physiognomic Class

This category represents what you see when you are standing in the classification plot looking across at the vegetation. The following definitions can be used as guidelines, but may not always apply in desert locales. For example, areas with scattered Ashe juniper, oaks, or mesquite may not fit the cover classes below but they would best be described as a woodland.

Forest: trees with crowns overlapping (generally forming 60-100% cover).

Woodland: open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively.

Shrubland: shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 10% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation composed of woody vines is included in this class.

Dwarf-shrubland: low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 10% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively.

Shrub Herbaceous: low or taller shrubs forming approximately equal cover with a grass or forb component. Individuals or clumps of shrubs generally not touching and usually forming more than 25% cover; trees less than 10% cover. Spaces between shrubs are generally mostly occupied by grasses and/or forbs.

Herbaceous: perennial herbs (graminoids or forbs) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 10% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.

Nonvascular: nonvascular cover (bryophytes, lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular perennial vegetation cover may be less than 25%, as long as it exceeds tree, shrub, dwarf-shrub, and herb cover.

Sparsely Vegetated: abiotic substrate features dominant. Perennial vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources. Total vegetation cover is typically less than 5% and greater than 0%. Badlands or sand dunes supporting communities of annual plants should be included in this category, regardless of cover.

PROVISIONAL COMMUNITY NAME

You have been provided a list of potential vegetation alliances and plant associations for AMIS, based on what has been classified in legacy studies, field observations, and from the NatureServe database. Find the name of the alliance and/or association which most closely resembles your classification plot. It is very likely that some of your plots will not resemble types on the list – as some to many plant communities are not yet described and classified. If so, devise a name based on: (1) the dominant species of the dominant strata (including nonvascular) and (2) indicate the physiognomic class (the class must match the physiognomic class checked on the backside of the datasheet). For example, if you are in an oak – alligator juniper woodland with only scattered shrubs but a really nice mountain muhly layer, you would use a provisional name like "*Juniperus ashei* – *Quercus fusiformis* / *Muhlenbergia porteri* Woodland." The 'provisional community name' will be used in tallying how many of each plant community has been sampled as the field season progresses. The provisional name is also a great help to the ecologists who will be using your work to construct a classification. Note: this field should be completed only after the entire classification plot form is completed.

• PLANT SPECIES LIST AND STRATA FORM

PLOT CODE

AMIS will be entered on the field form prior to copying. Write the plot number on the blank line. This field is a **must** so that in the event that the two data sheets become separated, they can be paired up later. **Please record the plot code on every side of every form in the provided field.**

Species/Strata Data. A two-page dual purpose form has been developed for recording information on *species* composition and cover and *strata* cover and height. Data representing trees and shrubs are to be entered on the front page and herbaceous and non-vascular data are entered on the back of the page. Species lists and cover estimates should be completed first; then cover class and height class estimates for strata should be recorded.

The main body of the table is dedicated to recording species names and associated cover estimates. To begin this process, the observer needs to make a complete species list for the classification plot and assign each species to the appropriate stratum. The next section provides a brief discussion on assigning species to the appropriate strata, followed by instructions for completing the species level information.

Stratum: Species names will be recorded within the appropriate stratum. It is important that all crew members are consistent in assignment of species to strata throughout this project. Following are some guidelines to use in determining strata. The 'working draft' plant list for AMIS will be used as guides for assigning species to the appropriate stratum. Field crew members are expected to help 'improve' this list and associated categorization as the field season progresses.

Begin by assessing the strata at your classification plot. Trees are defined as single-stemmed woody plants, generally 5m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5m in height at maturity and under optimal growing conditions. The exceptions are mature pinyon pine and junipers, which are considered trees regardless of their height.

T1 Emergent, T2 Canopy, T3 Subcanopy. Oak and juniper make up the majority of the AMIS "canopy", but where they are absent field crews begin with the shrubs or herbaceous species if no shrubs are present. If the tree crowns in your classification plot are mostly touching and similar in height, but a given tree species (Ashe juniper) is much taller than species would be an "emergent", which is not typical of vegetative communities in this area of Texas. Occasionally, you will sample an area where there may be several tall, scattered plains cottonwoods and then shorter scattered velvet ash. In this case, the plains cottonwoods would be your "canopy" and the velvet ash would be the "subcanopy".

The remaining vegetative strata are (remember to check with plant list for consistency):

S1 Tall Shrub. >2 meters tall. For example, *Juglans microphylla* and *Salix exigua*.

S2 Short Shrub. <2 meters tall. For example, *Prosopis glandulosa* and *Leucophyllum frutescens*.

S3 Dwarf Shrub. <0.5 meters tall. For example, *Opuntia phaeacantha* and *Gutierrezia microcephala*.

H1 Graminoid. All grass species. For example, *Aristida purpurea*, *Bouteloua curtipendula*, and including sedges, flat sedges, and rushes.

H2 Forb. All forbs.

H3 Fern or Fern Ally. All ferns. For example, *Adiantum capillus-veneris* and including *Equisetum laevigatum*.

H4 Tree Seedlings. Seedlings are trees with vertical stems less than 1.5 m tall, but that may vary by species.

N Nonvascular. This class is mainly dark cyanobacteria, mosses and lichens.

V Vine/liana. All vine species.

E Epiphyte. All epiphytic species.

Height can be used to define strata, but is not how species should be placed in strata. Species characteristically belong to one stratum or another (e.g., juniper are canopy (T2), sandbar willow is a tall shrub (S1), creosotebush and cenizo are short shrubs (S2), snakeweed is a dwarf-shrub (S3), etc.), EVEN when unusual environmental circumstances dictate that the plants have an unusually tall or unusually short growth form. So even if the junipers growing in cracks are only 1.5 m tall, as long as they are mature trees, they are recorded in the T2 category, and are measured. About the only rule regarding height should be that the tree layer is (usually) higher than the tall shrub layer, is taller than the short shrub layer, etc.

The second thing is to avoid splitting species between strata. If a few blackbrush have been browsed to <1m tall, but most are 2m tall, they all are estimated into the tall shrub stratum. There are two exceptions: (1) each height class covers more than 10% of plot, or (2) there is a reproductive layer of seedling/sapling shrubs or young trees.

The third thing is how to define some of the "borderline" species. What we want to avoid is some crews calling snakeweed a forb and some calling it a dwarf-shrub.

Species / Percent Cover Estimates. Once you have identified your strata, list all plant species in that strata and complete cover estimates per the following instructions. Be thorough in looking

for plant species in your classification plot, but do not spend excessive amounts of time looking for new or different plants. Remember that these plot data are to be used to classify the vegetation of the park, not to make a complete species list for it. If you had to spend much more than 20 minutes to *find* a species, it probably isn't going to be important in characterizing the vegetation type.

1. **Species Name:** Refer to the plant list you have been provided for plant names used in this area of Texas. Always record the full scientific name for each species. Please note that columns on both sides of the table may be used to record species within each stratum.
2. '*' – Complete this shaded column in the strata assessment (see below).
3. **Cover Class:** Estimate the aerial / crown cover of **each** plant listed, using the cover class codes listed in the bottom of the page.
4. **% Cover:** Record continuous cover value used to make cover class estimates.
5. **Specimen:** Place a check mark in this column when a specimen has been collected for a given taxon. Keep complete set of notes in a field notebook with required information for processing herbarium specimens.

Unknowns. If you cannot identify or easily key the plant to species at the classification plot, assign a name to it to be recorded on your data sheet. For example, if you know its family affiliation or its genus, label it "unknown Asteraceae sp." or "Unk. Erigeron sp.". If there are more than one unknowns in a family, add a number to the name you assign. If you do not know the family, label the plant "Unknown 1", using consecutive numbers for additional unknowns. Record the cover class and other data for the unknown as you would for any other species. Then, take a sample of the species with as much of the plant as possible, especially intact sexual parts, if present. Place the sample in a plastic baggie, and either label the plant (if you are putting more than one plant in the baggie) or label the baggie with the plot code, the date and the name you assigned on the data form. Plant samples in baggies can be stored in coolers or refrigerators for short periods. If you are not able to key the plant soon after collecting it, or you intend to keep the sample for the park collection, press the plant and include a label stating the plot or location of its collection (include UTM coordinates if the sample is not from a classification plot), date, collector's name, and name you assigned the plant. Also, thoroughly label any plant specimens collected as proof of plant occurrence for plants not listed on the park species list.

Strata / Height Class, Cover Class, and Diagnostic Species. Once the species list and associated cover data have been completed, the observer should then complete the following fields as specified below. Data for stratum characterization are all shaded in grey on the field form.

1. Indicate the average height class of the stratum in the first column, using the Height Scale at the bottom of the form.
2. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale at the bottom of the form.
3. '*' – This Column is used to indicate whether a particular species has been identified as a 'diagnostic' species for defining a particular stratum.

ALWAYS fill in the Height Class and Cover Class for "Ht Herbaceous", which represents total cover of species in the classification plot ground layer (H1, H2, H3, and H4). This field is located at the top of the back page and is labeled as '**Ht Herbaceous**'. It is easy for field crews to overlook this field – so please make an extra effort to complete it for each classification plot.

- **TREE STEM AND ROOT CROWN DIAMETERS**

This portion of the form is used to record information on the size (biomass) of trees in a given plot. Record the scientific name of the species on the form and check whether the measurement is DBH or DRC. It is acceptable to use 6-digit alpha codes for the species name in this part of the form. Please see instructions below to determine which measure should be used.

Diameter Breast Height (DBH) - all tree species except Oak/Pinyon Pine/Juniper

In plots containing single bole trees such as plains cottonwood, record the species name and diameter (in cm) of the tree stem/trunk at breast height (4.5 ft.) using a DBH tape. Often this measurement will involve only a single tree trunk, however on some occasions there may be multiple stems. In this case record all diameters associated with a given individual on the same line, separated by a comma or commas. Given the propensity of oak, pinyon pine, and juniper to grow in large multi-stemmed clumps we have decided to measure diameter of the root crown in these situations (see section below). If there are more than about 25 trees more than 4.5 feet tall, divide the plot into quarters and measure the DRC of trees in the southeast quarter/quadrant. **Please note** on the form that this is the procedure you have selected.

Diameter Root Crown (DRC) – Oak/Pinyon Pine/Juniper

In plots containing oak, pinyon pine, and/or juniper trees record the species and diameter at root crown (ground level) of all stems belonging to trees taller than 4.5 feet. This measurement typically requires crawling under the low tree branches to hook the DBH/DRC measuring tape and wrap it around the trunk to read the diameter. Record this value, in centimeters on an individual line on the field form that is labeled with the appropriate tree species. Should multiple stems emerge from the ground level, measure the DRC of each stem and record the diameters on the same line of the field form, separated by a comma or commas. If there are more than about 25 trees more than 4.5 feet tall, divide the plot into quarters and measure the DRC of trees in the southeast quarter/quadrant. **Please note** on the form that this is the procedure you have selected. Use caution when performing this measurement, as there may be pinyon pine pitch, sharp needles, sharp branch tips, cacti, and/or poisonous animals (spiders, scorpions, snakes, etc.) under these short-stature tree species or under the bark covering the lower portion of the tree. Always look up prior to standing to avoid collision with overhead branches. Juniper branch scratches tend to become infected, so be sure to clean and disinfect them thoroughly.

Pinyon pine-juniper Age Class. If you are in a plot that contains pinyon pine and/or juniper trees (whether or not you have placed the plot in a P-J alliance/association), check the box that best describes the age class of the stand based on these criteria:

Old-growth (>500 years). Ancient trees with flat crowns, much dead wood, dead trees on ground, some younger trees occupying canopy gaps. "You know it when you're in it". Generally occurs only in locations protected from fire.

Mature (350–500 years). Large old trees with flat crowns, some with gnarled trunks, lightning scars and dead wood, others without. Tends not to have much understory, depending on soils.

Young (100–500 years). Developed canopy of large trees, but some or all junipers have pointed crowns. Generally there tends to be a well-developed understory of shrubs and sometimes forbs and grasses.

Invasive (<80 years). Scattered smaller trees, all with pointed crowns, in a community clearly dominated by shrubs or grasses.

OBSERVATION POINT FORM INSTRUCTIONS - 2010

These instructions correspond to the 2010 version of the Observation Point Forms.

Many fields are identical to fields on the Plot Survey Forms and will not be re-defined here.

Observation Point Forms are to be used when: (1) you find a unique vegetation stand or patch too small to establish a classification plot; (2) you are unable to access a BPU but can view it well enough with binoculars to collect some data; (3) enough classification plots have been conducted for a given community type and the project supervisor instructs you to place Observation Points for BPUs encompassing that community; (4) you do not have time to conduct a plot and the area you are in is time consuming to access at a later date; or (5) to record information on park specials (e.g. springs, hanging gardens, etc.). You will notice that these forms are not as extensive as Plot Survey Forms. The primary role of Observation Point forms is to further aid in aerial image interpretation; a secondary role is to help fill out plant association descriptions.

Please note that the CHDN is in the process of developing a GPS Data Dictionary for recording several fields associated with the Observation Point Survey Form. Please note that all data entered into the GPS receiver will also be entered manually on the paper forms.

• IDENTIFIERS / LOCATORS SECTION

Most fields in this section are the same as the classification plot form. Please refer to the Plot Survey Form instructions for this section. As with the procedures for Plots, you must mark the location of the Observation Point on the corresponding topographic map, aerial image or photograph and BPU map.

Please indicate the type of observation point you are conducting (e.g. vegetation observation point, spring/seep/hanging garden point, other special feature).

You will not need to measure the area you are surveying for this form, although it is helpful to provide the size of the area described by the point. In terms of photographing this sample area, you are asked to take one digital photograph that accurately captures the vegetative stand. Use the chalkboard as you would at a classification plot.

Observation Points should be assigned a code similar to Plot Survey codes to be used as a file name and on the chalkboard in the photo. Observation point numbers will be assigned in the 9000 series.

• ENVIRONMENTAL DESCRIPTION SECTION

The majority of this section is the same as the Plot Survey Form for which the instructions are provided above. These fields include: Elevation, Slope, Aspect, Topographic Position, Landform, Geology, Cowardin Wetland Classification System, and Hydrologic Regime.

Environmental Comments

This field is also on the Plot Survey Form. However, it is the only comments field on the Observation Point Form. Please use this space to record comments like you would have made at classification plots, as well as any comments you would have made in the "Animal Use Evidence," "Natural and Anthropogenic Disturbance Comments" and "Other Comments" fields on the Plot Survey Form. Also note why an Observation Point was sampled instead of a Plot Survey.

Unvegetated Surface

This field is an ocular estimate of ground cover, so plants should be visualized as being cut off at ground level. Because there is no designated sample size for areas surveyed as Observation Points, you will have to estimate percent covers for the evaluated area. For this estimation, you must use the cover classes listed in the bottom right hand corner of the data sheet. If an unvegetated surface category is not present in your observation point area (e.g., water is very uncommon in the sampling units), leave the corresponding line blank. The cover class "01" represents occurrences greater than 0% but less than 10%.

***Note:** These cover classes are very broad, especially for desert species occurrences. If a species is not accurately represented by these cover classes, note this in the comments field.*

• VEGETATION DESCRIPTION SECTION

These fields: Leaf Phenology; Leaf Type; and Physiognomic Class are the same as those on the Plot Survey Form. Please refer to the previously listed instructions for these fields.

PROVISIONAL COMMUNITY NAME

You have been provided a list of potential vegetation alliances and plant associations for AMIS based on what has been determined from legacy research, the plant species list, and the NatureServe Website. Find the name of the plant association which most closely resembles your vegetation stand. It is very likely that some of your vegetation stands and patches will not resemble anything on the list – as many types are not yet described and classified. If so, devise a name based on: (1) the dominant species of the dominant strata (including nonvascular) and (2) indicate the physiognomic class (this must match the physiognomic class checked on the back side of the datasheet). For example, if you are in an Oak – Ashe juniper woodland with only scattered shrubs but a really nice purple threeawn layer, you would use a provisional name like "*Quercus fusiformis* – *Juniperus ashei* / *Aristida purpurea* Woodland." The 'provisional community name' will be used in tallying how many of each plant community have been sampled. The provisional name is also a great help to the ecologists who will be using your work to construct a classification. Note: this field should be completed only after the entire observation point is completed.

• DOMINANT PLANT SPECIES LIST

Record information on ***dominant species only***. There are four columns that correspond to the "Stratum" column in this table. The strata have been discussed in the Plot Survey Form instructions, which you should refer to for this form. As for the blank columns:

1. **Height.** Use the number code that best describes the heights of all plant species within a given stratum. The number codes are listed in the bottom left hand corner of the data sheet.
2. **Cover Class.** For this ocular estimation you are viewing the aerial cover of **all** plants within a given stratum. Use the cover class codes listed in the bottom right hand corner of the data sheet (note: these are broader cover classes than used on the plot form).
3. **Dominant Species (Mark species that characterize the stand with a *).** List the plant species using the full scientific name. You may find that there are not enough lines, in which case you can write in the blank area under the stratum name and number codes.
4. **% Cover.** Estimate the percent aerial cover for each plant species. Again, use the cover class codes listed in the bottom right hand corner of the data sheet.

EXTRA CURRICULAR INSTRUCTIONS - 2010

The CHDN I&M Program is engaged in a wide suite of inventory activities designed to improve the information basis for developing a long-term natural resource monitoring program. Since field crews will be visiting most areas of each park and especially remote portions – we are requesting assistance with documenting information on the following features as they are encountered and as time allows.

Springs/Seeps/Hanging Gardens (Use Observation Point Form)

These areas are considered significant ecosystems throughout the Chihuahuan Desert and have been identified as a high priority vital sign for inclusion in the long-term monitoring program. Little information has been documented on the location and characteristics of these areas within the parks.

Use the ‘Observation Point’ form to record basic data on springs, seeps and hanging gardens and circle ‘spring/hanging garden’ in the Type of Observation field. It is important to take one or more photos to document the site and UTM coordinates or other location reading. Please complete basic environmental and vegetation description fields as you are able. Completion of the comments field would be most appreciated.

If the spring community is sizeable enough please consider placing/conducting a regular vegetation plot, as we need this information to characterize the full suite of vegetation types. Keep in mind that BPU's will typically overlook springs and seeps.

INVASIVE PLANT SPECIES

Invasions of aggressive non-native species are one of the largest threats to ecosystem integrity of terrestrial and aquatic systems. Field crews are requested to document ‘noteworthy’ populations of invasive plants and take photos as feasible and appropriate. We are not requesting a comprehensive inventory of all invasive plants, as that would be another full project. However, the parks would appreciate help in documenting populations of invasive plants that are of especially high concern. Early detection of species populations that are small provides the park a chance for control or eradication.

In addition to looking for established invasive plant species in the park, field crews should take care to ensure that they are not contributing to the spread of weeds. If you are working in an infested area, please make sure that you are not carrying seeds or other propagules with you to new locations. Also for field workers coming from other areas, please make sure vehicles and clothing are free of weed seed.

GENERAL FLORISTIC INVENTORY – AMIS

An important part of the CHDN I & M Program is to assist parks with the documentation of all vascular plants and vertebrate species occurring within each park. As part of the vegetation mapping project, field crews are requested to assist in the collecting of vascular plant vouchers (herbarium specimens). The AMIS plant species list provided to field crews indicates whether or not a voucher has been collected for a given species. If a voucher has not been collected, field crews are to look for opportunities to make collections of these taxa. Field crews will receive training in how to collect, document and process vouchers. Specimens should contain appropriate flowering and/or fruiting material to assure correct identification. Additionally specimens should contain all appropriate plant parts (roots, leaves, stems, flowers etc.) and as possible show the habit of the plant using digital photographs. Enough material should be collected to fill a herbarium sheet when possible.

OFFICE DATA ENTRY AND TRACKING – 2010

- **DATA ENTRY**

CHDN has developed a park-specific vegetation mapping database application for this project. This database application houses all associated data with the project including vegetation classification plots, observation points, photographic documentation, and herbarium label information. Data will be entered at regular intervals as the field season progresses. Data will be entered both electronically (from the data dictionaries on the GPS receivers/data loggers) and manually from the field forms. NPS field crews or a data entry specialist will enter all data collected during the project. The CHDN staff is developing quality assessment and control procedures to help ensure that data collected are consistent, accurate, and complete.

- **SPECIES LIST MANAGEMENT**

As previously discussed, CHDN is working with each network park to prepare vouchered vascular plant species lists. An important ancillary activity of the vegetation inventory project is to contribute to the collection of voucher specimens for additional species. To aid in this effort CHDN will provide field crews with a ‘working copy’ of the vascular plant species list for AMIS as appropriate to the field crews. This list will include information on taxonomic number, family, genus, species, common name, life form, nativity and whether or not the taxon is documented with a specimen voucher. Field crews are requested to look for opportunities to collect vouchers where none exist. Field crews are requested to work with the CHDN Science Advisor and Data Manager to regularly update the ‘working’ species lists.

- **TRACKING PLANT ASSOCIATIONS**

At the beginning of the field season crews will be provided with a working list of ‘potential’ plant associations for AMIS. This list will represent the ‘best-guess’ of what is present in the parks and is based on recent vegetation alliance and plant association classification work on-park and nearby. As the field season progresses the field team leader will revise this list as needed. In

addition, the field team lead will assign each plot to preliminary plant associations and maintain a ‘tracking list’ throughout the field season (after each field session). This list will be used to adjust sampling priorities in the field. For example, once an adequate number of classification plots are collected for a certain type, it may be determined that only observation points are needed for subsequent BPUs. The list will also serve as a guide in knowing when something new is encountered and when to sample additional areas.

- **HERBARIUM SPECIMENS**

Field crews will be instructed on how to collect voucher specimens and associated label data. Specimens will be processed at regular intervals throughout the field season. Processing includes entering all appropriate information into the vegetation mapping database in order to generate herbarium labels, identification, mounting and labeling specimens. Each field crew member is required to record all specimen documentation in a field notebook.

Landform Glossary

(<http://soils.usda.gov/technical/handbook/contents/part629glossary1.html>)

alluvial cone - A semi-conical type of alluvial fan with very steep slopes; it is higher, narrower, and steeper (e.g., > 40% slopes) than a fan, and composed of coarser, and thicker layers of material deposited by a combination of alluvial episodes and to a much lesser degree, landslides (e.g., debris flow). Compare - alluvial fan, talus cone.

alluvial fan - A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream. It is steepest near its apex which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

alluvial flat (a) (colloquial: western US) A nearly level, graded, alluvial surface in bolsons and semi-bolsons which commonly does not manifest traceable channels, terraces or floodplain levels. Compare - flood-plain step, terrace, valley flat. (b) (**not preferred**) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods.

alluvial plain - (a) A large assemblage of fluvial landforms (braided streams, terraces, etc.,) that form low gradient, regional ramps along the flanks of mountains and extend great distances from their sources (e.g., High Plains of North America. SW (b) (not recommended, use flood plain.) An general, informal term for a broad flood plain or a low-gradient delta. Compare - alluvial flat.

alluvial plain remnant - An erosional remnant of an alluvial plain which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network. Compare - alluvial plain, erosional remnant, paleoterrace.

alluvial terrace - (not preferred) refer to stream terrace.

alluvium - Unconsolidated, clastic material subaerially deposited by running water, including gravel, sand, silt, clay, and various mixtures of these. Compare - colluvium, slope alluvium.

anticline - (a) A unit of folded strata that is convex upward and whose core contains the stratigraphically oldest rocks, and occurs at the earth's surface. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally convex upward whose core contains the stratigraphically older rocks.

arroyo - (colloquial: southwest A.) The channel of a flat-floored, ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; sometimes called a wash. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed. Where arroyos intersect zones of ground-water discharge, they are more properly classed as intermittent stream channels.

artificial levee - An artificial embankment constructed along the bank of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.

backslope - The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e. free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water. Compare - summit, shoulder, footslope, toeslope.

backswamp - A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces. Compare - valley flat.

badlands - A landscape which is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sandstones) sometimes with soluble minerals such as gypsum or halite.

bajada - (colloquial: southwestern US.) A broad, gently inclined, alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins. Synonym - coalescent fan piedmont. Compare - colluvial apron.

ballena - (colloquial: western US.) A fan remnant having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave sideslopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas. A partial ballena is a fan remnant large enough to retain some relict fan surface on a remnant summit. Compare - fan remnant.

ballon - (colloquial: western US). A rounded, dome-shaped hill, formed by erosion or uplift.

bar - A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g. a channel bar or a meander bar. A generic term for any of various elongate offshore ridges, banks, or mounds of sand, gravel, or other unconsolidated material submerged at least at high tide, and built up by the action of waves or currents, especially at the mouth of a river or estuary, or at a slight distance offshore from the beach.

barchan dune - A crescent-shaped dune with tips extending leeward (downwind), making this side concave and the windward (upwind) side convex. Barchan dunes tend to be arranged in chains extending in the dominant wind direction. Compare - parabolic dune.

base slope - A geomorphic component of hills consisting of the concave to linear slope (perpendicular to the contour) which, regardless of the lateral shape is an area that forms an apron or wedge at the bottom of a hillside dominated by colluvial and slope wash processes and sediments (e.g., colluvium and slope alluvium). Distal base slope sediments commonly grade to, or interfinger with, alluvial fills, or gradually thin to form pediment over residuum. Compare - head slope, side slope, nose slope, interfluvium, free face.

basin - (a) Drainage basin; (b) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated. (c) (colloquial: western US) A general term for the nearly level to gently sloping, bottom surface of an intermontane basin (bolson). Landforms include playas, broad alluvial flats containing ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding. Where through-drainage systems are well developed, flood plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of piedmont slopes.

basin floor - A general term for the nearly level, lower-most part of intermontane basins (i.e. bolsons, semi-bolsons). The floor includes all of the alluvial, eolian, and erosional landforms below the piedmont slope. Compare - basin, piedmont slope.

basin-floor remnant - (colloquial: western US) A flat erosional remnant of any former landform of a basin floor that has been dissected following the incision of an axial stream.

bench - (not preferred) refer to structural bench.

beveled base - The lower portion of a canyon wall or escarpment marked by a sharp reduction in slope gradient from the precipitous cliff above, and characteristically composed of thinly mantled colluvium (e.g. < 1 m) and / or capped with a thin surficial mantle of large rock fragments from above, which overly residuum of less resistant rock (e.g., shale) whose thin strata intermittently outcrop at the surface; a zone of erosion and transport common in the canyonlands of the semi-arid, southwestern US. Compare - talus slope.

blowout - A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand, loose soil, or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Commonly small, some blowouts may be large (kilometers in diameter). Compare - deflation basin.

bluff - (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; ex. a river bluff. (b) (not preferred) use cliff. Any cliff with a steep, broad face.

bolson - (colloquial: western US.) A landscape term for an internally drained (closed) intermontane basin into which drainages from surrounding mountains converge inward toward a central depression. Bolsons are often tectonically depressed areas and, according to Peterson, include alluvial flat, alluvial plain, beach plain, barrier beach, lake plain, sand sheets, dunes, and playa. The piedmont slope includes slopes of erosional origin adjoining the mountain front (pediments) and complex construction surfaces (fans). A semi-bolson is an externally drained (open) bolson.

Synonym - intermontane basin.

borrow pit - An excavated area from which earthy material has been removed typically for construction purposes offsite; also called barrow pit.

bottomland - (not recommended) use flood plain. An obsolete, informal term loosely applied to varying portions of a flood plain.

box canyon - a) A narrow gorge or canyon containing an intermittent stream following a zigzag course, characterized by high, steep rock walls and typically closed upstream by a similar wall, giving the impression, as viewed from its bottom, of being surrounded or "boxed in" by almost vertical walls. b) A steep-walled canyon heading against a cliff a dead-end canyon.

braided stream - A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling (in plain view) the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and a

steep gradient. At bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams. Compare - meandering channel, flood-plain landforms.

break - (slopes) An abrupt change or inflection in a slope or profile. Compare - knickpoint, shoulder, escarpment. (geomorphology) A marked variation of topography, or a tract of land distinct from adjacent land, or an irregular or rough piece of ground. Compare - breaks.

breaks - (colloquial: western US) A landscape or large tract of steep, rough or broken land dissected by ravines and gullies and marks a sudden change in topography as from an elevated plain to lower hilly terrain, or a line of irregular cliffs at the edge of a mesa or a river (e.g., the Missouri River breaks).

butte - An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks. Compare - mesa, plateau, cuesta.

caldera - A large, more or less circular depression, formed by explosion and/or collapse, which surrounds a volcanic vent or vents, and whose diameter is many times greater than that of the included vent, or vents. Compare - crater.

canyon - A long, deep, narrow, very steep-sided valley cut primarily in bedrock with high and precipitous walls in an area of high local relief (e.g., mountain or high plateau terrain), often with a perennial stream at the bottom; similar to but larger than a gorge. Compare - gorge, box canyon, slot canyon.

canyon bench - One of a series of relatively narrow, flat landforms occurring along a canyon wall and caused by differential erosion of alternating strong and weak horizontal strata; a type of structural bench.

canyonlands - A deeply and extensively dissected landscape composed predominantly of relatively narrow, steep-walled valleys with small flood plains or valley floors; commonly with considerable outcrops of hard bedrock on steep slopes, ledges, or cliffs, and with broader summits or interfluvies than found in badlands. Sideslopes exhibit extensive erosion, active back-wearing, and relatively sparse vegetation.

channel - (a) The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water. (b) (colloquial: western US.) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and mounds of cobbles and stones. (c) Small, trough-like, arcuate or sinuous channels separated by small bars or ridges, caused by fluvial processes; common to flood plains and young alluvial terraces; a constituent part of **bar and channel** topography.

cinder cone - A conical hill formed by the accumulation of cinders and other pyroclastics, normally basaltic or andesitic composition. Slopes generally exceed 20 percent.

cliff - Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice. Compare - bluff.

climbing dune - A dune formed by the piling-up of sand by wind against a cliff or mountain slope; very common in arid regions with substantial local relief and strong winds. Compare - sand ramp.

closed depression - A generic name for an enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of low ground indicated on a topographic map by a hachured contour line forming a closed loop. Compare - open basin.

collapse sinkhole - A type of sinkhole that is formed by collapse of a cave within the underlying soluble bedrock (e.g., limestone, gypsum, salt). Compare - solution sinkhole.

colluvium - Unconsolidated, unsorted material being transported or deposited on sideslopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, unconcentrated runoff. Compare - alluvium, slope alluvium, scree, talus, mass movement.

complex landslide - A category of mass movement processes, associated sediments (complex landslide deposit) or resultant landforms characterized by a composite of several mass movement processes none of which dominates or leaves a prevailing landform. Numerous types of complex landslides can be specified by naming the constituent processes evident (e.g. a complex earth spread - earth flow landslide). Compare - fall, topple, slide, lateral spread, flow, landslide.

crest - (a) The commonly linear, narrow top of a ridge, hill, or mountain. It is appropriately applied to elevated areas where retreating backslopes are converging such that these high areas are almost exclusively composed of convex shoulders; (b) (not preferred) Sometimes used as an alternative for the hillslope component **summit**. Compare - summit (**part b**), saddle.

cuesta - An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip (commonly less than 15 percent); produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the other side has a relatively

short and steep or cliff-like slope (scarp) that cuts through the tilted rocks. Compare - hogback, mesa, dipslope, scarp slope, cuesta valley.

cuesta valley - A low relief, low angle, asymmetrical depression which lies parallel to the strike of underlying strata; a type of strike valley. It's formed by the differential erosion of weaker strata interbedded with more resistant bedrock. It may or may not contain a local drainage network and commonly lies above and is not connected to the regional drainage system. Compare - cuesta, valley, trough, hanging valley.

debris fall - The process, associated sediments (debris fall deposit) or resultant landform characterized by a rapid type of **fall** involving the relatively free, downslope movement or collapse of detached, unconsolidated material which falls freely through the air (lacks an underlying slip face); sediments have substantial proportions of both fine earth and coarse fragments; common along undercut stream banks. Compare - rock fall, soil fall, landslide.

debris flow - The process, associated sediments (debris flow deposit) or landform resulting from a very rapid type of **flow** dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50% of the particles are > 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving. Compare - lahar, mudflow, landslide.

deflation basin - A topographic basin excavated and maintained by wind erosion which removes unconsolidated material and commonly leaves a rim of resistant material surrounding the depression. Unlike a blowout, a deflation basin does not include adjacent deposits derived from the basin. Compare - blowout.

depression - Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage (e.g. a sinkhole). An open depression has a natural outlet for surface drainage. Compare - closed depression, open depression.

desert pavement - A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects the underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter. Compare - erosion pavement, stone line.

dike - A tabular igneous intrusion that cuts across the bedding or foliation of the country rock. Compare - sill.

dip - A geomorphic component (characteristic piece) of flat plains (e.g., lake plain, low coastal plain, low-relief till plain) consisting of a shallow and typically closed depression that tends to be an area of focused groundwater recharge but not a permanent water body and that lies slightly lower and is wetter than the adjacent talf, and favors the accumulation of fine sediments and organic materials.

ditch - An open and usually unpaved (unlined), channel or trench excavated to convey water for drainage (removal) or irrigation (addition) to or from a landscape; smaller than a canal; some ditches are modified natural waterways.

divide - (a) The line of separation; (b) The summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction. Compare - interfluvium.

dome - (a) An uplift or anticlinal structure, either circular or elliptical in outline, in which the rocks dip gently away in all directions. A dome may be small (e.g. a salt dome) or many kilometers in diameter. (b) A smoothly rounded landform of rock mass such as a rock-capped mountain summit, that roughly resembles the dome of a building. (e.g. the rounded granite peaks of Yosemite, CA).

drainageway - (a) A general term for a course or channel along which water moves in draining an area. (b) a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams).

draw - A small, natural watercourse cut in unconsolidated materials, generally more open with a broader floor and more gently sloping sides than an arroyo, ravine or gulch, and whose present stream channel may appear inadequate to have cut the drainageway that it occupies.

dune - A low mound, ridge, bank or hill of loose, windblown, subaerially deposited granular material (generally sand), either barren and capable of movement from place to place, or covered and stabilized with vegetation, but retaining its characteristic shape. (See barchan dune, parabolic dune, parna dune, shrub-coppice dune, seif dune, transverse dune).

dune field - An assemblage of moving and/or stabilized dunes, together with sand plains, interdune areas, and the ponds, lakes, or swamps produced by the blocking of streams by the sand. See dune lake.

earthflow - The process, associated sediments (earthflow deposit) or resultant landforms characterized by slow to rapid types of flow dominated by downslope movement of soil, rock, and mud (more than 50% of the particles are < 2 mm), and whether saturated or comparatively dry, behaves as a viscous fluid when moving. Compare - debris flow (coarser, less fluid), mudflow (finer, more fluid).

aeolian deposit - Sand, silt or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess. Conventionally, primary volcanic deposits (e.g. tephra) are handled separately. Compare - loess, parna, beach sands.

aeolian sands - Sand-sized, clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sand sheet. Compare - beach sands.

ephemeral stream - Generally a small stream, or upper reach of a stream, that flows only in direct response to precipitation. It receives no protracted water supply from melting snow or other sources and its channel is above the water table at all times. Compare - arroyo, intermittent stream, perennial stream.

eroded fan remnant - All, or a portion of an alluvial fan that is much more extensively eroded and dissected than a fan remnant; sometimes called an **erosional fan remnant**. It consists primarily of a) eroded and highly dissected sides (**eroded fan-remnant sideslopes**) dominated by hillslope positions (shoulder, backslope, etc.), and b) to a lesser extent an intact, relatively planar, relict alluvial fan "summit" area best described as a tread.

eroded fan-remnant sideslope - A rough or broken margin of an **eroded fan remnant** highly dissected by ravines and gullies that can be just a fringe or make up a large part of an eroded alluvial fan; its bounding escarpments (risers), originally formed by inset channels, have become highly dissected and irregular such that terrace components (tread and riser) have been consumed or modified and replaced by hillslope positions and components (shoulder, backslope, footslope, etc.); sometimes referred to as **fan remnant sideslopes**. Compare - eroded fan remnant.

escarpment - A continuous, steep slope or cliff produced by erosion or faulting and that topographically interrupts or breaks the general continuity of more gently sloping land surfaces. The term is most commonly applied to cliffs produced by differential erosion. Synonym = scarp.

falling dune - An accumulation of sand that is formed as sand is blown off a mesa top or over a cliff face or steep slope, forming a solid wall, sloping at the angle of repose of dry sand, or a fan extending downward from a re-entrant in the mesa wall. Compare - climbing dune, sand ramp.

fan - (a) A gently sloping, fan-shaped mass of detritus forming a section of a low-angle cone commonly at a place where there is a notable decrease in gradient; specifically an alluvial fan (not preferred – use alluvial fan). Compare - alluvial fan, alluvial cone. (b) A fan-shaped mass of congealed lava that formed on a steep slope by the continually changing direction of flow.

fan apron - A sheet-like mantle of relatively young alluvium and soils covering part of an older fan piedmont (and occasionally alluvial fan) surface, commonly thicker and further down slope (e.g., mid-fan or mid-fan piedmont) than a fan collar. It somewhere buries an older soil that can be traced to the edge of the fan apron where the older soil emerges as the land surface, or relict soil. No buried soils should occur within a fan-apron mantle itself. Compare - fan collar.

fan collar - A landform comprised of a thin, short, relatively young mantle of alluvium along the very upper margin (near the proximal end or apex) of a major alluvial fan. The young mantle somewhere buries an older soil that can be traced to the edge of the collar where the older soil emerges at the land surface as a relict soil. Compare - fan apron.

fan remnant - A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface. A nonburied fan-remnant is a relict surface in its entirety. Compare - eroded fan remnant, ballena.

fan skirt - The zone of smooth, laterally-coalescing, small alluvial fans that issue from gullies cut into the fan piedmont of a basin or that are coalescing extensions of the inset fans of the fan piedmont, and that merge with the basin floor at their toeslopes. These are generally younger fans which onlap older fan surfaces.

fault-line scarp - (a) A steep slope or cliff formed by differential erosion along a fault line, as by the more rapid erosion of soft rock on the side of a fault as compared to that of more resistant rock on the other side; e.g. the east face of the Sierra Nevada in California. (b) (not recommended) A fault scarp that has been modified by erosion. This usage is not recommended because the scarp is usually not located on the fault line.

fen - Waterlogged, spongy ground containing alkaline decaying vegetation, characterized by reeds, that develops into peat. It sometimes occurs in sinkholes of karst regions. Compare - bog, marsh, swamp.

finger ridge - One in a group of small, tertiary spur ridges that form crudely palmate extensions of erosional remnants along the flanks or nose of larger ridges. Compare - ballena, rib.

flat - (a) (adjective) Said of an area characterized by a continuous surface or stretch of land that is smooth, even, or horizontal, or nearly so, and that lacks any significant curvature, slope, elevations, or depressions. (b) (noun) An informal, generic term for a level or nearly level surface or small area of land marked by little or no local relief.

Compare - mud flat. (c) (not recommended) A nearly level region that visibly displays less relief than its surroundings.

floodplain - The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

foothills - A steeply sloping upland composed of hills with relief of 30 up to 300 meters and fringes a mountain range or high-plateau escarpment. Compare - hill, mountain, plateau. SW &

footslope - The hillslope profile position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope). Compare - summit, shoulder, backslope, and toeslope.

free face - A geomorphic component of hills and mountains consisting of an outcrop of bare rock that sheds rock fragments and other sediments to, and commonly stands more steeply than the angle of repose of, the colluvial slope immediately below; most commonly found on shoulder and backslope positions, and can comprise part or all of a nose slope or side slope. Compare - interfluvium, crest, nose slope, side slope, head slope, base slope.

gorge - (a) A narrow, deep valley with nearly vertical, rocky walls, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains.

graben - An elongate trough or basin bounded on both sides by high-angle, normal faults that dip towards the interior of the trough. It is a structural form that may or may not be geomorphically expressed as a rift valley.

Compare - horst.

gravel pit - A depression, ditch or pit excavated to furnish gravel for roads or other construction purposes; a type of borrow pit.

ground soil - Any soil at the present-day land surface and actively undergoing pedogenesis,

gulch - (colloquial: western US.; not preferred - refer to ravine) A small stream channel, narrow and steep-sided in cross section, and larger than a gully, cut in unconsolidated materials. General synonym - ravine. Compare - arroyo, draw, gully, wash.

gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water usually during and immediately following heavy rains or ice / snow melt. A gully generally is an obstacle to wheeled vehicles and too deep (e.g., > 0.5 m) to be obliterated by ordinary tillage; (a rill is of lesser depth and can be smoothed over by ordinary tillage). Compare - rill, ravine, arroyo, swale, draw.

hanging valley - A tributary valley whose floor at the lower end is notably higher than the floor of the main valley in the area of junction.

head slope - A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway, resulting in converging overland water flow (e.g. sheet wash); head slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium); contour lines form concave curves. Slope complexity (downslope shape) can range from simple to complex. Headslopes are comparatively moister portions of hillslopes and tend to accumulate sediments (e.g., cummulic profiles) where they are not directly contributing materials to channel flow. Compare - side slope, nose slope, free face, interfluvium, crest, base slope.

headwall - A steep slope at the head of a valley; e.g. the rock cliff at the back of a cirque. Compare - cirque headwall.

high hill - A generic name for an elevated, generally rounded land surface with high local relief, rising between 90 meters (approx. 300 ft.) to as much as 300 m (approx. 1000 ft.) above surrounding lowlands. Compare - low hill, hill, hillock.

hill - A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: **low hill** (30 - 90 m) or **high hill** (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention. Compare - hillock, plateau, mountain, foothills, hills.

hillock - A generic name for a small, low hill, generally between 3 - 30 m in height and slopes between 5 and 50% (e.g., bigger than a mound but smaller than a hill); commonly considered a microfeature. Compare - mound, hill.

hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. Compare - mountain slope.

hogback - A sharp-crested, symmetric (homoclinal) ridge formed by highly tilted resistant rock layers; produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25 degrees (45 percent).

Compare - cuesta.

hoodoo - A bizarrely shaped column, pinnacle, or pillar of rock produced by differential weathering or erosion in a region of sporadically heavy rainfall. Formation is facilitated by joints and layers of varying hardness. Compare - earth pillar.

horst - An elongate block that is bounded on both sides by normal faults that dip away from the interior of the horst. It is a structural form and may or may not be expressed geomorphically.

hummock - (a) (not preferred - see hillock). An imprecise, general term for a rounded or conical mound or other small elevation. (b) (not preferred) A slight rise of ground above a level surface.

impact crater - a) A generally circular or elliptical depression formed by hypervelocity impact of an experimental projectile or ordinance into earthy or rock material. Compare - caldera, crater, meteorite crater. SW; b) (not recommended - use meteorite crater) A generally circular crater formed by the impact of an interplanetary body (projectile) on a planetary surface.

inset fan - (colloquial; western US) The flood plain of an ephemeral stream that is confined between fan remnants, ballenas, basin-floor remnants, or closely-opposed fan toeslopes of a basin.

interdune - The relatively flat surface, whether sand-free or sand-covered, between dunes. GG

interfluve - A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways. Compare - divide.

intermittent stream - A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when it receives a) base flow (i.e. solely during wet periods), or b) ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources. Compare - ephemeral stream.

island - (a) Land completely surrounded by water; (b) An elevated area of land surrounded by swamp, or marsh, or isolated at high water or during floods. Compare - barrier island.

knob - (a) A rounded eminence, a small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the Southern United States. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain. Compare - stack.

knoll - A small, low, rounded hill rising above adjacent landforms.

lake - An inland body of permanent standing water, fresh or saline, occupying a depression, generally of appreciable size (larger than a pond) and too deep to permit vegetation (excluding subaqueous vegetation) to take not completely across the expanse of water.

lakebed - (a) The flat to gently undulating ground underlain or composed of fine-grained sediments deposited in a former lake. (b) The bottom of a lake; a lake basin.

lakeshore - The narrow strip of land in contact with or bordering a lake; especially a beach.

landslide - A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials, caused by gravitational forces and which may or may not involve saturated materials. Names of landslide types generally reflect the dominant process and/or the resultant landform. The main operational categories of mass movement are **fall** (rockfall, soil fall, topple), **slide** (rotational landslide, block glide, debris slide, lateral spread), **flow** [rock fragment flow (especially rockfall avalanche), debris avalanche, debris flow (e.g., lahar), earthflow, (creep, mudflow)], and **complex landslides**. Compare - solifluction.

ledge - (a) A narrow shelf or projection of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave action on softer rocks; erosion is by combined biological and chemical weathering. (b) A rocky outcrop; solid rock. (c) A shelf-like quarry exposure or natural rock outcrop. Compare - structural bench.

levee - An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel. Compare artificial levee, natural levee.

longitudinal dune - A long, narrow sand dune, usually symmetrical in cross profile, oriented parallel to the prevailing wind direction ; it is wider and steeper on the windward side but tapers to a point on the lee side. It commonly forms behind an obstacle in an area where sand is abundant and the wind is strong and constant. Such dunes can be a few meters high and up to 100 km long. Compare - seif dune, transverse dune.

low hill - A generic name for an elevated, generally rounded land surface with low local relief, rising between 30 meters (100 ft.) to as much as 90 m (approx. 300 ft.) above surrounding lowlands. Compare - high hill, hill, hillock.

lowland - (a) A generic, imprecise term for low-lying land or an extensive region of low-lying land, especially near a coast and including the extended plains or country lying not far above tide level. (b) (not preferred) A generic, imprecise term for a landscape of low, comparatively level ground of a region or local area, in contrast with the

adjacent higher country. (c) (not recommended - use valley, bolson, etc.) A generic term for a large valley. Compare - upland.

marsh - Periodically wet or continually flooded areas with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants. Compare - salt marsh, swamp, bog, fen.

meander belt - The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops. Landform components of the meander-belt surface are produced by a combination of gradual (lateral and down-valley) migration of meander loops and avulsive channel shifts causing abrupt cut-offs of loop segments. Landforms flanking the sinuous stream channel include: point bars, abandoned meanders, meander scrolls, oxbow lakes, natural levees, and flood-plain splays. Meander belts may not exhibit prominent natural levee or splay forms. Flood plains of broad valleys may contain one or more abandoned meander belts in addition to the zone flanking the active stream channel.

meander scar - (a) A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream which impinged upon and undercut the bluff; if it's no longer adjacent to the modern stream channel it indicates an abandoned route of the stream; (b) (not recommended - refer to oxbow) An abandoned meander, commonly filled in by deposition and vegetation, but still discernable.

meander scroll - (a) One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank. Compare - meander belt, point bar. (b) (not recommended; refer to oxbow lake) - A small, elongate lake on a flood plain in a well-defined part of an abandoned stream channel.

mesa - A broad, nearly flat-topped, and usually isolated landmass bounded by steep slopes or precipitous cliff and capped by layers of resistant, nearly horizontal, rocky summit width greater than the height of bounding escarpments. (Colloquial: western US; not preferred) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys. Compare - butte, plateau, cuesta.

monocline - (a) A unit of folded strata that dips from the horizontal in one direction only, is not part of an anticline or syncline, and occurs at the earth's surface.. This structure is typically present in plateau areas where nearly flat strata locally assume steep dips caused by differential vertical movements without faulting. Compare - anticline, syncline, fold. (b) - A local steepening in an otherwise uniform gentle dip.

mountain - A generic term for an elevated area of the land surface, rising more than 300 meters above surrounding lowlands, usually with a nominal summit area relative to bounding slopes and generally with steep sides (greater than 25 percent slope) with or without considerable bare-rock exposed. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion. Compare - hill, hillock, plateau, foothills, mountains.

natural levee - A long, broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both sides of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. It has a gentle slope away from the river and toward the surrounding floodplain, and its highest elevation is closest to the river bank. Compare - levee, artificial levee, meander belt.

open depression - A generic name for any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit. Compare - closed basin.

overbank deposit - Fine-grained sediments (silt and clay) deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel.

overflow stream channel - A watercourse that is generally dry but conducts flood waters that have overflowed the banks of a river, commonly from large storms or annual meltwater.

oxbow - A closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream. (colloquial: northeastern A.) the land enclosed, or partly enclosed, within an oxbow. Compare - meander belt, oxbow lake, bayou.

oxbow lake - The crescent-shaped, often ephemeral body of standing water situated by the side of a stream in the abandoned channel (oxbow) of a meander after the stream formed a neck cutoff and the ends of the original bend were silted up. Compare - meander belt, oxbow.

parabolic dune - A sand dune with a long, scoop-shaped form, convex in the downwind direction so that its horns point upwind, whose ground plan, when perfectly developed, approximates the form of a parabola.

peak - Sharp or rugged upward extension of a ridge chain, usually at the junction of two or more ridges; the prominent highest point of a summit area.

pediment - A gently sloping erosional surface at the foot of a receding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with

alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland. In hill-foot slope terrain the mantle is designated “pedisegment.” The term has been used in several geomorphic contexts: Pediments may be classed with respect to (a) landscape positions, for example, intermontane-basin piedmont or valley-border footslope surfaces (respectively, apron and terrace pediments); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above. Compare - Piedmont slope.

perennial stream - A stream or reach of a stream that flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream. Compare - Ephemeral stream, Intermittent stream.

piedmont - (adjective) Lying or formed at the base of a mountain or mountain range; e.g., a piedmont terrace or a piedmont pediment. (noun) An area, plain, slope, glacier, or other feature at the base of a mountain; e.g., a foothill or a bajada. In the United States, the Piedmont is a low plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains.

piedmont slope - (colloquial - western US) The dominant gentle slope at the foot of a mountain; generally used in terms of intermontane-basin terrain in arid to subhumid regions. Main components include: (a) An erosional surface on bedrock adjacent to the receding mountain front (pediment, rock pediment); (b) A constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and (c) A distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to basin-floor depressions with alluvial and temporary lake plains or to surfaces associated with through drainage (e.g., axial streams). Compare - bolson, fan piedmont.

plain - A general term referring to any flat, lowland area, large or small, at a low elevation. Specifically, any extensive region of comparatively smooth and level gently undulating land. A plain has few or no prominent hills or valleys but sometimes has considerable slope, and usually occurs at low elevation relative to surrounding areas. Where dissected, remnants of a plain can form the local uplands. A plain may be forested or bare of trees and may be formed by deposition or erosion. Compare - lowland, plateau.

plateau - A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters) above adjacent lower-lying terrain, and is commonly limited on at least one side by an abrupt descent, has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level. Compare - hill, foothill, mountain, mesa, plain.

playa - The usually dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have high water table and saline conditions.

point bar - One of a series of low, arcuate ridges of sand and gravel developed on the inside of a growing meander by the slow addition of individual accretions accompanying migration of the channel toward the outer bank. Compare - meander scroll.

pond - (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water. Compare - salt pond.

pool - A small, natural body of standing water, usually fresh; e.g. a stagnant body of water in a marsh, or a transient puddle in a depression following a rain.

quarry - Excavation areas, open to the sky, usually for the extraction of stone.

ravine - A small stream channel; narrow, steep-sided, commonly V-shaped in cross section and larger than a gully, cut in unconsolidated materials. General synonym (not preferred) - gulch. Compare - arroyo, draw, gully.

reef - (a) A ridge-like or mound-like structure, layered or massive, built by sedentary calcareous organisms, especially corals, and consisting mostly of their remains; it is wave-resistant and stands above the surrounding contemporaneously deposited sediment. Also, such a structure built in the geologic past and now enclosed in rock, commonly of differing lithology. (b) A mass or ridge of rocks, especially coral and sometimes sand, gravel, or shells, rising above the surrounding sea or lake bottom to or nearly to the surface, and dangerous to navigation; specifically such a feature at 10 fathoms (18.3 m) or less, formerly 6 fathoms (11 m).

ridge - A long, narrow elevation of the land, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.

rill - A very small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice/snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough to be obliterated by ordinary tillage. Compare - gully.

rim - The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specifically the rimrock of a plateau or canyon.

rise - (refer to lake plain) (a) A general term for a slight increase in slope and elevation of the land surface, usually with a broad summit and gently sloping sides. (b) same as (a) but the term is restricted to microfeatures in areas of very low relief such as lake plains or coastal plains.

river - (a) A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea. (b) (not recommended: colloquial - New England, US) A small watercourse which elsewhere in the US is known as a **creek**. Compare - stream.

river valley - an elongate depression of the Earth's surface; carved by a river during the course of its development. Compare - valley side, valley floor.

rockfall - The process, associated sediments (rockfall deposit) or resultant landform characterized by a very rapid type of **fall** dominated by downslope movement of detached rock bodies which fall freely through the air or by leaps and bounds (lacks an underlying slip face); also spelled rock fall. Compare - debris fall, soil fall, landslide.

rock pediment - An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pediment or residuum (e.g. < 1.5 m) over bedrock; it occurs along the flanks of mountain fronts, or at the base of mountains or high hills. Its surface grades to the backwearing mountain slopes or hillslopes above, and generally grades down to and merges with a lower-lying alluvial plain, piedmont slope or valley floor below.

rotational slide - The process, associated sediments (rotational landslide deposit) or resultant landforms characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely soil-rock materials, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare - rotational debris slide, rotational earth slide, rotational rock slide, translational slide, lateral spread, landslide.

rubble - An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia. Compare - scree, talus.

saddle - A low point on a ridge or interfluvium, generally a divide (pass, col) between the heads of streams flowing in opposite directions. Compare - summit, crest.

sandhills - A region of semi-stabilized sand dunes or sandy hills, either covered with vegetation or bare, as in north-central Nebraska and the midlands of the Carolinas.

sand plain - (a) A sand-covered plain which may originate by deflation of sand dunes, and whose lower limit of erosion is governed by the ground-water level. Also spelled **sandplain**. (b) (not preferred - refer to **sandy** outwash plain) A small outwash plain composed chiefly of sand deposited by meltwater streams flowing from a glacier.

sand ramp - A sand sheet blown up onto the lower slopes of a bedrock hill or mountain and forming an inclined plane, sometimes filling small mountain-side valleys and even crossing low passes. Compare - climbing dune, sand sheet.

sand sheet - A large, irregularly shaped, commonly thin, surficial mantle of eolian sand, lacking the discernible slip faces that are common on dunes.

scarp - An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height. Compare - escarpment.

scarp slope - The relatively steeper face of a cuesta, facing in a direction opposite to the dip of the strata. Compare - dip slope.

scree - A collective term for an accumulation of coarse rock debris or a sheet of coarse debris mantling a slope.

Scree is not a synonym of talus, as scree includes loose, coarse fragment material on slopes without cliffs. Compare - talus, colluvium, mass movement.

scree slope - A portion of a hillside or mountainslope mantled by scree and lacking an up-slope rockfall source (i.e. cliff). Compare - talus slope, scree, talus.

seep - (noun) An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a seepage spring, but it is used by some for flows too small to be considered as springs.

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope. Compare - summit, crest, backslope, footslope, and toeslope.

shrub-coppice dune - A small, streamlined dune that forms around brush and clump vegetation.

side slope - A laterally planar area of a hillside, resulting in predominantly parallel overland water flow (e.g., sheet wash); contour lines generally form straight lines. Side slopes are dominated by colluvium and slope wash sediments. Slope complexity (downslope shape) can range from simple to complex. Compare - head slope, nose

slope, free face, interfluvium, crest, base slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluvium. It is generally linear along the slope width.

slide - (a) Mass movement processes, associated sediments (slide deposit) or resultant landforms (e.g., rotational, translational, and snow slide) characterized by a failure of earth, snow, or rock under shear stress along one or several surfaces that are either visible or may reasonably be inferred. The moving mass may or may not be greatly deformed, and movement may be rotational (rotational slide) or planar (translational slide). A slide can result from lateral erosion, lateral pressure, weight of overlying material, accumulation of moisture, earthquakes, expansion owing to freeze-thaw of water in cracks, regional tilting, undermining, fire, and human agencies. Compare -fall, topple, lateral spread, flow, complex landslide. (b) The track of bare rock or furrowed earth left by a slide. (c) The mass of material moved by or deposited by a slide.

slip face - The steeply sloping surface of a dune, standing at or near the angle of repose of loose sand, and advancing downwind by a succession of slides wherever that angle is exceeded.

slope - (also called slope gradient or gradient) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100.

slope alluvium - Sediment gradually transported down mountain or hill slopes primarily by non-channel alluvial processes (i.e., slope wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of coarse fragments and may be separated by stone lines. Sorting of pebbles or cobbles and burnished pedis distinguish these materials from unsorted colluvial deposits. Compare - colluvium, slope wash.

slope wash - A collective term for non-fluvial, incipient alluvial **processes** (e.g. overland flow, minor rills) that detach, transport, and deposit sediments down hill and mountain slopes. Related sediments (**slope alluvium**) exhibit nominal sorting or rounding of particles, pedis, etc., and lateral sorting downslope on long slopes; stratification is crude and intermittent and readily destroyed by pedoturbation and frost action. Also called **slope wash processes**. Compare - slope alluvium, colluvium, valley-side alluvium.

slot canyon - A long, narrow, deep and tortuous channel or drainageway with sheer rock walls eroded into sandstone or other sedimentary rocks, especially in the semi-arid western US (e.g. Colorado Plateau); subject to flash flood events; depth to width ratios exceed 10:1 over most of its length and can approach 100:1; commonly containing unique ecological communities distinct from the adjacent, drier uplands.

strath terrace - A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

stream - (a) A body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the ground surface, in a subterranean cavern, or beneath or in a glacier. It is a mixture of water and dissolved, suspended, or entrained matter. (b) A term used in quantitative geomorphology interchangeably with channel. Compare - river.

stream terrace - One or a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition (i.e., currently very rarely or never floods; inactive cut and fill and/or scour and fill processes). Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called "strath terraces." Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces. Compare - alluvial terrace, flood-plain step, strath terrace, terrace.

strike valley - A subsequent valley eroded in, and developed parallel to the strike of, underlying weak strata; such as a cuesta; a valley that often, but not necessarily contains a strike valley.

structural bench - A platform-like, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches are bedrock controlled, and in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plain development following an episode of valley trenching. Compare - pediment, ledge; see scarp.

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. Compare - shoulder, backslope, footslope, and toeslope, crest. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluvium area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments.

swale - (a) A shallow, open depression in unconsolidated materials which lacks a defined channel but can funnel overland or subsurface flow into a drainageway. Soils in swales tend to be more moist and thicker (cummulic) compared to surrounding soils. (b) A small, shallow, typically closed depression in an undulating ground moraine formed by uneven glacial deposition; Compare - swell-and-swale topography. (c) (not preferred; refer to interdune)

A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

syncline - (a) A unit of folded strata that is concave upward whose core contains the stratigraphically younger rocks, and occurs at the earth's surface. In a single syncline, beds forming the opposing limbs of the fold dip toward its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally concave upward whose core contains the stratigraphically younger rocks.

tableland - A term for a broad upland with an extensive, nearly level or undulating summit area and steep side slopes descending to surrounding lowlands. Compare - plateau, mesa, cuesta.

talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of loose broken rock formed chiefly by falling, rolling, or sliding. Compare - talus slope, colluvium, mass movement, scree.

talus cone - A small, steep, cone-shaped landform at the base of a cliff or escarpment, that heads in a relatively small declivity or ravine, and composed of poorly sorted rock and soil debris that has accumulated primarily by episodic rockfall or, to a lesser degree, by slope wash. Not to be confused with an **alluvial cone**; a similar feature but of fluvial origin, composed of better stratified and more sorted material, and that tapers up into a more extensive drainageway. Compare - alluvial cone, beveled base, talus slope.

talus slope - a portion of a hillslope or mountainslope mantled by talus and lying below a rockfall source (e.g. cliff). Compare - scree slope, scree, talus. Compare - beveled base.

tank - (colloquial: southwestern US) A natural depression or cavity in impervious rocks in which water collects and remains for the greater part of the year.

terrace - A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper slope (scarp, riser), descending to a lower base level. Compare - stream terrace, flood-plain step. Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage.

terraces - Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock such as sheep or cattle. Synonyms (not preferred) - catstep, sheep or cattle track.

toeslope - The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hill-slope continuum that grades to valley or closed-depression floors. Compare - summit, shoulder, backslope, footslope, valley floor.

translational slide - A category of mass movement processes, associated sediments (translational slide deposit) or resultant landforms characterized by the extremely slow to moderately rapid downslope displacement of comparatively dry soil-rock material on a surface (slip face) that is roughly parallel to the general ground surface, in contrast to falls, topples, and rotational slides. The term includes such diverse **slide** types as translational debris slides, translational earth slide, translational rock slide, block glides, and slab or flake slides. Compare - rotational slide, slide, landslide.

transverse dune - A very asymmetric sand dune elongated perpendicular to the prevailing wind direction, having a gentle windward slope and a steep leeward slope standing at or near the angle of repose of sand; it generally forms in areas of sparse vegetation. Compare - longitudinal dune.

valley - An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity. Compare - basin.

valley floor - A general term for the nearly level to gently sloping, lowest surface of a valley. Landforms include axial stream channels, the flood plain, flood-plain steps, and, in some areas, low terrace surfaces. Compare - flood-plain landforms, meander, braided channel, valley side.

valley side - The sloping to very steep surfaces between the valley floor and summits of adjacent uplands. Well-defined, steep valley sides have been termed valley walls (not recommended). Note: Scale, relief, and perspective may require use of closely related terms such as hill slope or mountain slope.

wash (dry wash) - (colloquial: western US.) The broad, flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium. Note: When channels reach intersect zones of ground-water discharge they are more properly classed as "intermittent stream" channels. Synonym - arroyo. Compare - gully.

zibar - A small, low-relief sand dune that lacks discernible slip faces and commonly occurs on sand sheets, in interdune areas, or in corridors between larger dunes. Zibar spacing can range from 50-400 m with local relief < 10 m. Unlike coppice dunes, zibars are unrelated to deposition around vegetation. Generally dominated by coarser sands. Compare - dune, coppice dune.

SOIL TEXTURE KEY

(Modified from Brewer and McCann 1982)

Soil primarily organic:

- 0a. Soil is black, is saturated with water, and often smells of rotten eggs**muck**
0b. Soil is dark brown, usually saturated, and consists of clearly identifiable plant parts**peat**

Soil primarily mineral:

- 1a. Soil does not remain in a ball when squeezed, leaves your fingers clean**sand**
1b. Soil remains in a ball when squeezed 2

Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you push up over your finger.

- 2a. Soil makes no ribbon but leaves your fingers dirty.....**loamy sand**
2b. Soil makes at least a very short ribbon.....3

- 3a. Ribbon extends less than 1 inch before breaking 4
3b. Ribbon extends 1 inch or more before breaking 5

- 4a. Add excess water to small amount of soil. Soil feels slightly gritty.....**loam**
4b. Soil feels very gritty.....**sandy loam**
4c. Soil feels smooth..... **silt loam**

- 5a. Soil makes a ribbon that breaks when 1-2 inches long; cracks if bent into a ring 6
5b. Soil makes a ribbon 2+ inches long; does not crack when bent into a ring 7

- 6a. Add excess water to small amount of soil; soil feels slightly gritty..... **clay loam**
6b. Soil feels very gritty and slightly sticky.....**sandy clay loam**
6c. Soil feels very smooth but not at all sticky..... **silt**
6d. Soil feels slightly gritty and slightly sticky.....**silty clay loam**

- 7a. Add excess water to a small amount of soil; soil feels gritty..... **sandy clay**
7b. Soil feels smooth and sometimes sticky.....8

- 8a. Soil feels smooth but leaves a gritty taste in the mouth.....**silty clay**
8b. Soil leaves a smooth taste in the mouth, not at all gritty.....**clay**

CONSIDERATIONS FOR PLANNING

Planning for the day:

1. Safety and sustenance: Plenty of food, water, first-aid kit, raingear, sunscreen.
2. Field communications:
 - a. Develop a plan with other team(s) for radio check-in time.
 - b. Do you have a radio and are batteries charged? If you have a walkie talkie, do you have extra batteries for it? Does park staff know the area in which you will be working?
3. Make sure you have the right maps and photos.
4. Check your GPS (Datum set to NAD83? WAAS on? Needs new batteries?).
5. Plan the day's mission before departing using a) USGS quads, b) aerial photos, c) BLM maps.
6. Considerations for mission planning:
 - a. Plan travel based on topography, best access routes, density and complexity of vegetation (more time for forest and woodland plots, less for herbaceous and scrub).
 - b. Plan data collection based on priority needs; new types get higher priority.
 - c. Communicate with the other team(s) to make sure you aren't duplicating effort.

Planning for the Week (do this on the first day of the trip)

1. Do you have all appropriate maps, photos?
2. Develop a reasonable estimate of the number of plots for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week to capture all essential associations in the work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information and backups for the week's planning? e.g., blank field forms, film, plenty of batteries.

Wrapup (Do this on the last day of the trip, after you have returned to base)

1. Clean, recharge and repair equipment.
2. Hold brief meeting to discuss data collection issues, things that came up during the work week, and plan for next work hitch.
3. Edit field forms and file them systematically. File observation points separately.
4. Re-file the aerial photos and maps.
5. Download digital photographs.
6. Key unknown plants.
7. Enter edited data into database.

Communicate among teams / Topics for wrap-up meetings.

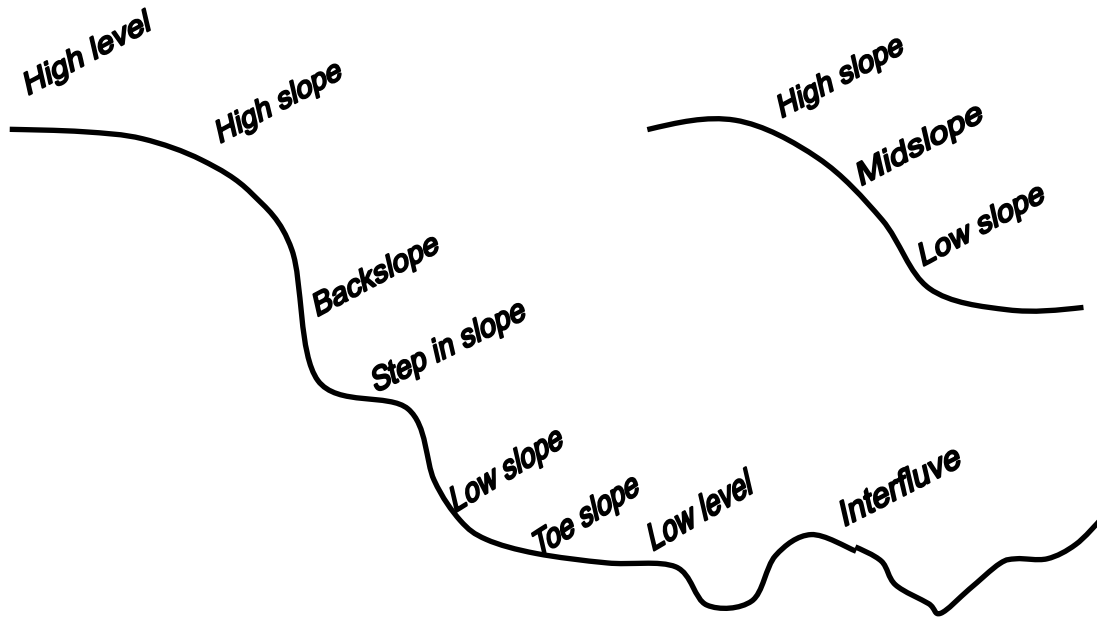
1. What were your questions about the polygons visited during the week?
2. Do you have any questions about the forms or fields?
3. What was accomplished, what was not accomplished?
4. Pass on developments and questions after every trip. Don't let them build up. For example, should we sample the new types we saw? Were there problems with interpreting the aerial photos, or are there personnel issues, problems in consistency in interpreting the forms, or with park-related logistics?

Materials Checklist

- Park research permit
- Topographic maps
- Park maps for general navigation
- Maps of BPU locations
- Geology map
- Aerial images or photographs
- DBH tape and 2 tape measure(s)
- Trowel or U-dig-it, soil water bottle
- Compass with adjustable declination
- Clinometer
- GPS receiver
- Plenty of AA batteries for GPS receiver and walkie talkie
- Radio or walkie talkie and/or cell phone or satellite phone
- Digital camera & SD cards (allow at least 3 exposures per plot plus general and scenic photographs)
- Baggies for temporary storage of unknown plants, and masking tape for labeling
- Plant press & paper
- Plant Keys / Flora(s)
- Pens / sharpies
- Forms: plot survey (both pages) and observation point
- Clipboard/forms holder
- Pens, pencils, pencil lead, slate board, chalk, and chalkboard eraser or supply of clean rags
- Stapler and extra staples
- Most recent version of provisional classification of the park, with the number of plots still needed per type (updated approx. every 2 weeks)
- All ancillary information (cheat sheet, species list, floras, sampling priority list for zone, main sampling protocol).
- First aid kit, personal gear (food, water, rain gear, etc.)

<u>LANDFORM</u> alluvial fan alluvial flat alluvial plain remnant alluvial terrace alluvium artificial levee backslope badlands bajada ballena ballon basin basin floor bench blowout bluff bolson borrow pit bottomland box canyon braided stream break butte canyon channel cliff climbing dune closed depression colluvium crest cuesta debris flow deflation basin depression desert pavement dike dip ditch divide dome drainageway draw dune dune field earthflow eolian deposit eolian sands ephemeral stream escarpment falling dune finger ridge flat flood plain foothills gorge gravel pit gulch gully	hanging valley hill hillslope hogback hummock interdune interfluv intermittent stream island knob knoll lakebed lakeshore landslide ledge levee meander belt mesa mountain natural levee overflow channel oxbow pediment perennial stream plain plateau playa point bar pool quarry ravine reef ridge rise rim rockfall saddle sand ramp sand sheet scarp scree slope shoulder side slope slope slope alluvium slope wash slot canyon stream terrace summit swale talus slope tank terrace terraces toeslope valley valley floor valley side wash (dry wash) zibar	<u>TOPOGRAPHIC POSITION</u> SEE THE DIAGRAM ON OTHER SIDE <u>VEGETATIVE STRATA</u> T1 = EMERGENT TREE T2 = TREE CANOPY T3 = TREE SUB-CANOPY. S1 = TALL SHRUB, > 2M S2 = SHORT SHRUB, < 2M S3 = DWARF SHRUB. < 0.5M H1 = GRAMINOID H2 = FORB H3 = FERN OR FERN ALLY H4 = TREE SEEDLINGS N = NONVASCULAR OTHER THAN FERN V = VINE/LIANA E = EPIPHYTE <u>PARK SPECIALS</u> (keep an eye out for) Rare plants Upland springs and seeps Hanging Gardens Invasive weeds (ignore cheatgrass, dandelions) <u>PHYSIOGNOMIC CLASS</u> Forest: Crowns touching Woodland: Trees>10%, crowns not touching Shrubland: Shrubs> grass, forbs or trees Dwarf Shrubland: Shrubland <0.5 m tall Shrub Herbaceous: Shrubs = Forbs/grasses Herbaceous: Grass/forbs > trees or shrubs <u>SOIL TEXTURE</u> Sand: clean, no ball Loamy sand: ball, no ribbon Sandy loam: v. gritty weak ribbon Silt loam: smooth weak ribbon Loam: slightly gritty weak ribbon Clay loam: long ribbon, no ring, slightly gritty Sandy clay loam: long ribbon, no ring, very gritty Silt: long ribbon, no ring, smooth Silty clay loam: long ribbon, no ring, slightly gritty and sticky. Clay: smooth ribbon/ring, edible Sandy Clay; gritty ribbon & ring Silty Clay: smooth ribbon/ring Peat: still has plant parts Muck: smelly black ooze <u>ASPECT</u> Flat Azimuth (deg.) Variable	<u>SURFICIAL GEOLOGY</u> Obscured by soil Aeolian sands New Alluvium (Holocene) Older Alluvium (pre Holocene) Talus / Colluvium / Landslides Boquillas Formation Buda Limestone Formation Del Rio Clay Formation Devils River Limestone Formation Salmon Peak Limestone Formation <u>DISTURBANCE</u> Water gullies Mass wasting Flash flooding Grazing evidence Development, historic structures Agriculture ORV use or Recreation Wildlife concentration Fire Drought <u>PLOT SIZE</u> 400m² (22.6m d): Forests, Woodlands, Shrublands 100m² (11.3m d): Dwarf-shrublands, Shrub-Herbaceous, Herbaceous 25m² (5.65m d): Non vascular *You may adapt plot size and shape to fit the situation; but never choose a plot size smaller than listed here.
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TOPOGRAPHIC POSITION - CHEAT SHEET



Appendix 3: List of Preliminary Plant Associations and Alliances at AMIS

The entire updated list of preliminary plant and association and alliances for AMIS includes 82 vegetation alliances and 102 plant associations. In addition, 52 provisional plant communities described by Poole (2004) are included in this classification list to alert field researchers that previously undescribed communities may be present and should be sampled. There are 15 potential forest and woodland alliances comprising 24 potential associations and 8 provisional plant communities; 33 potential shrubland, dwarf-shrubland, and shrub herbaceous alliances comprising 53 potential associations and 32 provisional plant communities; and 34 potential herbaceous and sparse alliances comprising 25 potential associations and 12 provisional plant communities. As deemed appropriate from the NVC and from legacy research, semi-natural vegetation types characterized by nonnative plant species were included in this classification (representing 10 vegetation alliances and 11 plant associations).

This vegetation classification list will be invaluable as a guidance tool for field crews to apply provisional names to vegetation stands sampled in the field with classification plots, prior to formal classification using statistical analyses. By reviewing this classification list, field crews will also be able to determine when they have encountered a previously undescribed vegetation type. A structured alliance/association list also allows field crews to tally classification plot and observation point numbers on a daily or trip basis to reduce unnecessary field sampling and also to ensure distribution of plots to sample diversity AMIS-wide, saving the project time and funding while ensuring thorough vegetation type sampling.

Table 1. NVC Forest and Woodland Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
Acacia farnesiana - Parkinsonia aculeata Temporarily Flooded Forest Alliance - Acacia farnesiana - Parkinsonia aculeata Temporarily Flooded Forest	Huisache - Retama Temporarily Flooded Forest Alliance - Huisache - Retama Temporarily Flooded Forest	A.1908 CEGL007755
Acacia farnesiana Woodland Alliance - Acacia farnesiana / Mixed Grasses Wooded Herbaceous Vegetation - Acacia farnesiana - (Prosopis glandulosa) Woodland - Acacia farnesiana – Prosopis glandulosa / Aloysia gratissima Woodland	Huisache Woodland Alliance - Huisache / Mixed Grasses Wooded Herbaceous Vegetation - Huisache - (Honey Mesquite) Woodland - Huisache – Honey Mesquite / Whitebrush Woodland	A.660 CEGL00xxxx CEGL002131 CEGL00xxxx
Carya illinoensis – (Celtis laevigata) Temporarily Flooded Forest Alliance - Carya illinoensis - Celtis laevigata Forest	Pecan – (Sugarberry) Temporarily Flooded Forest Alliance - Pecan - Sugarberry Forest	A.282 CEGL002087
- Celtis pallida – Prosopis glandulosa Woodland	- Granjeno – Honey Mesquite Woodland	CEGL00xxxx
Juniperus ashei Woodland Alliance	Ashe's Juniper Woodland Alliance	A.501
Juniperus pinchotii Woodland Alliance - Juniperus pinchotii / Bouteloua curtipendula - Bouteloua hirsuta Woodland - Juniperus pinchotii / Bouteloua gracilis Woodland	Pinchot's Juniper Woodland Alliance - Pinchot's Juniper / Sideoats Grama - Hairy Grama Woodland - Pinchot's Juniper / Blue Grama Woodland	A.505 CEGL004940 CEGL002122
Pinus cembroides – Quercus gravesii Forest Alliance	Mexican Pinyon Pine – Chisos Red Oak Forest Alliance	A.392
Populus deltoides Temporarily Flooded Forest Alliance - Populus deltoides - Celtis laevigata / Sapindus saponaria Woodland - Populus deltoides / Panicum virgatum – Schizachyrium scoparium Woodland - Populus deltoides – (Salix amygdaloides) / Salix (exigua, interior) Woodland - Populus deltoides - Salix nigra Woodland - Populus deltoides ssp. wislizeni / Schizachyrium scoparium Woodland - Populus deltoides (ssp. wislizeni, ssp. monilifera) / Salix exigua Woodland	Eastern Cottonwood Temporarily Flooded Forest Alliance - Eastern Cottonwood - Sugarberry / Wingleaf Soapberry Woodland - Eastern Cottonwood Switchgrass – Little Bluestem Woodland - Eastern Cottonwood – (Peachleaf Willow) / (Coyote, Sandbar Willow) Woodland - Eastern Cottonwood / Black Willow Woodland - Rio Grande Cottonwood / Little Bluestem Woodland - (Rio Grande Cottonwood, Plains Cottonwood) / Coyote Willow Woodland	A.290 CEGL005025 CEGL001454 CEGL000659 CEGL004919 CEGL005973 CEGL002685
Prosopis glandulosa Temporarily Flooded Woodland Alliance - Prosopis glandulosa Temporarily Flooded Woodland Prosopis glandulosa Woodland Alliance - Prosopis glandulosa Woodland - Prosopis glandulosa – Acacia farnesiana Woodland - Prosopis glandulosa / Bouteloua curtipendula – Nassella leucothricha Woodland - Prosopis glandulosa - Celtis pallida Woodland - Prosopis glandulosa / Leucophyllum frutescens Woodland - Prosopis glandulosa var. glandulosa - Acacia greggii - Celtis pallida /	Honey Mesquite Temporarily Flooded Woodland Alliance - Honey Mesquite Temporarily Flooded Woodland Honey Mesquite Woodland Alliance - Honey Mesquite Woodland - Honey Mesquite – Huisache Woodland - Honey Mesquite / Sideoats Grama – Texas Needlegrass Woodland - Honey Mesquite - Granjeno Woodland - Honey Mesquite / Cenizo Woodland - Honey Mesquite - Catclaw Acacia - Granjeno / Slender	A.637 CEGL004934 A.611 CEGL00xxxx CEGL00xxxx CEGL002133 CEGL00xxxx CEGL00xxxx CEGL007786

Table 1. NVC Forest and Woodland Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
- Paspalum setaceum - Urochloa ciliatissima Woodland - Prosopis glandulosa var. glandulosa - Celtis pallida / Opuntia spp. - Xylothamia palmeri Woodland - Prosopis glandulosa var. glandulosa / (Celtis pallida, Phaulothamnus spinescens, Ziziphus obtusifolia var. obtusifolia) Woodland	- Crowngrass - Fringed Signalgrass Woodland - Honey Mesquite - Granjeno / Prickly-pear species - South Texas Ericameria Woodland - Honey Mesquite / (Granjeno, Snake Eyes, Lotebush) Woodland	CEGL007787 CEGL002132
- Quercus gravesii – Pistacia mexicana Woodland	- Chisos Red Oak – Mexican Pistachio Woodland	CEGL00xxxx
Quercus fusiformis Woodland Alliance - Quercus fusiformis / Hilaria belangeri Woodland - Quercus fusiformis / Schizachyrium scoparium Woodland Quercus fusiformis – Celtis laevigata var. reticulata Woodland Alliance - Quercus fusiformis - (Celtis laevigata var. reticulata, Ulmus crassifolia) Woodland	Plateau Oak Woodland Alliance - Plateau Oak / Curly-mesquite Woodland - Plateau Oak / Little Bluestem Woodland Plateau Oak – Netleaf Hackberry Woodland Alliance - Plateau Oak - (Netleaf Hackberry, Cedar Elm) Woodland	A.477 CEGL002116 CEGL002115 A.663 CEGL002153
Salix exigua Seasonally Flooded Woodland Alliance - Salix exigua / Baccharis salicifolia – Baccharis neglecta / Schoenoplectus spp. Woodland	Coyote Willow Seasonally Flooded Woodland Alliance - Coyote Willow / Mule's Fat – Rooseveltweed / Clubrush species Woodland	A.649 CEGL004587
Salix gooddingii Temporarily Flooded Woodland Alliance - Salix gooddingii Woodland - Salix gooddingii - Fraxinus velutina Temporarily Flooded Woodland	Goodding's Willow Temporarily Flooded Woodland Alliance - Goodding's Willow Woodland - Goodding's Willow - Velvet Ash Temporarily Flooded Woodland	A.640 CEGL002743 CEGL003729
Salix nigra Seasonally Flooded Forest Alliance - Salix nigra / (Cephalanthus occidentalis) Forest Salix nigra Temporarily Flooded Forest Alliance - Salix nigra – Celtis laevigata var. laevigata / Baccharis neglecta Forest - Salix nigra Forest	Black Willow Seasonally Flooded Forest Alliance - Black Willow / (Common Buttonbush) Forest Black Willow Temporarily Flooded Forest Alliance - Black Willow – Sugarberry / Rooseveltweed Forest - Black Willow Forest	A.334 CEGL004773 A.297 CEGL007754 CEGL002103
Sapindus saponaria Woodland Alliance - Sapindus saponaria var. drummondii Woodland	Wingleaf Soapberry Woodland Alliance - Western Soapberry Woodland	A.627 CEGL004535

Table 2. NVC Shrubland, Dwarf-shrubland, and Shrub Herbaceous Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
<i>Acacia rigidula</i> – <i>Leucophyllum frutescens</i> – <i>Acacia berlandieri</i> Shrubland Alliance - <i>Acacia berlandieri</i> Shrubland - <i>Acacia berlandieri</i> South Texas Plains Shrubland - <i>Acacia berlandieri</i> – <i>Acacia rigidula</i> Shrubland - <i>Acacia berlandieri</i> - <i>Calliandra conferta</i> - <i>Castela texana</i> - <i>Forestiera angustifolia</i> Shrubland - <i>Acacia berlandieri</i> - <i>Diospyros texana</i> - <i>Sophora secundiflora</i> Shrubland - <i>Acacia berlandieri</i> - <i>Krameria ramosissima</i> Shrubland - <i>Acacia berlandieri</i> – <i>Leucophyllum frutescens</i> Shrubland - <i>Acacia berlandieri</i> - <i>Quercus pungens</i> var. <i>vaseyana</i> - <i>Quercus fusiformis</i> - <i>Porophyllum scoparium</i> - <i>Perityle lindheimeri</i> Open Cliff Sparse Shrubland	Chaparro-Prieto – Cenizo – Guajillo Shrubland Alliance - Guajillo Shrubland - Guajillo South Texas Plains Shrubland - Guajillo- Chaparro–Prieto Shrubland - Guajillo – Rio Grande Stickpea – Goatbush – Texas Swampprivet Shrubland - Guajillo – Texas Persimmon – Mescal Bean Shrubland - Guajillo – Manystem Ratany Shrubland - Guajillo – Cenizo Shrubland - Guajillo – Vasey Sandpaper Oak – Plateau Oak – Trans-Pecos Poreleaf – Lindheimer's Rockdaisy Open Cliff Sparse Shrubland	A.1909 CEGL00xxxx CEGL002181 CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx
<i>Acacia farnesiana</i> Shrubland Alliance - <i>Acacia farnesiana</i> – <i>Baccharis neglecta</i> Shrubland	Huisache Shrubland Alliance - Huisache – Rooseveltweed Shrubland	A.1029 CEGL00xxxx
<i>Acacia greggii</i> Shrubland Alliance	Catclaw Acacia Shrubland Alliance	A.1036
<i>Acacia neovernicosa</i> Shrubland Alliance - <i>Acacia neovernicosa</i> / <i>Bouteloua hirsuta</i> - <i>Bouteloua gracilis</i> - <i>Bouteloua eriopoda</i> Shrub Herbaceous Vegetation - <i>Acacia neovernicosa</i> / <i>Muhlenbergia porteri</i> Shrubland	Viscid Acacia Shrubland Alliance - Viscid Acacia / Hairy Grama - Blue Grama - Black Grama Shrub Herbaceous Vegetation - Viscid Acacia / Bush Muhly Shrubland	A.1037 CEGL004244 CEGL001342
<i>Acacia rigidula</i> - <i>Leucophyllum frutescens</i> - <i>Acacia berlandieri</i> Shrubland Alliance - <i>Acacia rigidula</i> Shrubland - <i>Acacia rigidula</i> – <i>Acacia berlandieri</i> Shrubland - <i>Acacia rigidula</i> - <i>Leucophyllum frutescens</i> Shrubland - <i>Acacia rigidula</i> - <i>Leucophyllum frutescens</i> - <i>Acacia berlandieri</i> Shrubland - <i>Acacia rigidula</i> - <i>Leucophyllum frutescens</i> - <i>Hechtia glomerata</i> Shrubland - <i>Acacia rigidula</i> - <i>Acacia berlandieri</i> - <i>Jatropha dioica</i> / <i>Selaginella wrightii</i> Shrubland - <i>Acacia rigidula</i> - <i>Acacia berlandieri</i> - <i>Leucophyllum frutescens</i> Shrubland - <i>Acacia rigidula</i> - <i>Aloysia gratissima</i> Shrubland - <i>Acacia rigidula</i> - <i>Baccharis neglecta</i> Shrubland - <i>Acacia rigidula</i> - <i>Calliandra conferta</i> Shrubland - <i>Acacia rigidula</i> - <i>Diospyros texana</i> / <i>Bothriochloa ischaemum</i> var. <i>songarica</i> Shrubland - <i>Acacia rigidula</i> - <i>Krameria ramosissima</i> Shrubland	Chaparro-Prieto - Cenizo - Guajillo Shrubland Alliance - Chaparro-Prieto Shrubland - Chaparro-Prieto – Guajillo Shrubland - Chaparro-Prieto – Cenizo Shrubland - Chaparro-Prieto – Cenizo – Guajillo Shrubland - Chaparro-Prieto - Cenizo - Guapilla Shrubland - Chaparro-Prieto – Guajillo – Leatherstem / Wright's Spikemoss Shrubland - Chaparro-Prieto – Guajillo - Cenizo Shrubland - Chaparro-Prieto - Whitebrush Shrubland - Chaparro-Prieto – Rooseveltweed Shrubland - Chaparro-Prieto – Rio Grande Stickpea Shrubland - Chaparro-Prieto – Texas Persimmon / Yellow (King Ranch) Beardgrass Shrubland - Chaparro-Prieto – Manystem Ratany Shrubland	A.1909 CEGL003874 CEGL00xxxx CEGL00xxxx CEGL007759 CEGL007760 CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx
<i>Arundinaria gigantea</i> Temporarily Flooded Shrubland Alliance - <i>Arundinaria gigantea</i> ssp. <i>gigantea</i> Shrubland	Giant Cane Temporarily Flooded Shrubland Alliance - Giant Cane Shrubland	A.795 CEGL003836
<i>Atriplex canescens</i> Shrubland Alliance - <i>Atriplex canescens</i> / <i>Bouteloua gracilis</i> Shrubland	Fourwing Saltbush Shrubland Alliance - Fourwing Saltbush / Blue Grama Shrubland	A.869 CEGL001283
<i>Baccharis salicifolia</i> Intermittently Flooded Shrubland Alliance	Mule's-fat Intermittently Flooded Shrubland Alliance	A.933

Table 2. NVC Shrubland, Dwarf-shrubland, and Shrub Herbaceous Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
<i>Baccharis salicifolia</i> – <i>Baccharis neglecta</i> Seasonally Flooded Shrubland Alliance	Mule's-fat – Rooseveltweed Seasonally Flooded Shrubland Alliance	A.987
<i>Bouteloua hirsuta</i> – <i>Bouteloua gracilis</i> – <i>Bouteloua eriopoda</i> Shrub Herbaceous Alliance	Hairy Grama – Blue Grama – Black Grama Shrub Herbaceous Alliance	A.1548
<i>Brickellia laciniata</i> Intermittently Flooded Shrubland Alliance	Splitleaf Brickellbush Intermittently Flooded Shrubland Alliance	A.940
- <i>Calliandra conferta</i> – <i>Acacia berlandieri</i> Shrubland	Rio Grande Stickpea - Guajillo Shrubland	CEGL00xxxx
- <i>Calliandra conferta</i> – <i>Krameria ramosissima</i> Shrubland	Rio Grande Stickpea – Manystem Ratany Shrubland	CEGL00xxxx
<i>Juglans microcarpa</i> Temporarily Flooded Shrubland Alliance	Little Walnut Temporarily Flooded Shrubland Alliance	A.945
- <i>Celtis laevigata</i> var. <i>reticulata</i> - <i>Juglans microcarpa</i> / <i>Leptochloa dubia</i> Shrubland	- Netleaf Hackberry - Little Walnut / Green Sprangletop Shrubland	CEGL002166
- <i>Celtis pallida</i> – <i>Prosopis glandulosa</i> Shrubland	- Granjeno – Honey Mesquite Shrubland	CEGL00xxxx
<i>Cephalanthus occidentalis</i> Semipermanently Flooded Shrubland Alliance	Common Buttonbush Semipermanently Flooded Shrubland Alliance	A.1011
- <i>Cephalanthus occidentalis</i> / <i>Carex</i> spp. - <i>Lemna</i> spp. Southern Shrubland	- Common Buttonbush / Sedge species - Duckweed species Southern Shrubland	CEGL002191
<i>Chilopsis linearis</i> Intermittently Flooded Shrubland Alliance	Desert-willow Intermittently Flooded Shrubland Alliance	A.1044
- <i>Chilopsis linearis</i> / <i>Brickellia laciniata</i> Shrubland	- Desert-willow / Splitleaf Brickellbush Shrubland	CEGL004933
<i>Dalea formosa</i> – <i>Mimosa borealis</i> Dwarf-shrubland Alliance	Featherplume – Pink Mimosa Dwarf-shrubland Alliance	A.3568
- <i>Dalea formosa</i> - <i>Mimosa borealis</i> Dwarf-shrubland	- Featherplume - Pink Mimosa Dwarf-shrubland	CEGL005009
<i>Dasyllirion leiophyllum</i> - (<i>Agave lechuguilla</i> , <i>Viguiera stenoloba</i>) Shrubland Alliance	Green Sotol - (Lechuguilla, Skeletonleaf Goldeneye) Shrubland Alliance	A.850
- <i>Dasyllirion leiophyllum</i> - <i>Agave lechuguilla</i> / <i>Bouteloua hirsuta</i> - <i>Bouteloua gracilis</i> - <i>Bouteloua eriopoda</i> Shrubland	- Green Sotol - Lechuguilla / Hairy Grama - Blue Grama - Black Grama Shrubland	CEGL004245
- <i>Dasyllirion leiophyllum</i> - <i>Viguiera stenoloba</i> - <i>Agave lechuguilla</i> / <i>Bouteloua ramosa</i> Shrubland	- Green Sotol - Skeletonleaf Goldeneye - Lechuguilla / Chino Grama Shrubland	CEGL004604
<i>Fallugia paradoxa</i> Intermittently Flooded Shrubland Alliance	Apache Plume Intermittently Flooded Shrubland Alliance	A.934
- <i>Fallugia paradoxa</i> Shrubland	- Apache Plume Shrubland	CEGL003875
<i>Flourensia cernua</i> Shrubland Alliance	Tarbush Shrubland Alliance	A.861
- <i>Flourensia cernua</i> / <i>Bouteloua curtipendula</i> Shrubland	- Tarbush / Sideoats Grama Shrubland	CEGL001336
- <i>Flourensia cernua</i> / <i>Pleuraphis mutica</i> Shrubland	- Tarbush / Tobosa Grass Shrubland	CEGL001541
<i>Fouquieria splendens</i> Shrubland Alliance	Ocotillo Shrubland Alliance	A.863
- <i>Fouquieria splendens</i> / <i>Bouteloua curtipendula</i> Shrubland	- Ocotillo / Sideoats Grama Shrubland	CEGL001376
- <i>Fouquieria splendens</i> / <i>Bouteloua hirsuta</i> Shrubland	- Ocotillo / Hairy Grama Shrubland	CEGL001377
- <i>Fouquieria splendens</i> / <i>Parthenium incanum</i> Shrubland	- Ocotillo / Mariola Shrubland	CEGL001378
- <i>Fouquieria splendens</i> Shrubland	- Ocotillo Shrubland	CEGL004452
<i>Gutierrezia sarothrae</i> Dwarf-shrubland Alliance	Broom Snakeweed Dwarf-shrubland Alliance	A.2528
- <i>Indigofera lindheimeri</i> – <i>Senna lindheimeri</i> Shrubland	- Lindheimer's Indigo – Lindheimer's Senna Shrubland	CEGL00xxxx
<i>Juglans microcarpa</i> Temporarily Flooded Shrubland Alliance	Little Walnut Temporarily Flooded Shrubland Alliance	A.945
- <i>Juglans microcarpa</i> - <i>Brickellia laciniata</i> / <i>Indigofera lindheimeriana</i> Edwards Plateau Shrubland	- Little Walnut - Splitleaf Brickellbush / Creek Indigo Edwards Plateau Shrubland	CEGL004932
- <i>Juglans microcarpa</i> / <i>Cladium mariscus</i> ssp. <i>jamaicense</i> Shrubland	- Little Walnut / Jamaica Swamp Sawgrass Shrubland	CEGL004593
- <i>Juglans microcarpa</i> Shrubland	- Little Walnut Shrubland	CEGL001103
<i>Larrea tridentata</i> Shrubland Alliance	Creosotebush Shrubland Alliance	A.851
- <i>Larrea tridentata</i> - <i>Agave lechuguilla</i> Shrubland	- Creosotebush - Lechuguilla Shrubland	CEGL004562

Table 2. NVC Shrubland, Dwarf-shrubland, and Shrub Herbaceous Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
- <i>Larrea tridentata</i> / <i>Dasychloa pulchella</i> Shrubland - <i>Larrea tridentata</i> - <i>Euphorbia antisiphilitica</i> Shrubland - <i>Larrea tridentata</i> - <i>Flourensia cernua</i> Shrubland - <i>Larrea tridentata</i> - <i>Jatropha dioica</i> var. <i>graminea</i> Shrubland - <i>Larrea tridentata</i> / <i>Muhlenbergia porteri</i> Shrubland - <i>Larrea tridentata</i> - <i>Opuntia schottii</i> Shrubland - <i>Larrea tridentata</i> - <i>Parthenium incanum</i> Shrubland - <i>Larrea tridentata</i> - <i>Prosopis glandulosa</i> Shrubland - <i>Larrea tridentata</i> / Sparse Understory Shrubland - <i>Larrea tridentata</i> / <i>Tiquilia canescens</i> Shrubland	- Creosotebush / Low Woolly Grass Shrubland - Creosotebush - Candelilla Shrubland - Creosotebush - Tarbush Shrubland - Creosotebush - Leatherstem Shrubland - Creosotebush / Bush Muhly Shrubland - Creosotebush - Dog Cholla Shrubland - Creosotebush - Mariola Shrubland - Creosotebush - Honey Mesquite Shrubland - Creosotebush / Sparse Understory Shrubland - Creosotebush / Gray Tiquilia Shrubland	CEGL001269 CEGL004564 CEGL001270 CEGL004566 CEGL001272 CEGL004567 CEGL001274 CEGL001275 CEGL001276 CEGL004569
<i>Acacia rigidula</i> – <i>Leucophyllum frutescens</i> – <i>Acacia berlandieri</i> Shrubland Alliance - <i>Leucophyllum frutescens</i> Shrubland - <i>Leucophyllum frutescens</i> – <i>Acacia berlandieri</i> Shrubland - <i>Leucophyllum frutescens</i> - <i>Salvia ballotiflora</i> - <i>Lippia graveolens</i> Shrubland	Chaparro-Prieto – Cenizo – Guajillo Shrubland Alliance - Cenizo Shrubland - Cenizo – Guajillo Shrubland - Cenizo - Mejorana - Redbrush Lippia Shrubland	A.1909 CEGL002168 CEGL00xxxx CEGL007789
- <i>Lippia graveolens</i> – <i>Acacia berlandieri</i> Shrubland - <i>Lippia graveolens</i> – <i>Acacia rigidula</i> Shrubland - <i>Lippia graveolens</i> – <i>Aristida purpurea</i> Shrubland - <i>Opuntia engelmannii</i> var. <i>lindheimeri</i> - <i>Salvia farinacea</i> Shrubland - <i>Parkinsonia aculeata</i> / <i>Cynodon dactylon</i> Shrubland - <i>Parkinsonia texana</i> – <i>Castela texana</i> – <i>Forestiera angustifolia</i> Shrubland	- Mexican Oregano – Guajillo Shrubland - Mexican Oregano – Chaparro-Prieto Shrubland - Mexican Oregano – Purple Three-awn Shrubland - Texas Pricklypear – Mealy Cup Sage Shrubland - Retama / Bermudagrass Shrubland - Texas Paloverde - Goatbush – Texas Swampprivet Shrubland	CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx CEGL00xxxx
<i>Pleuraphis mutica</i> Shrub Herbaceous Alliance	Tobosa Grass Shrub Herbaceous Alliance	A.1551
- <i>Porophyllum scoparium</i> Rock Outcrop Sparse Shrubland - <i>Porophyllum scoparium</i> / <i>Heterotheca fulcrata</i> – <i>Penstemon baccharifolius</i> Rock Outcrop Sparse Shrubland - <i>Porophyllum scoparium</i> - <i>Perityle lindheimeri</i> Open Cliff Sparse Shrubland	- Trans-Pecos Poreleaf Rock Outcrop Sparse Shrubland - Trans-Pecos Poreleaf / Rockyscree False Goldenaster – <i>Baccharis</i>leaf Beardtongue Rock Outcrop Sparse Shrubland - Trans-Pecos Poreleaf - Lindheimer's Rockdaisy Open Cliff Sparse Shrubland	CEGL00xxxx CEGL00xxxx CEGL00xxxx
<i>Prosopis glandulosa</i> Shrubland Alliance - <i>Prosopis glandulosa</i> / <i>Atriplex canescens</i> Shrubland - <i>Prosopis glandulosa</i> / <i>Bouteloua curtipendula</i> Shrubland - <i>Prosopis glandulosa</i> / <i>Bouteloua gracilis</i> Shrubland - <i>Prosopis glandulosa</i> / <i>Cynodon dactylon</i> Shrubland - <i>Prosopis glandulosa</i> / <i>Muhlenbergia porteri</i> Shrubland - <i>Prosopis glandulosa</i> / <i>Pleuraphis mutica</i> Shrub Herbaceous Vegetation - <i>Prosopis glandulosa</i> - <i>Ziziphus obtusifolia</i> Shrubland - <i>Prosopis glandulosa</i> var. <i>glandulosa</i> - <i>Opuntia engelmannii</i> var. <i>lindheimeri</i> - <i>Borrichia frutescens</i> Shrubland - <i>Prosopis glandulosa</i> var. <i>glandulosa</i> - <i>Parkinsonia texana</i> var. <i>macra</i> - (<i>Cordia boissieri</i>, <i>Koeberlinia spinosa</i>) Shrubland - <i>Prosopis glandulosa</i> var. <i>torreyana</i> Shrubland	Honey Mesquite Shrubland Alliance - Honey Mesquite / Fourwing Saltbush Shrubland - Honey Mesquite / Sideoats Grama Shrubland - Honey Mesquite / Blue Grama Shrubland - Honey Mesquite / Bermudagrass Shrubland - Honey Mesquite / Bush Muhly Shrubland - Honey Mesquite / Tobosa Grass Shrub Herbaceous Vegetation - Honey Mesquite - Lotebush Shrubland - Honey Mesquite - Texas Prickly-pear - Bushy Seaside-tansy Shrubland - Honey Mesquite - Texas Paloverde - (Anacahuita, Allthorn) Shrubland - Western Honey Mesquite Shrubland	A.1031 CEGL001382 CEGL002194 CEGL001383 CEGL00xxxx CEGL001511 CEGL001641 CEGL004939 CEGL007790 CEGL007762 CEGL001381
<i>Quercus mohriana</i> Shrubland Alliance	Mohr Oak Shrubland Alliance	A.782

Table 2. NVC Shrubland, Dwarf-shrubland, and Shrub Herbaceous Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
- <i>Quercus mohriana</i> - <i>Juniperus pinchotii</i> / <i>Bouteloua curtipendula</i> Shrubland	- Mohr Oak - Pinchot's Juniper / Sideoats Grama Shrubland	CEGL002173
<i>Rhus trilobata</i> Shrubland Alliance - <i>Rhus trilobata</i> / <i>Bouteloua curtipendula</i> - <i>Schizachyrium scoparium</i> Shrubland	Skunkbush Sumac Shrubland Alliance - Skunkbush Sumac / Sideoats Grama - Little Bluestem Shrubland	A.3569 CEGL005026
<i>Rhus virens</i> var. <i>choriophylla</i> Shrubland Alliance	Evergreen Sumac Shrubland Alliance	A.922
<i>Salix</i> (<i>exigua</i> , <i>interior</i>) Temporarily Flooded Shrubland Alliance - <i>Salix exigua</i> Temporarily Flooded Shrubland - <i>Salix interior</i> / <i>Phragmites australis</i> Temporarily Flooded Shrubland	(Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance - Coyote Willow Temporarily Flooded Shrubland - Sandbar Willow / Common Reed Temporarily Flooded Shrubland	A.947 CEGL001197 CEGL007753
<i>Salix nigra</i> Temporarily Flooded Shrubland Alliance - <i>Salix nigra</i> Temporarily Flooded Shrubland	Black Willow Temporarily Flooded Shrubland Alliance - Black Willow Temporarily Flooded Shrubland	A.948 CEGL003901
- <i>Salvia ballotiflora</i> – <i>Rhus virens</i> – <i>Diospyros texana</i> Shrubland	- Meiorana – Evergreen Sumac - Texas Persimmon Shrubland	CEGL00xxxx
<i>Sophora secundiflora</i> - <i>Diospyros texana</i> Shrubland Alliance	Mescal Bean - Texas Persimmon Shrubland Alliance	A.751
<i>Tamarix</i> spp. Semi-natural Temporarily Flooded Shrubland Alliance	Salt-cedar species Semi-natural Temporarily Flooded Shrubland Alliance	A.842
<i>Varilla texana</i> - <i>Castela erecta</i> Shrubland Alliance	Saladillo - Amargosa Shrubland Alliance	A.1910
- <i>Viguiera stenoloba</i> - <i>Bernardia obovata</i> / <i>Chamaesyce</i> sp. Shrubland	- Skeletonleaf Goldeneye - Desert Myrtle-croton / Sandmat species Shrubland	CEGL004603
- <i>Zanthoxylum fagara</i> - <i>Forestiera angustifolia</i> - <i>Diospyros texana</i> Shrubland	- Lime Prickly-ash - Texas Swamp-privet - Texas Persimmon Shrubland	CEGL004615

Table 3. NVC Herbaceous and Sparse Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
<i>Adiantum capillus-veneris</i> Saturated Herbaceous Alliance	Southern Maidenhair Saturated Herbaceous Alliance	A.1683
<i>Aristida purpurea</i> Herbaceous Alliance	Purple Threeawn Herbaceous Alliance	A.2570
<i>Arundo donax</i> Temporarily Flooded Herbaceous Alliance - <i>Arundo donax</i> Break Herbaceous Vegetation	Giant Reed Temporarily Flooded Herbaceous Alliance - Giant Reed Break Herbaceous Vegetation	A.1339 CEGL00xxxx
<i>Bothriochloa barbinodis</i> Herbaceous Alliance - <i>Bothriochloa barbinodis</i> Herbaceous Vegetation	Cane Beardgrass Herbaceous Alliance - Cane Beardgrass Herbaceous Vegetation	A.1209 CEGL005323
<i>Bouteloua curtipendula</i> Herbaceous Alliance - <i>Bouteloua curtipendula</i> - <i>Bouteloua (eriopoda, gracilis)</i> Herbaceous Vegetation	Sideoats Grama Herbaceous Alliance - Sideoats Grama – (Black Grama, Blue Grama) Herbaceous Vegetation	A.1244 CEGL002250
<i>Bouteloua gracilis</i> Herbaceous Alliance - <i>Bouteloua gracilis</i> - <i>Bouteloua curtipendula</i> Herbaceous Vegetation - <i>Bouteloua gracilis</i> - <i>Bouteloua hirsuta</i> Herbaceous Vegetation - <i>Bouteloua gracilis</i> – <i>Buchloe dactyloides</i> Herbaceous Vegetation	Blue Grama Herbaceous Alliance - Blue Grama – Sideoats Grama Herbaceous Vegetation - Blue Grama – Hairy Grama Herbaceous Vegetation - Blue Grama – Buffalograss Herbaceous Vegetation	A.1282 CEGL001754 CEGL001755 CEGL001756
<i>Bouteloua hirsuta</i> Herbaceous Alliance - <i>Bouteloua hirsuta</i> - <i>Bouteloua curtipendula</i> Herbaceous Vegetation	Hairy Grama Herbaceous Alliance - Hairy Grama – Sideoats Grama Herbaceous Vegetation	A.1285 CEGL001764
<i>Cenchrus (Pennisetum) ciliaris(e)</i> Herbaceous Alliance - <i>Cenchrus ciliaris</i> Semi-natural Herbaceous Vegetation	Buffelgrass Herbaceous Alliance - Buffelgrass Semi-natural Herbaceous Vegetation	A.1211 CEGL00xxxx
<i>Cladium mariscus</i> ssp. <i>jamaicense</i> Seasonally Flooded Temperate Herbaceous Alliance	Jamaica Swamp Sawgrass Seasonally Flooded Temperate Herbaceous Alliance	A.1369
<i>Cynodon dactylon</i> Herbaceous Alliance	Bermudagrass Herbaceous Alliance	A.1279
<i>Eleocharis palustris</i> Temporarily Flooded Herbaceous Alliance - <i>Eleocharis</i> spp. Herbaceous Vegetation	Common Spikerush Temporarily Flooded Herbaceous Alliance - Spikerush Species Herbaceous Vegetation	A.1342 CEGL00xxxx
<i>Eragrostis lehmanniana</i> Semi-natural Herbaceous Alliance	Lehmann's Lovegrass Semi-natural Herbaceous Alliance	A.2687
<i>Hilaria belangeri</i> – <i>Bouteloua curtipendula</i> Herbaceous Alliance - <i>Hilaria belangeri</i> – <i>Bouteloua curtipendula</i> Herbaceous Vegetation	Curly Mesquite – Sideoats Grama Herbaceous Alliance - Curly Mesquite – Sideoats Grama Herbaceous Vegetation	A.1214 CEGL002238
<i>Hydrilla verticillata</i> Permanently Flooded Herbaceous Alliance - <i>Hydrilla verticillata</i> Submerged Aquatic Vegetation	Water-Thyme Permanently Flooded Herbaceous Alliance - Water-Thyme Submerged Aquatic Vegetation	A.1745 CEGL00xxxx
<i>Lemna</i> spp. Permanently Flooded Herbaceous Alliance	Duckweed Species Permanently Flooded Herbaceous Alliance	A.1747
<i>Lesquerella (gordonii, ovalifolia)</i> Herbaceous Alliance - <i>Lesquerella (gordonii, ovalifolia)</i> - <i>Schizachyrium scoparium</i> Herbaceous Vegetation	Gordon's Bladderpod, Oval-leaf Bladderpod) Herbaceous Alliance - (Gordon's Bladderpod, Oval-leaf Bladderpod) - Little Bluestem Herbaceous Vegetation	A.1619 CEGL004917
<i>Justicia americana</i> Temporarily Flooded Herbaceous Alliance - <i>Justicia americana</i> Herbaceous Vegetation - <i>Justicia americana</i> - <i>Bacopa monnieri</i> Edwards Plateau Herbaceous Vegetation - <i>Marrubium vulgare</i> Semi-natural Herbaceous Vegetation	American Water-willow Temporarily Flooded Herbaceous Alliance - American Water-willow Herbaceous Vegetation - American Water-willow - Coastal Water-hyssop Edwards Plateau Herbaceous Vegetation - Horehound Semi-natural Herbaceous Vegetation	A.1657 CEGL004286 CEGL004926 CEGL00xxxx
Open Cliff Sparsely Vegetated Alliance	Open Cliff Sparsely Vegetated Alliance	A.1836
<i>Panicum obtusum</i> Herbaceous Alliance	Vine-mesquite Herbaceous Alliance	A.1238

Table 3. NVC Herbaceous and Sparse Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
- <i>Panicum obtusum</i> – <i>Buchloe dactyloides</i> Herbaceous Vegetation - <i>Panicum obtusum</i> - <i>Panicum hallii</i> Herbaceous Vegetation - <i>Panicum obtusum</i> Herbaceous Vegetation	- Vine-mesquite – Buffalograss Herbaceous Vegetation - Vine-mesquite - Hall's Panicgrass Herbaceous Vegetation - Vine-mesquite Herbaceous Vegetation	CEGL001573 CEGL001575 CEGL002708
<i>Panicum virgatum</i> Temporarily Flooded Herbaceous Alliance - <i>Panicum virgatum</i> - <i>Andropogon glomeratus</i> – <i>Cladium mariscus</i> ssp. <i>jamaicense</i> Herbaceous Vegetation	Switchgrass Temporarily Flooded Herbaceous Alliance - Switchgrass - Bushy Bluestem – Jamaica Swamp Sawgrass Herbaceous Vegetation	A.1343 CEGL004928
<i>Phragmites australis</i> Herbaceous Alliance - <i>Phragmites australis</i> Western North America Temperate Semi-natural Herbaceous Vegetation <i>Phragmites australis</i> Semipermanently Flooded Herbaceous Alliance <i>Phragmites australis</i> Temporarily Flooded Herbaceous Alliance - <i>Phragmites australis</i> Riverbank Herbaceous Vegetation - <i>Phragmites australis</i> - <i>Arundo donax</i> Riparian Corridor Herbaceous Vegetation - <i>Phragmites australis</i> - <i>Panicum virgatum</i> Herbaceous Vegetation	Common Reed Herbaceous Alliance - Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation Common Reed Semipermanently Flooded Herbaceous Alliance Common Reed Temporarily Flooded Herbaceous Alliance - Common Reed Riverbank Herbaceous Vegetation - Common Reed – Giant Reed Riparian Corridor Herbaceous Vegetation - Common Reed – Switchgrass Herbaceous Vegetation	A.1196 CEGL001475 A.1431 A.1345 CEGL004115 CEGL00xxxx CEGL00xxxx
- <i>Phyla nodiflora</i> – <i>Cynodon dactylon</i> – <i>Bacopa monnieri</i> Herbaceous Vegetation - <i>Phyla nodiflora</i> / <i>Nicotiana glauca</i> – <i>Vitex agnus-castus</i> Rock Outcrop Sparse Vegetation	- Turkey Tangle Fogfruit – Bermudagrass – Water Hyssop Herbaceous Vegetation - Turkey Tangle Fogfruit / Tree Tobacco – Lilac Chastetree Rock Outcrop Sparse Wooded Herbaceous Vegetation	CEGL00xxxx CEGL00xxxx
<i>Pleuraphis mutica</i> Herbaceous Alliance - <i>Pleuraphis mutica</i> – <i>Buchloe dactyloides</i> Herbaceous Vegetation <i>Pleuraphis mutica</i> Intermittently Flooded Herbaceous Alliance - <i>Pleuraphis mutica</i> - <i>Panicum obtusum</i> Herbaceous Vegetation	Tobosa Grass Herbaceous Alliance - Tobosa Grass – Buffalograss Herbaceous Vegetation Tobosa Grass Intermittently Flooded Herbaceous Alliance - Tobosa Grass – Vine-mesquite Herbaceous Vegetation	A.1249 CEGL002272 A.1330 CEGL001639
<i>Polygonum</i> spp. (section <i>Persicaria</i>) Seasonally Flooded Herbaceous Alliance - <i>Salsola kali</i> Semi-natural Herbaceous Vegetation	Smartweed species Seasonally Flooded Herbaceous Alliance - Russian-thistle Herbaceous Vegetation	A.1881 CEGL00xxxx
<i>Schizachyrium scoparium</i> - <i>Bouteloua curtipendula</i> Herbaceous Alliance - <i>Schizachyrium scoparium</i> - <i>Bouteloua curtipendula</i> – <i>Nassella leucotricha</i> Herbaceous Vegetation - <i>Schizachyrium scoparium</i> - <i>Bouteloua curtipendula</i> Western Great Plains Herbaceous Vegetation	Little Bluestem – Sideoats Grama Herbaceous Alliance - Little Bluestem – Sideoats Grama – Texas Wintergrass Herbaceous Vegetation - Little Bluestem – Sideoats Grama Western Great Plains Herbaceous Vegetation	A.1225 CEGL004070 CEGL001594
<i>Schoenoplectus americanus</i> Semipermanently Flooded Herbaceous Alliance	Chairmaker's Bulrush Semipermanently Flooded Herbaceous Alliance	A.1432
<i>Schoenoplectus californicus</i> Semipermanently Flooded Herbaceous Alliance - <i>Schoenoplectus californicus</i> Gulf Coast Herbaceous Vegetation - <i>Schoenoplectus californicus</i> Herbaceous Vegetation	Giant Bulrush Semipermanently Flooded Herbaceous Alliance - Giant Bulrush Gulf Coast Herbaceous Vegetation - Giant Bulrush Herbaceous Vegetation	A.1171 CEGL008464 CEGL00xxxx
<i>Schoenoplectus pungens</i> Semipermanently Flooded Herbaceous Alliance	Common Threesquare Semipermanently Flooded Herbaceous Alliance	A.1433
<i>Sorghum halepense</i> Semi-natural Herbaceous Alliance - <i>Sorghum halepense</i> - (<i>Amaranthus palmeri</i>) Semi-natural Herbaceous Vegetation	Johnson Grass Semi-natural Herbaceous Alliance - Johnson Grass - (Palmer's Amaranth) Semi-natural Herbaceous Vegetation	A.2020 CEGL005324

Table 3. NVC Herbaceous and Sparse Vegetation Alliances and Plant Associations Identified as Potentially Occurring within the AMIS Vegetation Inventory Project Area

NVC Alliance and/or Association	Common Name	Element Code
<i>Sporobolus cryptandrus</i> Herbaceous Alliance - <i>Sporobolus cryptandrus</i> - <i>Schizachyrium scoparium</i> - <i>Bouteloua curtipendula</i> Herbaceous Vegetation	Sand Dropseed Herbaceous Alliance - Sand Dropseed - Little Bluestem - Sideoats Grama Herbaceous Vegetation	A.1252 CEGl005031
<i>Sporobolus wrightii</i> Saturated Herbaceous Alliance - <i>Sporobolus wrightii</i> Herbaceous Vegetation - <i>Sporobolus wrightii</i> - <i>Panicum obtusum</i> Herbaceous Vegetation	Big Alkali Sacaton Saturated Herbaceous Vegetation - Big Alkali Sacaton Herbaceous Vegetation - Big Alkali Sacaton - Vine-mesquite Herbaceous Vegetation	A.1435 CEGl002232 CEGl001486
<i>Typha domingensis</i> Semipermanently Flooded Tropical Herbaceous Alliance - <i>Typha domingensis</i> – <i>Colacasia esculenta</i> Semipermanently Flooded Herbaceous Vegetation	Southern Cattail Semipermanently Flooded Tropical Herbaceous Alliance - Southern Cattail – Asian Taro Semipermanently Flooded Herbaceous Vegetation	A.1175 CEGl00xxxx

Appendix 4: Plant Species List for AMIS

Comprehensive list of plant species observed at AMIS, organized alphabetically by family, and based on field surveys from 1993 to 2004.

(Sources: (1) Poole, J. M. 2004. An inventory of the vascular plants at Amistad National Recreation Area. Texas Natural Heritage Program. (2) 1995. Biological survey of Lake Amistad Recreational Site: Final Report. Texas Natural Heritage Program. Resource Protection Division. Texas Parks and Wildlife Department. 3000 South Interstate 35, Suite 100, Austin, TX 78704.)

<i>Scientific Name</i>	<i>Common Name</i>
<i>Acanthaceae</i>	<i>Acanthaceae</i>
Carlowrightia texana	Texas wrightwort
Carlowrightia torreyana	Torrey's wrightwort
Dyschoriste linearis	narrowleaf dyschoriste
Justicia americana	American waterwillow
Justicia wrightii	Wright's justicia
Nomaphila stricta	temple plant
Ruellia corzoi	Corzo's wild petunia
Ruellia davisiorum	Rio Grande wild petunia
Ruellia humilis	fringeleaf wild petunia
Ruellia metziae	Metz's wild petunia
Ruellia nudiflora var. nudiflora	violet wild petunia
Ruellia nudiflora var. runyonii	Runyon's wild petunia
Ruellia occidentalis	western wild petunia
Ruellia parryi	Parry's wild petunia
Siphonoglossa pilosella	hairy tubetongue
Yeatesia platystegia	Montell bractspike
<i>Agavaceae</i>	<i>Agavaceae</i>
Agave americana	century plant
Agave lechuguilla	lechuguilla
Hesperaloe parviflora	red yucca
Yucca constricta	Buckley yucca
Yucca reverchonii	San Angelo yucca
Yucca rostrata	Thompson yucca
Yucca rupicola	Texas yucca
Yucca thompsoniana	Thompson yucca
Yucca torreyi	Torrey yucca
Yucca treculeana	Don Quixote's lace
<i>Amaranthaceae</i>	<i>Amaranthaceae</i>
Alternanthera caracasana	mat chaff-flower
Amaranthus blitoides	prostrate pigweed
Amaranthus crassipes	spreading amaranth
Amaranthus hybridus	green amaranth
Amaranthus palmeri	Palmer's amaranth
Amaranthus scleropoides	bonebract amaranth
Froelichia arizonica	Arizona snakecotton
Froelichia gracilis	slender snakecotton
Gossypianthus lanuginosus var. lanuginosus	woolly cottonflower
<i>Anacardiaceae</i>	<i>Anacardiaceae</i>
Pistacia mexicana	Texas pistachio
Rhus microphylla	littleleaf sumac
Rhus trilobata var. trilobata	skunkbush sumac
Rhus virens	evergreen sumac
Rhus virens var. choriophylla	evergreen sumac
Rhus virens var. virens	evergreen sumac
Toxicodendron radicans	poison ivy
<i>Anemiaceae</i>	<i>Anemiaceae</i>
Anemia mexicana	Mexican fern
<i>Apiaceae</i>	<i>Apiaceae</i>
Ammoselinum butleri	Butler's sand parsley
Ammoselinum popei	Pope's sand parsley
Bifora americana	American bifora
Bowlesia incana	hoary bowlesia
Chaerophyllum tainturieri	chervil

Ciclospermum leptophyllum		slimlobe celery	
Cicuta maculata		spotted water hemlock	
Daucus pusillus		southwestern carrot	
Eryngium diffusum		bushy eryngo	
Eryngium leavenworthii		Leavenworth's eryngo	
Hydrocotyle verticillata		whorled pennywort	
Spermolepis inermis		smooth scaleseed	
Torilis arvensis		sockbane	
<i>Apocynaceae</i>		<i>Apocynaceae</i>	
Amsonia longiflora var. salpignanthera		trumpet slimpod	
Macrosiphonia lanuginosa var. macrosiphon		plateau rocktrumpet	
<i>Aristolochiaceae</i>		<i>Aristolochiaceae</i>	
Aristolochia coryi		Cory's pipevine	
<i>Asclepiadaceae</i>		<i>Asclepiadaceae</i>	
Asclepias asperula		spider antelopehorn	
Asclepias incarnata		swamp milkweed	
Asclepias oenotheroides		longhorn milkweed	
Cynanchum barbigerum		bearded swallowwort	
Cynanchum maccartii		MacCart's swallowwort	
Cynanchum racemosum var. unifarium		talayote	
Funastrum crispum		wavyleaf twinevine	
Matelea reticulata		pearl milkvine	
Matelea sagittifolia		arrowleaf milkvine	
Sarcostemma cynanchoides ssp. cynanchoides		twinevine	
<i>Asteraceae</i>		<i>Asteraceae</i>	
Acourtia runcinata		peonia	
Ageratina havanensis		shrubby boneset	
Amblyolepis setigera		huisache daisy	
Ambrosia artemisiifolia		common ragweed	
Ambrosia confertiflora		field ragweed	
Ambrosia psilostachya		western ragweed	
Aphanostephus ramosissimus var. ramosissimus		lazy daisy	
Aphanostephus riddellii		Riddell's lazy daisy	
Artemisia dracunculus		false tarragon sagewort	
Baccharis neglecta		Roosevelt weed	
Baccharis salicifolia		seepwillow	
Bahia absinthifolia		hairyseed bahia	
Baileya multiradiata		desert marigold	
Brickellia dentata		gravelbar brickellbush	
Brickellia eupatorioides var. chlorolepis		false boneset	
Brickellia laciniata		splitleaf brickellbush	
Calypocarpus vialis		straggler daisy	
Carduus tenuiflorus		slender bristlethistle	
Centaurea americana		American basketflower	
Centaurea melitensis		yellow star-thistle	
Chaetopappa bellidifolia		hairy leastdaisy	
Chaetopappa bellioides		manyflower leastdaisy	
Chaptalia texana		silverpuff	
Chloracantha spinosa		spiny aster	
Chrysactinia mexicana		damianita	
Cirsium texanum		Texas thistle	
Cirsium turneri		Turner's cliff thistle	
Conoclinium greggii		Gregg's eupatorium	
Conyza canadensis		Canadian horseweed	
Eclipta prostrata		false daisy	
		running fleabane	

Erigeron colomexicanus	Plains fleabane
Erigeron modestus	white boneset
Eupatorium serotinum	flathead rabbit tobacco
Evax prolifera	roundhead rabbit tobacco
Evax verna	sticky palafoxia
Florestina tripteris	tarbush
Flourensia cernua	Shinner's brickelbush
Flyriella parryi	Coahuila Indian blanket
Gaillardia coahuilensis	slender gaillardia
Gaillardia pinnatifida	Indian blanket
Gaillardia pulchella var. pulchella	rayless gaillardia
Gaillardia suavis	narrowleaf purple everlasting
Gamochaeta falcata	chomonque
Gochnatia hypoleuca	manyray gumweed
Grindelia grandiflora	threadleaf snakeweed
Gutierrezia microcephala	broom snakeweed
Gutierrezia sarothrae	roundleaf snakeweed
Gutierrezia sphaerocephala	tatalencho
Gymnosperma glutinosum	false broomweed
Haploesthes greggii var. texana	pretty sneezeweed
Helenium elegans var. elegans	smallhead sneezeweed
Helenium microcephalum	smallhead sneezeweed
Helenium microcephalum var. microcephalum	smallhead sneezeweed
Helenium microcephalum var. ooclinium	common sunflower
Helianthus annuus	rocky goldaster
Heterotheca fulcrata	camphorweed
Heterotheca subaxillaris	fragrant bitterweed
Hymenoxys odorata	wild lettuce
Lactuca serriola	Coulter's conyza
Laennecia coulteri	dotted gayfeather
Liatris punctata	Texas star
Lindheimera texana	lacy tansyaster
Machaeranthera pinnatifida var. pinnatifida	blackfoot daisy
Melampodium cinereum var. hirtellum	plains blackfoot daisy
Melampodium leucanthum	small palafox
Palafoxia callosa	Texas palafoxia
Palafoxia texana var. texana	lyreleaf parthenium
Parthenium confertum	ragweed parthenium
Parthenium hysterophorus	mariola
Parthenium incanum	crownseed pectis
Pectis angustifolia	narrowleaf rockdaisy
Perityle angustifolia	Lindheimer rockdaisy
Perityle lindheimeri	rock lettuce
Pinaropappus roseus	purple pluchea
Pluchea carolinensis	poreleaf
Porophyllum scoparium	Jersey cudweed
Pseudognaphalium luteoalbum	cudweed paperflower
Psilostrophe gnaphalioides	hairy paperflower
Psilostrophe tagetina var. cerifera	manystem false dandelion
Pyrrhopappus pauciflorus	Mexican hat
Ratibida columnifera	threadleaf groundsel
Senecio flaccidus var. flaccidus	bush sunflower
Simsia calva	Julia's goldenrod
Solidago juliae	common sowthistle
Sonchus oleraceus	hierba del marrano
Symphytotrichum divaricatum	southwestern annual saltmarsh aster

Symphyotrichum expansum	Plateau nerveray
Tetragonotheca texana	clustered bitterweed
Tetraneuris scaposa var. argyrocaulon	slender greenthread
Thelesperma filifolium	bighead greenthread
Thelesperma megapotamicum	slender greenthread
Thelesperma simplicifolium	needle dogweed
Thymophylla acerosa	woolly dogweed
Thymophylla micropoides	five needle pricklyleaf
Thymophylla pentachaeta	parralena
Thymophylla pentachaeta var. pentachaeta	Texas pricklyleaf
Thymophylla setifolia var. radiata	bristleleaf dogweed
Thymophylla tenuiloba var. tenuiloba	Trecul's bristleleaf dogweed
Thymophylla tenuiloba var. treculii	cowpen daisy
Verbesina encelioides	plateau golden-eye
Viguiera dentata	skeletonleaf goldeneye
Viguiera stenoloba	hairy wedelia
Wedelia texana	cocklebur
Xanthium strumarium	
<i>Berberidaceae</i>	<i>Berberidaceae</i>
Mahonia trifoliolata	agarita
<i>Bignoniaceae</i>	<i>Bignoniaceae</i>
Chilopsis linearis	desert willow
Tecoma stans	yellow bells
<i>Bixaceae</i>	<i>Bixaceae</i>
Amoreuxia wrightii	yellow show
<i>Boraginaceae</i>	<i>Boraginaceae</i>
Antiphytum heliotropioides	Mexican saucerflower
Cordia podocephala	cluster cordia
Cryptantha mexicana	Mexican cryptantha
Cryptantha micrantha	redroot cryptantha
Cryptantha palmeri	Palmer's cryptantha
Heliotropium confertifolium	leafy heliotrope
Heliotropium curassavicum var. curassavicum	seaside heliotrope
Heliotropium curassavicum var. curassavicum	salt heliotrope
Heliotropium procumbens	fourspike heliotrope
Heliotropium torreyi	Torrey heliotrope
Lappula occidentalis	flatspine stickseed
Lappula redowskii	flatspine stickseed
Lithospermum incisum	narrowleaf gromwell
Lithospermum matamorensis	Mexican navelseed
Lithospermum mirabile	San Antonio stoneseed
Lithospermum parksii	Parks' gromwell
Omphalodes aliena	Mexican navelseed
Tiquilia canescens	woody crinklemat
Tiquilia canescens var. canescens	gray coldenia
Tiquilia mexicana	Mexican coldenia
<i>Brassicaceae</i>	<i>Brassicaceae</i>
Brassica juncea	India mustard
Descurainia pinnata	tansy mustard
Draba cuneifolia	wedgeleaf draba
Draba platycarpa	broadpod whitlowwort
Eruca vesicaria ssp. sativa	rocketsalad
Lepidium austrinum	hairy peppergrass
Lepidium lasiocarpum var. wrightii	hairypod peppergrass
Lepidium virginicum	smooth pepperweed
Lesquerella argyraea	silver bladderpod

Lesquerella fendleri	Fendler's bladderpod
Lesquerella gordonii	Gordon bladderpod
Lesquerella gracilis	white bladderpod
Lesquerella purpurea	rose bladderpod
Lesquerella recurvata	slender bladderpod
Nerisyrenia camporum	mesa greggia
Rorippa nasturtium-aquaticum	watercress
Rorippa teres	southern marsh yellowcress
Sisymbrium irio	London rocket
Streptanthus platycarpus	broadpod twistflower
<i>Bromeliaceae</i>	<i>Bromeliaceae</i>
Tillandsia recurvata	ballmoss
<i>Cactaceae</i>	<i>Cactaceae</i>
Ancistrocactus brevihamatus	short-spined fishhook cactus
Ancistrocactus tobuschii	Tobusch fishhook cactus
Ariocarpus fissuratus	living rock cactus
Coryphantha echinus var. echinus	sea-urchin cactus
Coryphantha pottsiana	Runyon's pincushion cactus
Coryphantha sulcata	grooved nipple cactus
Coryphantha tuberculosa	cob cactus
Echinocactus horizionthalonius	eagle claw cactus
Echinocactus texensis	horse-crippler
Echinocereus coccineus var. paucispinus	Texas claret-cup cactus
Echinocereus enneacanthus var. enneacanthus	strawberry cactus
Echinocereus pectinatus var. wenigeri	Langtry rainbow cactus
Echinocereus stramineus	strawberry cactus
Epithelantha micromeris	common button cactus
Ferocactus hamatacanthus var. hamatacanthus	giant fishhook-cactus
Glandulicactus uncinatus var. wrightii	eagle-claw cactus
Hamatocactus bicolor	twisted-rib cactus
Mammillaria heyderi var. heyderi	Heyder's pincushion cactus
Mammillaria lasiacantha	golf ball cactus
Mammillaria prolifera var. texana	hair-covered cactus
Neolloydia conoidea	Texas cone cactus
Opuntia atrispina	black-and-yellow spined prickly pear
Opuntia engelmannii var. lindheimeri	Texas prickly pear
Opuntia leptocaulis	Christmas cholla
Opuntia macrocentra var. macrocentra	long-spined purplish prickly pear
Opuntia phaeacantha	brown-spined prickly pear
Opuntia schottii var. schottii	Schott's dog cholla
Opuntia X subarmata	prickly pear
<i>Campanulaceae</i>	<i>Campanulaceae</i>
Lobelia berlandieri var. brachypoda	blue lobelia
Lobelia cardinalis	cardinal flower
Triodanis coloradoensis	Colorado Venus' looking-glass
Triodanis leptocarpa	slimpod Venus' looking-glass
Triodanis perfoliata	Venus' looking-glass
<i>Capparaceae</i>	<i>Capparaceae</i>
Koeberlinia spinosa	allthorn
Polanisia dodecandra ssp. trachysperma	clammyweed
<i>Caryophyllaceae</i>	<i>Caryophyllaceae</i>
Arenaria benthamii	Bentham sandwort
Paronychia jamesii	James nailwort
Silene antirrhina	sleepy catchfly

<i>Celastraceae</i>	
Mortonia sempervirens	
Schaefferia cuneifolia	
<i>Chenopodiaceae</i>	
Atriplex canescens	
Chenopodium berlandieri var. berlandieri	
Chenopodium incanum	
Chenopodium pratericola	
Kochia scoparia	
Salsola tragus	
Suaeda moquinii	
<i>Commelinaceae</i>	
Commelina erecta	
Tinantia anomala	
Tradescantia brevifolia	
Tradescantia occidentalis	
<i>Convolvulaceae</i>	
Bonamia repens	
Convolvulus arvensis	
Convolvulus equitans	
Dichondra micrantha	
Evolvulus alsinoides var. angustifolius	
Evolvulus nuttallianus	
Evolvulus sericeus	
Ipomoea cordatotriloba	
Ipomoea cordatotriloba var. cordatotriloba	
Ipomoea costellata	
Ipomoea lindheimeri	
Ipomoea rupicola	
Ipomoea sagittata	
Merremia dissecta	
<i>Crassulaceae</i>	
Sedum wrightii	
<i>Cucurbitaceae</i>	
Apodanthera undulata	
Cucurbita foetidissima	
Ibervillea lindheimeri	
Ibervillea tenuisecta	
Melothria pendula	
<i>Cupressaceae</i>	
Juniperus ashei	
Juniperus pinchotii	
<i>Cuscutaceae</i>	
Cuscuta exaltata	
Cuscuta indecora	
Cuscuta indecora var. indecora	
Cuscuta indecora var. neuropetala	
Cuscuta pentagona var. glabrior	
Cuscuta pentagona var. pubescens	
<i>Cyperaceae</i>	
Carex microdonta	
Carex planostachys	
Cladium mariscus ssp. jamaicense	
Cyperus acuminatus	
Cyperus elegans	

<i>Celastraceae</i>	
rough mortonia	
desert yaupon	
<i>Chenopodiaceae</i>	
fourwing saltbush	
pitseed goosefoot	
mealy goosefoot	
thickleaf goosefoot	
Mexican fireweed	
Russian thistle	
quelite salad	
<i>Commelinaceae</i>	
erect dayflower	
false dayflower	
Trans-Pecos spiderwort	
prairie spiderwort	
<i>Convolvulaceae</i>	
creeping petrogenia	
field bindweed	
hoary bindweed	
Asian ponysfoot	
ojo de vibora	
hairy evolvulus	
silky evolvulus	
tievine	
tievine	
crestrib morning glory	
Lindheimer morning glory	
cliff morning glory	
saltmarsh morning glory	
Alamovine	
<i>Crassulaceae</i>	
Wright's stonecrop	
<i>Cucurbitaceae</i>	
chile coyote	
buffalo gourd	
Lindheimer globeberry	
slimlobe globeberry	
creeping cucumber	
<i>Cupressaceae</i>	
Ashe juniper	
redberry juniper	
<i>Cuscutaceae</i>	
oak dodder	
bigseed alfalfa dodder	
bigseed alfalfa dodder	
bigseed dodder	
bushclover dodder	
bushclover dodder	
<i>Cyperaceae</i>	
littletooth sedge	
cedar sedge	
Jamaica sawgrass	
taperleaf flatsedge	
sticky flatsedge	

Cyperus ochraceus	pond flatsedge
Cyperus odoratus	fragrant flatsedge
Cyperus squarrosus	bearded flatsedge
Eleocharis cellulosa	Gulf Coast spikesedge
Eleocharis geniculata	annual spikesedge
Eleocharis interstincta	knotted spikerush
Eleocharis montevidensis	sand spikesedge
Eleocharis palmeri	sand spikerush
Eleocharis palustris	large spikesedge
Eleocharis rostellata	tussock spikesedge
Fimbristylis vahlii	Vahl's fimbry
Fuirena simplex	porcupine sedge
Rhynchospora colorata	whitetop sedge
Rhynchospora nivea	showy whitetop
Schoenoplectus americanus	chairmaker's bulrush
Schoenoplectus californicus	California bulrush
Schoenoplectus pungens	American bulrush
Schoenoplectus tabernaemontani	softstem bulrush
<i>Ebenaceae</i>	<i>Ebenaceae</i>
<i>Diospyros texana</i>	<i>Texas persimmon</i>
<i>Ephedraceae</i>	<i>Ephedraceae</i>
Ephedra antisiphilitica	clap-weed, popote
Ephedra aspera	boundary ephedra
Ephedra pedunculata	vine joint-for
<i>Equisetaceae</i>	<i>Equisetaceae</i>
Equisetum hyemale var. affine	scouring-rush horsetail
Equisetum laevigatum	smooth scouring-rush
<i>Euphorbiaceae</i>	<i>Euphorbiaceae</i>
Acalypha monostachya	creeping copperleaf
Acalypha phleoides	Lindheimer copperleaf
Argythamnia neomexicana	New Mexico wildmercury
Bernardia myricifolia	brush myrtlecroton
Bernardia obovata	desert myrtlecroton
Chamaesyce acuta	pointed spurge
Chamaesyce albomarginata	whitemargin spurge
Chamaesyce angusta	narrowleaf spurge
Chamaesyce cinerascens	shy spurge
Chamaesyce glyptosperma	ridgeseed spurge
Chamaesyce hyssopifolia	hyssop-leaf spurge
Chamaesyce maculata	spotted sandmat
Chamaesyce prostrata	prostrate spurge
Chamaesyce serpens	smooth matspurge
Croton capitatus var. lindheimeri	Lindheimer's hogwort
Croton dioicus	grassland croton
Croton fruticosus	bush croton
Croton incanus	vara blanca
Croton lindheimerianus var. lindheimerianus	Tharp croton
Croton monanthogynus	oneseed croton
Croton pottsii	leatherweed croton
Croton pottsii var. pottsii	
Euphorbia antisiphilitica	candelilla
Euphorbia cyathophora	wild poinsettia
Euphorbia davidii	toothed spurge
Euphorbia longicruris	longhorn spurge
Euphorbia peplidion	low euphorbia

Euphorbia spathulata	warty spurge
Jatropha dioica var. dioica	leatherstem
Leptopus phyllanthoides	maidenbush
Phyllanthus polygonoides	knotweed leafflower
Ricinus communis	castorbean
Stillingia treculiana	Trecul stillingia
Tragia amblyodonta	dogtooth noseburn
Tragia ramosa	catnip noseburn
Triadica sebifera	Chinese tallow tree
<i>Fabaceae</i>	<i>Fabaceae</i>
Acacia angustissima var. chisosiana	Chisos prairie acacia
Acacia angustissima var. hirta	prairie acacia
Acacia berlandieri	guajillo
Acacia constricta	white thorn acacia
Acacia farnesiana	huisache
Acacia greggii	catclaw acacia
Acacia neovernicosa	stickleaf acacia
Acacia rigidula	blackbrush
Acacia roemeriana	Roemer acacia
Acacia wrightii	Wright acacia
Amorpha fruticosa	bastard indigo
Astragalus nuttallianus var. austrinus	small flowered milkvetch
Astragalus wrightii	Wright locoweed
Bauhinia lunarioides	Texas bauhinia
Calliandra conferta	fairy duster
Cercis canadensis	eastern redbud
Cercis canadensis var. texensis	redbud
Dalea aurea	golden dalea
Dalea bicolor var. argyrea	silver dalea
Dalea compacta var. pubescens	showy prairie clover
Dalea formosa	feather dalea
Dalea frutescens	black dalea
Dalea nana	dwarf dalea
Dalea neomexicana	New Mexico dalea
Dalea pogonathera var. pogonathera	bearded dalea
Dalea pogonathera var. walkerae	Walker's bearded dalea
Desmanthus glandulosus	glandular bundleflower
Desmanthus illinoensis	Illinois bundleflower
Desmanthus obtusus	bundleflower
Desmanthus velutinus	hairy bundleflower
Desmanthus virgatus	wild tantan
Eysenhardtia texana	Texas kidneywood
Galactia texana	Texas milkpea
Glottidium vesicarium	bagpod
Hoffmannseggia glauca	sicklepod rushpea
Hoffmannseggia oxycarpa	sharppod rushpea
Indigofera lindheimeriana	creek indigo
Leucaena retusa	golden ball leadtree
Lupinus texensis	Texas bluebonnet
Medicago arabica	spotted bur-clover
Melilotus indicus	annual yellow sourclover
Mimosa aculeaticarpa var. biuncifera	catclaw mimosa
Mimosa borealis	fragrant mimosa
Mimosa texana	Texas mimosa
Neptunia pubescens var. microcarpa	tropical puff
Parkinsonia aculeata	retama
Parkinsonia texana var. texana	Texas paloverde
Pediomelum humile	Rydberg scurfpea
Prosopis glandulosa	honey mesquite

Prosopis glandulosa var. glandulosa	mesquite
Prosopis glandulosa var. torreyana	western honey mesquite
Rhynchosia senna var. texana	Texas snoutbean
Senna bauhinioides	shrubby senna
Senna lindheimeriana	Lindheimer senna
Senna pumilio	dwarf senna
Senna roemeriana	twoleaf senna
Sophora secundiflora	Texas mountain laurel
Vicia leavenworthii	Leavenworth's vetch
<i>Fagaceae</i>	<i>Fagaceae</i>
Quercus fusiformis	Plateau liveoak
Quercus gravesii	Graves oak
Quercus mohriana	Mohrs shin oak
Quercus polymorpha	Mexican white oak
Quercus vaseyana	Vasey oak
<i>Fouquieriaceae</i>	<i>Fouquieriaceae</i>
Fouquieria splendens	ocotillo
<i>Fumariaceae</i>	<i>Fumariaceae</i>
Corydalis curvisiliqua ssp. curvisiliqua	scrambled eggs
Corydalis micrantha ssp. texensis	Texan fumewort
<i>Gentianaceae</i>	<i>Gentianaceae</i>
Centaurium beyrichii	mountain pink
Centaurium calycosum	rosita
Eustoma exaltatum	prairie gentian
Sabatia campestris	Texas star
<i>Geraniaceae</i>	<i>Geraniaceae</i>
Erodium cicutarium	alfilaria
Erodium texanum	Texas stork's bill
<i>Hydrangeaceae</i>	<i>Hydrangeaceae</i>
Fendlera wrightii	cliff Fendlerbush
<i>Hydrocharitaceae</i>	<i>Hydrocharitaceae</i>
Hydrilla verticillata	hydrilla
<i>Hydrophyllaceae</i>	<i>Hydrophyllaceae</i>
Nama havardii	Havard's fiddleleaf
Nama hispidum	rough nama
Nama jamaicense	fiddleleaf nama
Nama parvifolium	small leaf fiddlehead
Phacelia congesta	bluecurls
Phacelia patuliflora var. teucrifolia	sand phacelia
<i>Iridaceae</i>	<i>Iridaceae</i>
Sisyrinchium biforme	wiry blue-eyed grass
Sisyrinchium chilense	swordleaf blue-eyed grass
<i>Juglandaceae</i>	<i>Juglandaceae</i>
Carya illinoensis	pecan
Juglans microcarpa	little walnut
<i>Juncaceae</i>	<i>Juncaceae</i>
Juncus bufonius	toad rush
Juncus interior	inland rush
Juncus nodosus	jointed rush
Juncus torreyi	Torrey rush
<i>Krameriaceae</i>	<i>Krameriaceae</i>
Krameria erecta	littleleaf ratany
Krameria grayi	white ratany

Krameria lanceolata	trailing ratany
Krameria ramosissima	calderona
<i>Lamiaceae</i>	<i>Lamiaceae</i>
Hedeoma acinoides	annual pennyroyal
Hedeoma drummondii	lemoncillo
Hedeoma nana	dwarf hedeoma
Hedeoma serpyllifolia	false pennyroyal
Marrubium vulgare	horehound
Monarda citriodora	lemon beebalm
Monarda punctata	spotted beebalm
Physostegia correllii	Correll's false dragonhead
Salvia ballotiflora	shrubby blue sage
Salvia dolichantha	cluster sage
Salvia farinacea var. farinacea	mealy sage
Salvia reflexa	lanceleaf sage
Salvia roemeriana	cedar sage
Salvia texana	Texas sage
Scutellaria drummondii	Drummond's skullcap
Scutellaria drummondii var. edwardsiana	Drummond's skullcap
Scutellaria texana	Texas skullcap
Teucrium canadense	American germander
<i>Lemnaceae</i>	<i>Lemnaceae</i>
Lemna valdiviana	pale duckweed
<i>Lentibulariaceae</i>	<i>Lentibulariaceae</i>
Utricularia gibba	conespur bladderwort
<i>Liliaceae</i>	<i>Liliaceae</i>
Allium drummondii	Drummond wild onion
Allium perdulce var. sperryi	Sperry's onion
Cooperia drummondii	cebolleta
Cooperia pedunculata	giant rainlily
Dasyllirion texanum	sotol
Echeandia flavescens	yellow crag-lily
Nolina texana	beargrass
Nothoscordum bivalve	crow-poison
Schoenocaulon texanum	green lily
<i>Linaceae</i>	<i>Linaceae</i>
Linum berlandieri var. filifolium	Berlandier's yellow flax
Linum rigidum	stiffstem flax
Linum rupestre	rock flax
Linum usitatissimum	common flax
Linum vernale	spring flax
<i>Loasaceae</i>	<i>Loasaceae</i>
Cevallia sinuata	stinging cevallia
Eucnide bartonioides	rock nettle
Mentzelia albescens	wavyleaf mentzelia
Mentzelia multiflora	Adonis blazing star
Mentzelia oligosperma	stickleaf, chicken-thief
<i>Loganiaceae</i>	<i>Loganiaceae</i>
Mitreola petiolata	hornpod
<i>Lythraceae</i>	<i>Lythraceae</i>
Ammannia coccinea	valley redstem
Lythrum californicum	California loosestrife
Nesaea longipes	stalkflower
<i>Malpighiaceae</i>	<i>Malpighiaceae</i>
Aspicarpa hyssopifolia	hyssophead aspleaf
Galphimia angustifolia	narrowleaf thryallis

Janusia gracilis	slender janusia
<i>Malvaceae</i>	<i>Malvaceae</i>
Abutilon fruticosum	Texas indianmallow
Abutilon incanum	pelotazo
Abutilon parvulum	little leaf abutilon
Abutilon wrightii	Wright's Indianmallow
Allowissadula holosericea	velvet leaf mallow
Callirhoe involucrata	purple poppymallow
Callirhoe leiocarpa	tall poppymallow
Herissantia crispa	netvein herissantia
Hibiscus coulteri	yellow desert-mallow
Hibiscus martianus	heartleaf hibiscus
Malva parviflora	cheeseweed mallow
Malvastrum coromandelianum	threelobe falsemallow
Meximalva filipes	violet sida
Sida abutifolia	creeping yellow sida
Sida longipes	stalkflower sida
Sphaeralcea angustifolia	narrowleaf globe mallow
Sphaeralcea hastulata	spear globemallow
<i>Marsileaceae</i>	<i>Marsileaceae</i>
Marsilea vestita	narrowleaf pepperwort
Marsilea vestita ssp. vestita	narrowleaf pepperwort
<i>Meliaceae</i>	<i>Meliaceae</i>
Melia azedarach	Chinaberry
<i>Menispermeaceae</i>	<i>Menispermeaceae</i>
Cocculus carolinus	Carolina snailseed
<i>Moraceae</i>	<i>Moraceae</i>
Morus alba	white mulberry
<i>Najadaceae</i>	<i>Najadaceae</i>
Najas guadalupensis	Guadalupe water nymph
Najas marina	spiny water nymph
<i>Nyctaginaceae</i>	<i>Nyctaginaceae</i>
Acleisanthes anisophylla	oblique-leaf trumpets
Acleisanthes crassifolia	Texas trumpets
Acleisanthes longiflora	angel trumpets
Acleisanthes wrightii	Wright's trumpets
Allionia incarnata	trailing four-o'clock
Boerhavia coccinea	scarlet spiderling
Boerhavia linearifolia	narrowleaf spiderling
Cyphomeris gypsophiloides	red cyphomeris
Mirabilis albida	white four-o'clock
Nyctaginia capitata	scarlet muskflower
<i>Nymphaeaceae</i>	<i>Nymphaeaceae</i>
Nuphar lutea	yellow pond-lily
<i>Oleaceae</i>	<i>Oleaceae</i>
Forestiera angustifolia	narrowleaf elbowbush
Forestiera reticulata	netleaf elbowbush
Fraxinus berlandieriana	Berlandier ash
Fraxinus greggii	Gregg ash
Fraxinus texensis	Texas ash
Fraxinus velutina	velvet ash
Menodora heterophylla	redbud menodora
Menodora longiflora	showy menodora
Menodora scabra	rough menodora
<i>Onagraceae</i>	<i>Onagraceae</i>
Calylophus berlandieri ssp. berlandieri	halfshrub sundrops

Calylophus berlandieri ssp. pinifolius	Berlandier's sundrops
Calylophus hartwegii ssp. hartwegii	Hartweg evening primrose
Calylophus hartwegii ssp. maccartii	MacCart's sundrops
Calylophus hartwegii ssp. pubescens	Hartweg's sundrops
Calylophus tubicula	bush evening primrose
Gaura calicicola	Texas beeblossom
Gaura coccinea	scarlet gaura
Gaura drummondii	Drummond's beeblossom
Gaura mollis	lizardtail gaura
Gaura suffulta	wild honeysuckle
Ludwigia octovalvis	shrubby water primrose
Ludwigia palustris	creeping waterprimrose
Oenothera falfurriae	royal evening primrose
Oenothera kunthiana	Kunth sundrops
Oenothera laciniata	cutleaf evening primrose
Oenothera primiveris	desert evening primrose
Oenothera pubescens	South American evening primrose
Oenothera rosea	rose sundrops
Oenothera speciosa	showy evening primrose
Oenothera triloba	stemless evening primrose
<i>Orchidaceae</i>	<i>Orchidaceae</i>
Epipactis gigantea	chatterbox orchid
<i>Orobanchaceae</i>	<i>Orobanchaceae</i>
Orobanche ludoviciana	Louisiana broomrape
Orobanche multicaulis	spiked broomrape
<i>Oxalidaceae</i>	<i>Oxalidaceae</i>
Oxalis dichondrifolia	ponyfoot woodsorrell
Oxalis drummondii	Drummond woodsorrell
Oxalis stricta	yellow woodsorrell
Oxalis violacea	violet woodsorrell
<i>Papaveraceae</i>	<i>Papaveraceae</i>
Argemone aenea	golden pricklypoppy
Argemone chisosensis	Chisos pricklypoppy
Argemone mexicana	yellow pricklypoppy
<i>Passifloraceae</i>	<i>Passifloraceae</i>
Passiflora affinis	yellow passionflower
Passiflora tenuiloba	slenderlobe passionflower
<i>Pedaliaceae</i>	<i>Pedaliaceae</i>
Proboscidea louisianica	Devil's claw
<i>Phytolaccaceae</i>	<i>Phytolaccaceae</i>
Rivina humilis	pigeonberry
<i>Plantaginaceae</i>	<i>Plantaginaceae</i>
Plantago helleri	Heller plantain
Plantago hookeriana	Hooker's plantain
Plantago major	common plantain
Plantago rhodosperma	redseed plantain
<i>Platanaceae</i>	<i>Platanaceae</i>
Platanus occidentalis	sycamore
<i>Poaceae</i>	<i>Poaceae</i>
Andropogon glomeratus	bushy bluestem
Aristida adscensionis	sixweeks threeawn
Aristida purpurea var. longiseta	red threeawn
Aristida purpurea var. nealleyi	Nealley threeawn

Aristida purpurea var. purpurea	purple threeawn
Aristida purpurea var. wrightii	Wright's threeawn
Arundo donax	giant cane
Avena fatua	wild oat
Bothriochloa barbinodis	cane bluestem
Bothriochloa hybrida	hybrid bluestem
Bothriochloa ischaemum var. songarica	yellow bluestem
Bothriochloa laguroides ssp. torreyana	silver beardgrass
Bouteloua aristidoides	needle grama
Bouteloua barbata	sixweeks grama
Bouteloua curtipendula	sideoats grama
Bouteloua gracilis	blue grama
Bouteloua hirsuta	hairy grama
Bouteloua rigidisetata	Texas grama
Bouteloua trifida	red grama
Bromus catharticus	rescue grass
Bromus rubens	red brome
Buchloe dactyloides	buffalograss
Cenchrus ciliaris	buffelgrass
Cenchrus echinatus	southern sandbur
Cenchrus myosuroides	big sandbur
Cenchrus spinifex	common sandbur
Chloris crinita	false Rhodesgrass
Chloris cucullata	hooded windmill grass
Chloris pluriflora	multiflower false Rhodes grass
Chloris verticillata	tumble windmill grass
Chloris X subdolichostachya	shortspike windmill grass
Cynodon dactylon	Bermuda grass
Dasyochloa pulchella	fluffgrass
Dichanthelium acuminatum var. acuminatum	woolly panicgrass
Dichanthelium pedicellatum	cedar panicgrass
Dichanthium annulatum	Kleberg bluestem
Digitaria californica	Arizona cottontop
Digitaria cognata	fall witchgrass
Digitaria hitchcockii	shortleaf cottontop
Echinochloa colona	jungle-rice
Echinochloa muricata	rough barnyard grass
Echinochloa walteri	coast cockspur grass
Eleusine indica	Indian goosegrass
Elymus canadensis	Canada wildrye
Elymus virginicus	Virginia wildrye
Enneapogon desvauxii	feather pappusgrass
Eragrostis barrelieri	Mediterranean lovegrass
Eragrostis cilianensis	stinkgrass
Eragrostis curtipedicellata	gummy lovegrass
Eragrostis intermedia	Plains lovegrass
Eragrostis lehmanniana	Lehmann's lovegrass
Eragrostis palmeri	Rio Grande lovegrass
Eragrostis pectinacea	spreading lovegrass
Eriochloa sericea	silky cupgrass
Erioneuron pilosum	hairy tridens
Hemarthria altissima	limpograss
Heteropogon contortus	tanglehead
Hilaria belangeri	curlymesquite
Leersia oryzoides	rice cutgrass
Leptochloa dubia	green sprangletop
Leptochloa fascicularis	salt sprangletop

Leptochloa mucronata		red sprangletop	
Leptochloa uninervia		Mexican sprangletop	
Leptoloma cognatum		fall witchgrass	
Limnodea arkansana		Ozarkgrass	
Lolium perenne		perennial ryegrass	
Melica montezumae		Montezuma melic	
Melica nitens		threeflower melic	
Muhlenbergia lindheimeri		Lindheimer muhly	
Muhlenbergia parviglumis		longawn muhly	
Muhlenbergia porteri		bush muhly	
Nassella leucotricha		Texas wintergrass	
Panicum antidotale		blue panicum	
Panicum hallii var. filipes		filly panicum	
Panicum hallii var. hallii		Hall's panicum	
Panicum obtusum		vine mesquite	
Panicum virgatum		switchgrass	
Pappophorum bicolor		pink pappusgrass	
Paspalum dilatatum		Dallisgrass	
Paspalum distichum		knotgrass	
Paspalum pubiflorum		hairyseed paspalum	
Paspalum urvillei		Vaseygrass	
Phalaris caroliniana		Carolina canarygrass	
Phragmites australis		giant reed	
Pleuraphis mutica		tobosagrass	
Poa annua		annual bluegrass	
Poa bigelovii		Bigelow bluegrass	
Polypogon monspeliensis		rabbit-foot grass	
Polypogon viridis		water bentgrass	
Schizachyrium scoparium		little bluestem	
Setaria grisebachii		Grisebach bristlegrass	
Setaria leucopila		Plains bristlegrass	
Setaria parviflora		knotroot bristlegrass	
Setaria pumila		yellow bristlegrass	
Setaria ramiseta		Rio Grande bristlegrass	
Setaria reverchonii		Reverchon bristlegrass	
Setaria scheelei		southwestern bristlegrass	
Setaria texana		Texas bristlegrass	
Setaria verticillata		hooked bristlegrass	
Setaria viridis		green bristlegrass	
Sorghum halepense		Johnsongrass	
Sphenopholis obtusata		prairie wedgescale	
Sporobolus compositus		tall dropseed	
Sporobolus coromandelianus		whorled dropseed	
Sporobolus cryptandrus		sand dropseed	
Sporobolus wrightii		big sacaton	
Stenotaphrum secundatum		St. Augustine grass	
Trichoneura elegans		Silveus' grass	
Tridens albescens		white tridens	
Tridens eragrostoides		lovegrass tridens	
Tridens muticus var. muticus		slim tridens	
Tridens texanus		Texas tridens	
Trisetum interruptum		prairie trisetum	
Urochloa fasciculata		browntop panicum	
Vulpia octoflora		common sixweeksgrass	
X Agropogon littoralis		coast agropogon	
<i>Polemoniaceae</i>		<i>Polemoniaceae</i>	
Gilia incisa		cutleaf gilia	
Gilia insignis		marked gilia	
Gilia rigidula		blue gilia	
Gilia rigidula ssp. acerosa		blue gilia	
Gilia rigidula ssp. rigidula		blue gilia	

<i>Polygalaceae</i>		<i>Polygalaceae</i>	
Polygala alba		white milkwort	
Polygala lindheimeri var. lindheimeri		purple milkwort	
Polygala lindheimeri var. parvifolia		rock milkwort	
Polygala macradenia		glandleaf milkwort	
Polygala ovatifolia		eggleaf milkwort	
Polygala palmeri		Palmer's milkwort	
Polygala scoparioides		broom milkwort	
<i>Polygonaceae</i>		<i>Polygonaceae</i>	
Eriogonum havardii		Havard's wild buckwheat	
Eriogonum longifolium		longleaf buckwheat	
Eriogonum multiflorum		heartsepal buckwheat	
Polygonum hydropiperoides		swamp smartweed	
Polygonum pensylvanicum		Pennsylvania smartweed	
Polygonum persicaria		lady's thumb	
Polygonum punctatum		water smartweed	
Rumex altissimus		pale dock	
Rumex crispus		curly dock	
Rumex maritimus		golden dock	
Rumex stenophyllus		narrowleaf dock	
Rumex violascens		violet dock	
<i>Portulacaceae</i>		<i>Portulacaceae</i>	
Portulaca oleracea		common purslane	
Portulaca pilosa		shaggy portulaca	
Talinum aurantiacum		orange flameflower	
<i>Potamogetonaceae</i>		<i>Potamogetonaceae</i>	
Potamogeton illinoensis		Illinois pondweed	
Stuckenia pectinata		fennel-leaf pondweed	
<i>Primulaceae</i>		<i>Primulaceae</i>	
Anagallis arvensis		scarlet pimpernel	
Samolus ebracteatus ssp. cuneatus		largeflower brookweed	
Samolus valerandi ssp. parviflorus		smallflower brookweed	
<i>Pteridaceae</i>		<i>Pteridaceae</i>	
Adiantum capillus-veneris		southern maidenhair	
Argyrochosma microphylla		littleleaf cliffbrake	
Astrolepis cochisensis		Cochise scaly cloakfern	
Astrolepis integerrima		wavyleaf cloakfern	
Astrolepis sinuata ssp. sinuata		bulb lipfern	
Astrolepis windhamii		Windham's scaly cloakfern	
Cheilanthes aemula		Texas lipfern	
Cheilanthes alabamensis		Alabama lipfern	
Cheilanthes horridula		prickly lipfern	
Cheilanthes sinuata		wavy scaly cloakfern	
Notholaena copelandii		Copeland cloakfern	
Notholaena nealleyi		Neally's cloakfern	
Notholaena neglecta		Maxon's cloakfern	
Notholaena standleyi		star cloakfern	
Pellaea ovata		zigzag cliffbrake	
<i>Rafflesiaceae</i>		<i>Rafflesiaceae</i>	
Pilostyles thurberi		Thurber's stemsucker	
<i>Ranunculaceae</i>		<i>Ranunculaceae</i>	
Anemone edwardsiana		twoflower anemone	
Anemone tuberosa var. texana		tuber anemone	
Clematis drummondii		old man's beard	

Clematis pitcheri	leatherflower
Delphinium carolinianum ssp. virescens	Carolina larkspur
Delphinium madrense	Sierra Madre larkspur
Delphinium wootonii	Organ Mountain larkspur
Ranunculus sceleratus	blister buttercup
<i>Resedaceae</i>	<i>Resedaceae</i>
Oligomeris linifolia	lineleaf whitepuff
<i>Rhamnaceae</i>	<i>Rhamnaceae</i>
Colubrina texensis	hog-plum
Condalia ericoides	javelina bush
Condalia hookeri var. hookeri	brasil
Condalia spathulata	narrowleaf squawbush
Condalia viridis	green squawbush
Condalia warnockii	Warnock's squawbush
Karwinskia humboldtiana	coyotillo
Ziziphus obtusifolia	lotebush
<i>Rosaceae</i>	<i>Rosaceae</i>
Prunus minutiflora	Texas almond
Rubus riograndis	Rio Grande dewberry
<i>Rubiaceae</i>	<i>Rubiaceae</i>
Cephalanthus occidentalis	buttonbush
Galium aparine	cling-on bedstraw
Galium correllii	Correll's bedstraw
Galium microphyllum	bracted bedstraw
Galium proliferum	spreading bedstraw
Galium uncinulatum	sprawling bedstraw
Galium virgatum	wand bedstraw
Hedyotis nigricans	diamondflowers
Houstonia acerosa	needleleaf bluets
<i>Rutaceae</i>	<i>Rutaceae</i>
Ptelea trifoliata	skunkbush, wafer ash
Thamnosma texana	Dutchman's breeches
Zanthoxylum hirsutum	tickle-tongue
<i>Salicaceae</i>	<i>Salicaceae</i>
Populus deltoides	eastern cottonwood
Salix exigua	coyote willow
Salix gooddingii	Goodding willow
Salix nigra	black willow
<i>Sapindaceae</i>	<i>Sapindaceae</i>
Sapindus saponaria var. drummondii	western soapberry
Serjania brachycarpa	littlefruit slipperyjack
Ungradiopsis speciosa	Mexican buckeye
<i>Sapotaceae</i>	<i>Sapotaceae</i>
Sideroxylon lanuginosum ssp. rigidum	coma, gum elastic
<i>Scrophulariaceae</i>	<i>Scrophulariaceae</i>
Bacopa monnieri	water hyssop
Buchnera americana	Florida bluehearts
Castilleja lanata	woolly Indian paintbrush
Castilleja rigida	rigid Indian paintbrush
Castilleja sessiliflora	downy Indian paintbrush
Leucophyllum frutescens	cenizo
Leucophyllum minus	Big Bend barometer bush
Leucospora multifida	narrowleaf conobea
Maurandella antirrhiniflora	snapdragon vine
Mecardonia procumbens	baby jump-up

Mimulus glabratus	yellow monkeyflower
Penstemon baccharifolius	baccharisleaf penstemon
Penstemon triflorus	Heller Penstemon
Seymeria texana	Texas seymeria
Stemodia schottii	Schott's stemodia
Verbascum thapsus	common mullein
Veronica peregrina	wandering veronica
<i>Sellaginaceae</i>	<i>Sellaginaceae</i>
Selaginella lepidophylla	resurrection plant
Selaginella underwoodii	Underwood's spikemoss
Selaginella wrightii	Wright's spikemoss
<i>Simaroubaceae</i>	<i>Simaroubaceae</i>
Castela erecta ssp. texana	goatbush
<i>Smilacaceae</i>	<i>Smilacaceae</i>
Smilax bona-nox	common greenbriar
<i>Solanaceae</i>	<i>Solanaceae</i>
Calibrachoa parviflora	mudflat petunia
Chamaesaracha coniodes	gray five eyes
Chamaesaracha pallida	pale false nightshade
Chamaesaracha sordida	hairy false nightshade
Chamaesaracha villosa	Trans-Pecos five-eyes
Datura inoxia	Indian apple
Datura wrightii	Wright's jimsonweed
Hunzikeria texana	Texas cupflower
Lycium berlandieri	Berlandier wolfberry
Nicotiana glauca	tree tobacco
Nicotiana repanda	fiddleleaf tobacco
Nicotiana trigonophylla	desert tobacco
Physalis cinerascens var. cinerascens	beach groundcherry
Quincula lobata	purple groundcherry
Solanum elaeagnifolium	silverleaf nightshade
Solanum ptychanthum	American nightshade
Solanum rostratum	buffalobur
Solanum triquetrum	Texas nightshade
<i>Sterculiaceae</i>	<i>Sterculiaceae</i>
Ayenia pilosa	dwarf ayenia
Hermannia texana	Texas hermannia
Melochia pyramidata	angelpod melochia
<i>Tamaricaceae</i>	<i>Tamaricaceae</i>
Tamarix aphylla	athel
Tamarix ramosissima	salt cedar
<i>Thelypteridaceae</i>	<i>Thelypteridaceae</i>
Thelypteris ovata var. lindheimeri	Lindheimer's Maiden Fern
<i>Typhaceae</i>	<i>Typhaceae</i>
Typha domingensis	tule
<i>Ulmaceae</i>	<i>Ulmaceae</i>
Celtis laevigata var. laevigata	sugar hackberry
Celtis laevigata var. reticulata	netleaf hackberry
Celtis pallida	granjeno
Ulmus pumila	Chinese elm
<i>Urticaceae</i>	<i>Urticaceae</i>
Boehmeria cylindrica	false nettle
Parietaria pensylvanica	Pennsylvania pellitory
Urtica chamaedryoides	stinging nettle

<i>Verbenaceae</i>		<i>Verbenaceae</i>	
Aloysia gratissima		beebrush	
Bouchea linifolia		groovestem bouchea	
Glandularia bipinnatifida		Dakota mock vervain	
Glandularia bipinnatifida var. bipinnatifida		Dakota vervain	
Glandularia pumila		low pink vervain	
Glandularia quadrangulata		beaked vervain	
Glandularia tumidula		Plains vervain	
Lantana achyranthifolia		brushland lantana	
Lantana urticoides		calico bush	
Lantana velutina		velvet lantana	
Lippia graveolens		scented lippia	
Phyla nodiflora		frogfruit	
Tetradlea coulteri		Coulter's wrinklefruit	
Verbena bipinnatifida		Dakota mock vervain	
Verbena canescens		gray vervain	
Verbena halei		slender vervain	
Verbena neomexicana		New Mexico vervain	
Verbena perennis		perennial vervain	
Verbena plicata		whitevein vervain	
Verbena scabra		sandpaper vervain	
Vitex agnus-castus		chastetree	
<i>Violaceae</i>		<i>Violaceae</i>	
Hybanthus verticillatus		green violet	
<i>Viscaceae</i>		<i>Viscaceae</i>	
Phoradendron tomentosum		mistletoe	
<i>Vitaceae</i>		<i>Vitaceae</i>	
Cissus trifoliata		cow itch, ivy treebine	
Parthenocissus heptaphylla		sevenleaf creeper	
Parthenocissus quinquefolia		Virginia creeper	
Vitis cinerea var. helleri		Heller's grape	
Vitis monticola		mountain grape	
Vitis rupestris		sand grape	
<i>Zannichelliaceae</i>		<i>Zannichelliaceae</i>	
Zannichellia palustris		common poolmat	
<i>Zygophyllaceae</i>		<i>Zygophyllaceae</i>	
Guaiacum angustifolium		guayacan	
Kallstroemia hirsutissima		carpetweed	
Kallstroemia parviflora		warty caltrop	
Larrea tridentata		creosotebush	

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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