Vegetation and Rare Plant Surveys
Naval Air Station Fallon

Fallon, Nevada

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Executive Summary

The goal of this project was to document the vegetation communities that had been excluded from the 2007-08 mapping efforts, and to identify sensitive plant species in a diversity of habitats and terrains on three ranges at the Naval Air Station (NAS) Fallon, Fallon Range Training Complex (FRTC) near Fallon, Nevada. NAS Fallon encompasses a total area of 241,127 acres. This report documents the results of the field surveys conducted in 2014-15 on approximately 69,000 acres of NAS Fallon. The information provided in this report will aid the Navy to more effectively manage natural resources and in assessing potential effects of activities on natural resources.

Over the course of the 2014-15 field seasons, a total of 229 polygons were visually assessed for vegetation identification. Altogether, a total of 2,683 polygons were delineated over the approximately 69,000 acres. A total of 36 vegetation alliances (plus an additional five mapping units with little or no classifiable vegetation) were mapped, including 14 herbaceous alliances, 18 shrub alliances, and four alliances dominated by trees that included small stands of non-native salt cedar (*Tamarix ramosissima*) and Russian olives (*Elaeagnus angustifolia*). Within these alliances, a total of 86 unique associations were mapped. An additional 12 cover types were defined that contained little or no classifiable vegetation, such as playas, dunes, and disturbed areas.

Alkaline scrub alliances, dominated by shrubs of the family Chenopodiaceae, cover 40,663.1 acres (59.0%) of the mapping area, primarily species of *Sarcobatus* and *Atriplex*, which tend to favor the alkaline soils typical of the valley floors and lower slopes near playas (NatureServe 2015). By far the most widespread alliance was the Bailey's Greasewood (*Sarcobatus baileyi*) Alliance, which covered approximately 27,437.5 acres (39.8%) of the survey area. The Black Greasewood (*Sarcobatus vermiculatus*) Alliance was the second most widespread alliance, representing 10,919.4 acres (15.9%) of the survey area.

As the terrain grades upwards, away from the playas, other shrub species replace the chenopods as the dominants, although Bailey's greasewood and *Atriplex* species can still be prominent as well. The upland scrubs cover approximately 8,542.3 acres (12.4%) of the survey area and are mostly dominated by shrubs of the family Asteraceae (4,344.4 acres, 6.3%) or Ephedraceae (2,964.7 acres, 4.3%). Herbaceous alliances cover relatively small portions of the survey area, with the largest being the Cheatgrass (*Bromus tectorum*) Alliance, covering only 858.9 acres (1.2%). Herbaceous wetlands alliances were mapped only in the Dixie Valley area, especially in Dixie Meadows and the Settlement Area. These alliances typically cover very small areas, just 574.3 acres total (0.8%), and most of the polygons fall below the 2-acre minimum mapping unit used for the non-wetland alliances, but are important features of the NAS Fallon landscape.

While Bailey's greasewood is clearly the most widespread and dominant shrub species within the project area, the variety of other co-dominant or dominant species makes for a highly complex mosaic of vegetation communities. Most of the vegetation communities are also further divided among two or more ecosites based on topography (e.g. hill slopes, sandy flats, washes) and soil substrates (e.g. sand, gravelly sand, rocky, desert pavement). Such complexity makes for a wide variety of wildlife habitats.

Although there are no federally or state listed rare plants known to occur in the vicinity of NAS Fallon, both the Nevada Natural Heritage Program and Nevada Native Plant Society maintain lists of plant

species they consider sensitive at some level. Field personnel developed search images based on visits to known locations of the plant, herbarium specimens, photographs, and descriptions in published floral treatments (e.g. Flora of North America [Flora of North America Editorial Committee 1993], Intermountain Flora [Cronquist et al. 2012], and Jepson Manual [Baldwin et al. 2012]). Surveys were conducted by using visual sweeps along walking meandering transects.

Surveys were timed to coincide with the blooming periods of the target species. Most of the species included in the surveys are typically in bloom from May through June; therefore, this time period was the focus of our surveys. The timing of this effort was also dependent on climatic conditions that influence the phenological cycles of plants locally at the Station. A total of three survey passes were conducted in all areas to capture seasonally blooming species throughout the survey period.

Over the course of the 2014-15 field seasons, a total of 194 distinct plant species (including sub-species and varieties) were recorded. Of these, 27 represent additions to the NAS Fallon species list. Four species of sensitive plants were located during the survey effort: sand cholla (*Grusonia pulchella*), Nevada oryctes (*Oryctes nevadensis*), Lahontan indigobush (*Psorothamnus kingii*), and Nevada suncup (*Camissonia nevadensis*).

Sand cholla was the most widespread sensitive plant species encountered during the focused rare plant surveys, with a total of 55 individuals observed during the course of the study throughout various habitat types. The occurrences were mapped at B-16, B-17, and B-19. Nevada oryctes was the most numerous sensitive plant species that was encountered during the focused rare plant surveys with a total of 67 individuals observed during the course of the study, but was only found at a single location in B-19 in 2014. Survey efforts in 2015 in the same location and surrounding areas found no plants, possibly due to different timing of the seasonal rains in 2014 and 2015. Lahontan indigobush was observed at three individual locations within B-19. One location of Nevada suncup was located in Dixie Meadows.

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List of Acronyms and Abbreviations

°F	degree(s) Fahrenheit
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CCVI	Climate Change Vulnerability Index
CNPS	California Native Plant Society
EOD	Explosive Ordnance Disposal
ESRI	Environmental Systems Research Institute
FRTC	Fallon Range Training Complex
GIS	Geographic Information System
GPS	Global Positioning System
HEI	High Explosive Impact
IVC	International Vegetation Classification
m	meter(s)
MCV2	Manual of California Vegetation, 2nd Edition
NAS	Naval Air Station
NNHP	Nevada Natural Heritage Program
NNPS	Nevada Native Plant Society
TDI	Tierra Data Inc.
USMC	U.S. Marine Corps

1.0 Introduction

Over the course of two field seasons in 2014 and 2015, vegetation mapping and rare plant surveys were conducted by Tierra Data Inc. (TDI) at Naval Air Station (NAS) Fallon, and Fallon Range Training Complex (FRTC), together termed NAS Fallon-administered lands (Table 1-1; Map 1-1). This report documents those surveys and serves as an update to the previous ecological inventories of the flora, fauna, and habitats of NAS Fallon, completed in 1997 (U.S. Department of the Navy [Navy] 1997) and 2008 (TDI 2008). The vegetation mapping surveys covered lands that were not part of previous surveys conducted by TDI in 2007-08 (TDI 2008), while the rare plant surveys were conducted within the entirety of Ranges B-16, B-17, and B-19 (Map 1-2). Dixie Valley was not included in the rare plant surveys. See Table 1-1 for the acreages of each survey area and type of survey. The information in this report will aid NAS Fallon to effectively manage natural resources and in assessing potential effects of activities on those resources.

Table 1-1. Acreage summary for vegetation mapping and rare plant surveys at Naval Air Station Fallon.

Training Range	Vegetation Mapping (acres)	Rare Plant Survey	
		Acres*	Notes
B-16	17,411	18,681	Includes 1,270 acres within 2008 survey footprint for rare plant surveys only.
B-17	21,314	26,211	Includes 4,897 acres within 2008 survey footprint for rare plant surveys only.
B-19	17,334	22,889	Includes 5,555 acres within 2008 survey footprint for rare plant surveys only.
Dixie Valley Training Range	12,897	-	Vegetation mapping only in the northern portion of Dixie Valley, plus North Dixie Valley, Dixie Meadows, and the Settlement Area parcels.
Total Acreage	68,956	67,781	-

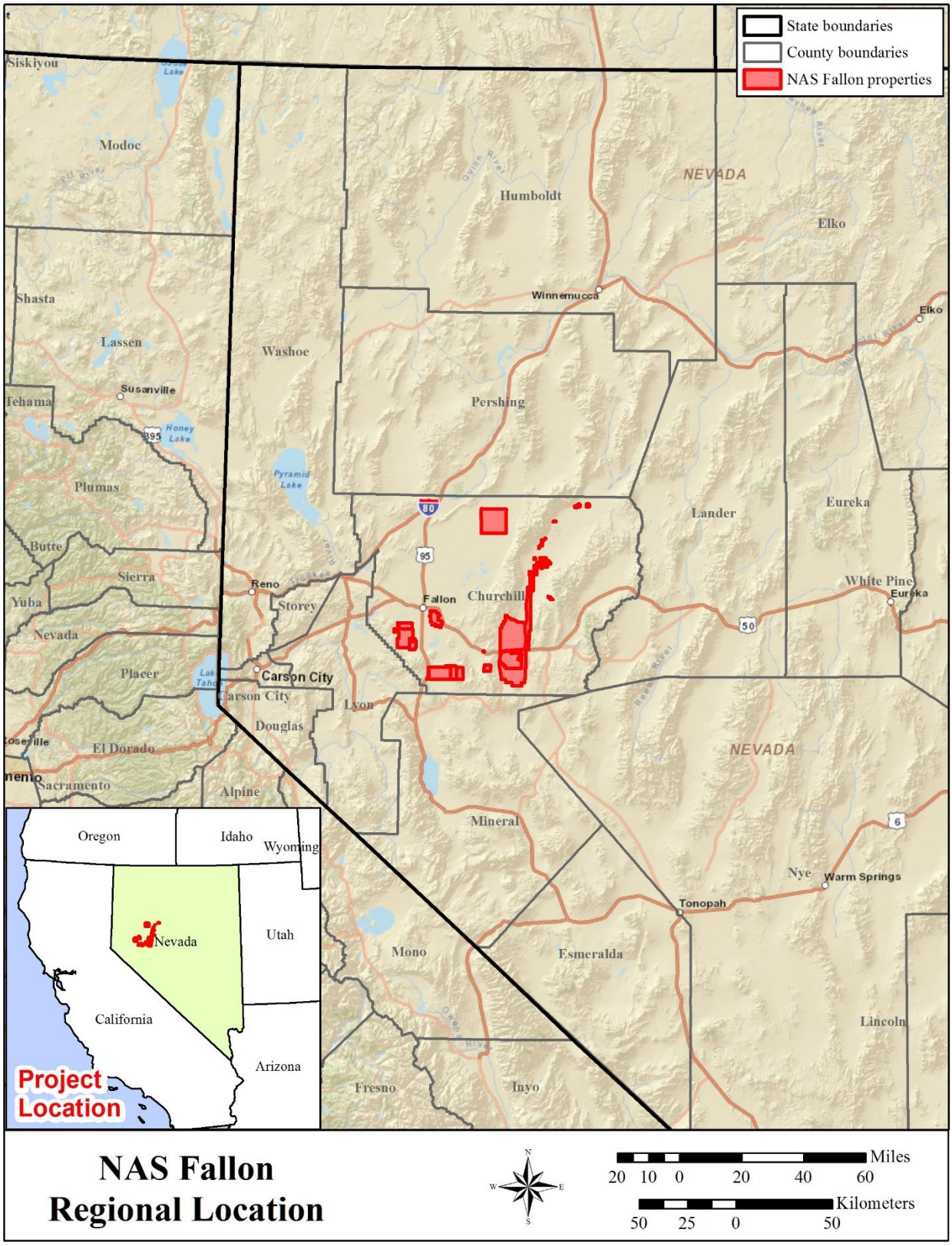
*The acres cited here represent the total area targeted for planning the rare plant surveys. Within these areas field crews targeted areas where potential habitat for sensitive species occurred.

1.1 Project Goal

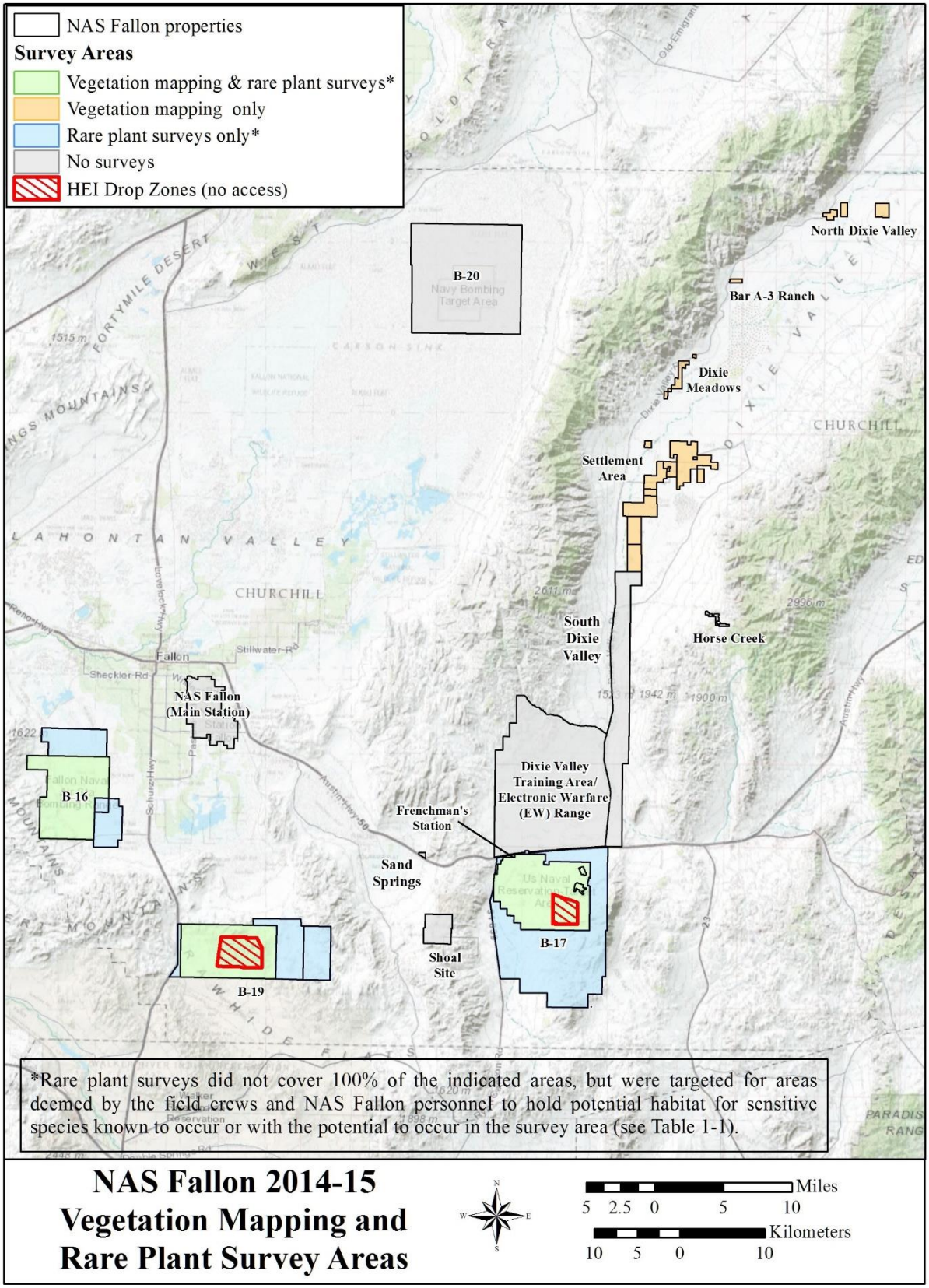
The goal of this project was to complete the vegetation map of the NAS Fallon-administered lands by surveying areas that had been excluded from the 2007-08 mapping efforts, and to conduct rare plant surveys within a diversity of habitats and terrains on the three ranges included in the study area. This will aid the Navy to manage the natural resources present and to assess potential effects of activities and operations on those natural resources.

1.2 Project Setting

NAS Fallon is located in Churchill County, Nevada (Map 1-1) and encompasses a total area of approximately 241,127 acres of withdrawn and acquired land. The NAS Fallon Main Station is approximately 6 miles southeast of the city of Fallon, in the Lahontan Valley. Additional range parcels of the FRTC are located in Carson Desert, the valley floor of the Carson Sink, and Dixie Valley up to 60 miles from NAS Fallon Main Station.



Map 1-1. Regional location of Naval Air Station Fallon.



Map 1-2. Vegetation mapping and rare plant survey areas for 2014-15 at Naval Air Station Fallon.

1.3 Military Mission

The mission of NAS Fallon is to provide the most realistic integrated air warfare training support available to carrier air wings, U.S. Marine Corps (USMC) air groups, tenant commands, and individual units participating in training events, including joint and multinational exercises, while remaining committed to its assigned personnel. In support of these critical training and personnel requirements, NAS Fallon will continually upgrade and maintain the FRTC, the airfield, aviation support facilities and base living/recreation accommodations, ensuring deployed unit training and a high local quality of life (Navy 2014). The mission of FRTC is to support Navy and USMC tactical training by providing the aforementioned warfare training, maintaining and operating facilities, and providing services and material to support the U.S. Pacific Fleet, U.S. Atlantic Fleet, USMC Forces Pacific, USMC Forces Atlantic, and other operating forces (Navy 2014).

Descriptive information about the training ranges (B-16, B-17, B-19, and B-20), Dixie Valley, Dixie Meadows, Settlement Area, and Horse Creek, taken from the 2014 Integrated Natural Resources Management Plan (Navy 2014) for NAS Fallon, follow.

NAS Fallon Main Station

Located six miles southeast of the city of Fallon, Nevada, and 70 miles east of Reno, Nevada, Main Station is in the central portion of the Carson Desert, commonly referred to as the Lahontan Valley. Consisting of more than 8,000 acres, including an airfield, industrial facilities, business facilities, recreation facilities, military housing and utility support facilities, Main Station is surrounded by federal (Bureau of Land Management [BLM] and Bureau of Reclamation [BOR]) and private lands.

Fallon Range Training Complex

The FRTC includes four geographically separate training ranges (B-16, B-17, B-19, and B-20) and two other training areas (Dixie Valley and the Shoal Site). In general, the FRTC provides target areas for air-to-ground ordnance delivery training and live weapons firing, and limited areas for integrated air and ground training.

B-16

Located approximately nine miles southwest of NAS Fallon Main Station, B-16 is the closest of the ranges to the Main Station. The BLM and BOR administer the lands around B-16. Within B-16, land status designations include both closed and open withdrawn lands (Table 1-1).

B-17

Located approximately 35 miles southeast of NAS Fallon Main Station, B-17 is in central Fairview Valley and is the most heavily used training range within the FRTC. With the exception of Frenchman's Station (a small parcel of Navy-acquired land south of U.S. Highway 50), all land within B-17 is closed withdrawn (refer to Table 1-1). Public lands primarily surround this range.

B-19

Located 16 miles south of NAS Fallon Main Station, B-19 is west of the Blow Sand Mountains. The Walker River Indian Reservation borders the southern boundary of this range and Highway 95 borders the western boundary. Land designation status includes open and closed withdrawn (Table 1-1).

B-20

In the Carson Sink, B-20 is located approximately 17 miles east of Highway 95 and 7 miles north of the Stillwater Wildlife Management Area. B-20 is the most remote training range in FRTC, the least developed, and has the largest impact area. Land status designations include both closed withdrawn lands and lands purchased by the Navy. This area is not included in the current project.

Dixie Valley

Located approximately 60 miles east of NAS Fallon Main Station, and 25 miles north of Highway 50, a mixture of Navy-acquired lands along Settlement Road and withdrawn public lands comprises the Dixie Valley training area.

- North Dixie Valley properties consist of four plots located east of B-20. This area is entirely Navy-acquired lands.
- Bar A-3 Ranch is located between North Dixie Valley and Dixie meadows and encompasses 150 acres.
- Dixie Meadows consists of 760 acres, including the Dixie Valley Marsh, cold and hot springs, and two ponds. The entire area is Navy-acquired lands.
- Settlement Area consists of former ranches and farms purchased by the Navy to mitigate potential noise impacts (Navy 2014). These parcels are interspersed with withdrawn public lands and total more than 8,400 acres.
- Horse Creek encompasses 272 acres purchased by the Navy and surrounds Horse Creek on the western side of the Clan Alpine Mountains. This area is not included in the current project.
- South Dixie Valley is located south of the Settlement Area and encompasses 16,749 acres. This area is not included in the current project.
- Dixie Valley Training Area/Electronic Warfare (EW) Range encompasses 49,460 acres located north of U.S. Highway 50. These are withdrawn lands. This area is not included in the current project.
- Frenchman's Station is a Navy-acquired, 54-acre parcel that straddles U.S. Highway 50. Only a portion north of U.S. Highway 50 is considered part of the Dixie Valley training area. This area is not included in the current project.

Shoal Site

Located approximately 15 miles east of NAS Fallon Main Station, south of Highway 50 and 3 miles west of B-17, the Shoal Site is withdrawn land and part of the 1999 Military Lands Withdrawal Act. Access to the site is currently unrestricted. The Shoal Site is not included in this project.

1.4 Survey Area

The survey areas for 2014-15 encompassed a total of approximately 69,000 acres of the NAS Fallon total land base (Table 1-1; Map 1-2). Most lands administered at the FRTC are BLM closed withdrawn lands or open withdrawn lands. As defined in the Environmental Impact Statement for the Withdrawal of Public Lands for Range Safety and Training Purposes 1998, 'open' lands are open to the public for multiple use; 'closed' lands are closed to all except authorized military personnel. These land status designations are based on military activities taking place in each area and the need to ensure public safety. The FRTC also includes some Navy-owned acquired parcels.

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2.0 Vegetation Mapping

2.1 Introduction

Maps of the vegetation communities (dominant plant species present) and ecotypes (vegetation communities plus the general soil substrate [sand, clay, etc.] and topography [flat, hills, wash, etc.]) were developed for portions of NAS Fallon in 1997 Ecological Inventory (Navy 1997) and with the 2007 Ecological Inventory Update (TDI 2008). The goal of this project was to cover areas not previously mapped on B-16, B-17, B-19, and the northern parcels of the Dixie Valley area (i.e. North Dixie Valley, Dixie Meadows, and the Settlement Area) totaling 68,956 acres.

In addition, the vegetation maps developed from the 2007-08 mapping efforts were to be made fully compatible with the updated protocols regarding the naming of vegetation alliances and Geographic Information System (GIS) formatting. The end result of this effort is to provide NAS Fallon with a complete map of the vegetation at all of the ranges and training areas that will be compliant with the International Vegetation Classification (IVC) protocols.

2.1.1 Background

NAS Fallon lies within the Great Basin intermountain ecoregion, which covers nearly two-thirds of the state of Nevada. This area covers essentially the region between the Sierra Nevada to the west and the Rocky Mountains to the east, and between the moister Pacific Northwest and the warmer drylands characterized by creosote (*Larrea tridentata*) to the south. It is the core of the region in which the foothills and lowlands are largely dominated by big sagebrush (*Artemisia tridentata*) and chenopodiaceous genera such as *Atriplex* and *Sarcobatus* (Cronquist et al. 2012).

The character of the vegetation communities is underlain by climate extremes. Rainfall at Fallon is about five inches annually. Of this, 2.3 inches, or 45 percent, usually falls in April through September during the growing season when temperatures are suitable for plant growth. In two years out of 10, the rainfall in April through September is less than 0.6 inches. (U.S. Department of Agriculture, Natural Resources Conservation Service 2001). Rainfall increases with elevation, perhaps ranging to as high as 12 inches. In the winter, temperatures are cold enough to bring more snow than rain. Warm springs and hot summers hasten snowmelt from the mountains and quickly evaporate the moisture in upland soils. Stream flow generally dwindles or stops by late summer. Temperatures average 44 to 55 degrees Fahrenheit (°F) in the winter and 70 to 80°F in summer (Western Regional Climate Center 2015).

The Great Basin physiographic province is distinguished by its basin-and-range topography, the result of block faulting, and interspersed interior playas. There are more than 300 isolated mountain ranges within the Great Basin, mostly oriented north-south, with narrow, intervening valleys and playas (Nachlinger et al. 2001). The lands covered by these surveys are part of the Lahontan Basin Section of the Great Basin. Here, surface water is more common. Elevation ranges from 4,000 to 9,800 feet (1,200 to 3,000 meters [m]). Soils include Mollisols, Vertisols, Entisols, Aridisols, Inceptisols, and Histosols. Mesic, frigid, and cryic soil temperature regimes predominate, along with torric, xeric, and aquic moisture regimes. Some saline-sodic soils are present; many soils are typified by hard duripans in the profiles.

In the lower valleys, salt tolerant shrubs and playas prevail, while sagebrush and other shrub communities occur in the higher valleys and slopes. Pinyon and juniper woodlands occupy portions of the lower elevation mountain slopes and ranges. Numerous springs are found in the valleys throughout the Great Basin.

2.1.2 Previous Vegetation Community Mapping Efforts at NAS Fallon

The 1997 Ecological Inventory (Navy 1997) identified and described 28 vegetation communities occurring on the parcels surveyed at that time, including 20 upland communities and eight wetland communities (Table 2-1).

Table 2-1. Vegetation communities identified on Naval Air Station Fallon in 1997 (Navy 1997).

Upland Communities	Wetland Communities
Wyoming Big Sagebrush-Common Rabbitbrush *Artemisia tridentata-Ericameria nauseosa*	Saltgrass Meadow *Distichlis spicata*
Wyoming Big Sagebrush/Basin Wildrye *Artemisia tridentata/Leymus cinereus*	Sedge-Spikerush Meadow *Carex* sp.-*Eleocharis* sp.
Black Sagebrush *Artemisia nova*	Bulrush Marsh *Scirpus* sp.
Fourwing Saltbush/Indian Ricegrass *Atriplex canescens/Achnatherum hymenoides*	Iodinebush Wetland *Allenrolfea occidentalis*
Bailey's Greasewood/Galleta-Indian Ricegrass *Sarcobatus baileyi/Hilaria jamesii-Achnatherum hymenoides*	Forested Riparian Wetland
Shadscale-Seepweed-Bailey Greasewood *Atriplex confertifolia-Suaeda moquini-Sarcobatus baileyi*	Alkali Riparian Wetland
Bailey's Greasewood-Shadscale/Indian Ricegrass *Sarcobatus baileyi-Atriplex confertifolia-Achnatherum hymenoides*	Man-made Ponds
Black Greasewood/Indian Ricegrass *Sarcobatus vermiculatus/Achnatherum hymenoides*	Man-made Ditches
Black Greasewood-Suaeda *Sarcobatus vermiculatus-Seepweed*	
Horsebrush-Fourwing Saltbush/Indian Ricegrass *Tetradymia sp.-Atriplex canescens/Achnatherum hymenoides*	
Shadscale-Black Greasewood/Indian Ricegrass *Atriplex confertifolia-Sarcobatus vermiculatus/Achnatherum hymenoides*	
Black Greasewood/Inland Saltgrass *Achnatherum hymenoides/Distichlis spicata*	
Torrey Quailbush-Black Greasewood-Seepweed *Atriplex torreyi-Sarcobatus vermiculatus-Suaeda moquini*	
Iodinebush/Inland Saltgrass *Allenrolfea occidentalis/Distichlis spicata*	
Black Greasewood/Basin Wildrye *Sarcobatus vermiculatus/Leymus cinereus*	
Valley Wash	
Fremont Cottonwood/Creeping Wildrye *Populus fremontii/Leymus triticoides*	
Badlands	
Agriculture	
Disturbed	

In 2007-08 extensive surveys were undertaken within much of the FRTC to update the 1997 natural resources inventory (TDI 2008). These surveys included vegetation mapping within the training ranges and associated properties. A total of 110 vegetation communities (plus an additional five mapping units with little or no classifiable vegetation) were mapped. This mapping effort served as the basis for the current mapping effort, with the aim of integrating the two sets of maps and ensuring that the resulting data is compliant with the IVC.

2.2 Methods

The vegetation communities were mapped using a combination of aerial photo interpretation and ground-truthing. Each aspect of the mapping effort is described below.

2.2.1 Aerial Photography Interpretation

As a first step in the mapping process the areas to be mapped were overlaid onto high resolution aerial photos, used to draw an initial set of polygons delineating stands of differing vegetation communities or land cover types (such as roads and developed areas). Several different sets of aerial photos were used for this procedure;

- National Agricultural Imagery Program aerial photos, both 2006 and 2012 editions.
- Environmental Systems Research Institute (ESRI) Basemap aerial photography, which includes photography from 2010-2013 at resolutions as high as 30 centimeters.

The images are in the projection NAD83 UTM Zone 11.

Using ESRI ArcGIS (version 10.2), polygon lines were digitized into a GIS data layer demarcating polygon boundaries between differing vegetation communities, ecosites, and topographic features. The minimum mapping unit (the smallest area to be delineated) was two acres for upland communities and one acre for riparian communities. Some smaller polygons were created in certain special cases:

- where a larger polygon was clearly bisected by a road, leaving a small section on the opposite side of the road that is still clearly different from the surrounding area;
- where an FRTC boundary line cut across a small portion of a much larger polygon and the portion within the boundary was sufficiently different from the surrounding areas to warrant inclusion in the map;
- in some areas where there are small (<1 acre in many cases) stands of non-native trees such as salt cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*), delineated in order to provide FRTC managers information on these occurrences.

Whenever discernible, interpreters assigned a vegetation or land cover type directly to each polygon, especially where survey areas included in this effort abutted areas mapped during the 2007-08 surveys and therefore could be assigned the same vegetation type. Other land cover types, such as playas, developed areas, and roads, were also labeled directly from viewing the aerial photos; however, in the majority of instances, no data was assigned to the polygons generated until direct field observations could be made to directly record the dominant vegetation and surface features in representative areas.

2.2.2 Ground-Based Mapping

After preliminary delineation of vegetation polygons using aerial photos was completed, a set of maps was generated for ground-truthing by field crews on subsequent visits. It should be noted that vegetation mapping of such a large area, as was required for this project, could not include 100 percent ground-truthing of all delineated polygons. As a result, while the field surveys visited all of the accessible areas of the training areas and ranges at least once, data was collected on only a sub-sample of the mapped polygons. The polygons targeted for field assessment were of two types:

- representative of widespread vegetation types, and thus could be used to assign attributes to other polygons of similar appearance and position on the landscape, or
- unique in appearance, necessitating a field visit whether or not the data could be applied to other polygons.

Simple descriptive data was recorded on datasheets (see Appendix A for an example of the datasheets used) from which the dominant vegetation and surface features for a given polygon were entered into the GIS data layer. Specific data recorded on field assessment datasheets included:

- dominant species present in tree, shrub, and/or herbaceous layers
- total shrub canopy cover in each layer
- general soil texture (i.e., sandy, gravelly, etc.)
- topography (i.e., flat, low hills, steep slopes, etc.)
- other notable plants, including sub-dominant shrubs and invasive weeds.

As stated above, the data from the field-assessed polygons were then used to help classify other polygons which exhibited the same appearance on the aerial photo. Every effort was made to extrapolate field data onto non-surveyed polygons which clearly exhibited similar appearances (i.e. colors, patterns and hues) on the aerial photos. The data from the field-assessed polygons were generally copied to each similar-looking polygon, with some adjustments when the vegetation density was notably different (higher or lower density of the shrub canopy) when the polygons otherwise looked similar. If a given polygon could not be confidently assigned attributes from the field data, it was targeted for the next field effort. In this way over the course of the three field survey periods conducted in 2014-15, the field efforts could be refined and focused on areas needing further assessment.

In some cases polygons that appeared different on the aerial photo were found to support the same dominant species and so were re-combined in the GIS database, such as when the difference in appearance on the aerial photo was found to simply be a change in the surface texture of the soils. In other cases additional polygons were drawn onto the field maps (and later transferred to the GIS database) to further refine the mapping. When assigning a vegetation community to a polygon that was not viewed in the field, there were almost always polygons nearby with a similar appearance on the aerial photo to extrapolate the classification. Classification of polygons that were not field-checked was based on the following factors:

- Survey parcel: It was assumed that the environmental conditions at the time the aerial photos were taken and the photo printing process were comparatively uniform for images within parcels in contrast to among parcels. As a result, each land parcel was treated separately to maximize the chance

of accurately and consistently attributing vegetation classification to areas that appeared visually distinct or similar on the photo based on as uniform a set of photo attributes as possible.

- Proximity: When identifying a field-assessed polygon to use as the exemplar for delineating other polygons that were not field-checked, the proximity of the polygons was a key factor. If two polygons were close to one another and exhibited the same appearance on the aerial photo, it was considered likely that they contained the same dominant species.
- Landscape position: The position of vegetation within the landscape (i.e. sandy flats, rocky hill slopes, etc.) strongly influences the species found within it, and this was factored into decisions when assigning data from field-assessed vegetation to mapping units that were not ground-truthed. Polygons with similar appearance and both located in similar landscape positions often contained similar species.

As an example, B-17 includes large areas where accessibility constraints, caused by military, security, or terrain issues, limited the number of polygons that could be field-assessed. Fortunately, many of the ecotypes found in B-17 also occur in other areas, particularly Dixie Valley, located just on the opposite side of the highway from B-17, and Shoal, located in the mountains a short distance to the west of B-17. In addition, some areas outside of the actual survey areas were field-assessed for their similarity to polygons within the survey area where ground access was limited.

Community designations and/or boundary lines were amended as necessary by drawing changes directly onto field maps. The GIS data was then edited to reflect the field findings. Full descriptions and representative digital photographs were made of each vegetation and ecotype encountered.

2.2.3 Vegetation Classification

Vegetation community types were defined using the standard developed by NatureServe (http://www.natureserve.org/), which utilizes the protocols of the IVC (of which the U.S. National Vegetation Classification Standard is a component). Developed by the Ecological Society of America, NatureServe, various Natural Heritage Programs around the U.S., and The Nature Conservancy, the IVC has won broad acceptance, including from the Federal Geographic Data Committee, which has accepted it as the standard approach to be used by all U.S. federal agencies (https://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation). The IVC combines both physiognomic and floristic approaches to vegetation classification and is based on vegetation as it currently exists on the landscape. The IVC consists of a seven-level hierarchy (Table 2-2) with lower, finer levels nested into progressively coarser levels. The finest level, an association, corresponds to an "element of biological diversity," although the next higher level (alliance) may also be considered an element in cases where associations have not yet been defined within the alliance.

Table 2-2. Sample IVC classification hierarchy (NatureServe 2015).

Class	2 - Shrub & Herb Vegetation
Subclass	2.C - Shrub & Herb Wetland
Formation	2.C.5 - Salt Marsh
Division	2.C.5.Nd - North American Western Interior Brackish Marsh
Macrogroup	Warm & Cool Desert Alkali-Saline Wetland
Group	North American Desert Alkaline-Saline Shrub Wetland
Alliance	Black Greasewood Alliance
Association	*Sarcobatus vermiculatus-Suaeda moquini* Association

The IVC is arranged by tree, shrub, and herbaceous-dominated vegetation, and within each group are described vegetation "alliances"—the principal classification unit. An alliance is a floristically defined vegetation type identified by its dominant and/or characteristic species. Alliances are defined by using basic rules of dominance with alliances named by the dominant species, usually in the highest strata, in a given stand of vegetation. An alliance name can include anywhere from one to three species names from the same stratum. Below the level of the alliances are "associations," which usually combine species from two or more vegetation strata, such as trees with a prominent shrub understory, or shrubs with an herbaceous understory.

NatureServe maintains a database of known vegetation alliances and associations, with detailed descriptions of each. Most of the vegetation types at NAS Fallon fit within these alliances but some unique assemblages can occur. The determination as to which alliance to assign to a given polygon is based upon the percent cover of the dominant species present, where that species is present at or above a certain percent cover and no other species have a higher cover within that vegetation layer. For example, if black greasewood is present at 5% cover, that polygon would be assigned to the Black Greasewood Alliance, assuming that no other shrub species are present at >5% cover.

One important factor in assigning alliance names is establishing threshold limits on the percent cover of given species to determine the proper alliance designation, especially for areas where the overall shrub cover is very low, as is often the case in the Fallon area. The process of assigning alliance names can be greatly aided by adopting a set of membership rules. These not only simplify the mapping process but also make the process easily repeatable. These membership rules can be determined for a given mapping project independently, based on particular goals of that mapping project, or can be derived from published sources and alliance descriptions. Although the NatureServe database provides detailed alliance descriptions, it does not include any specific membership rules. Another recently published resource for vegetation alliance mapping, the Manual of California Vegetation, 2nd Edition (MCV2) (Sawyer et. al 2009), does include membership rules for many of the Great Basin region alliances which occur at NAS Fallon. Therefore, the MCV2 membership rules were used as a framework for the membership rules presented in Table 2-3. In addition, if a polygon was found to be dominated by a species that does not appear in the MCV2 but is very similar (within the same Genus and similar in growth habit and landscape position) then the membership rule for that related species was used here.

The rules described in Table 2-3 do not cover all of the alliances observed at FRTC. In many cases the assignment of an alliance was obvious, such as polygons nearly completely covered by a single, clearly dominant species (e.g. some of herbaceous wetlands where a single rush, sedge, or grass species was the clear indicator). Where the rules proved especially useful was when lower cover values were observed and more than one species was present at roughly similar cover values. Note that for many of the shrub species a very low percent cover value is required to qualify as that alliance. Many of the areas mapped at FRTC were extremely low vegetation cover and did not reach any of the membership thresholds, in which case the polygon was designated as "sparsely vegetated".

Table 2-3. Membership rules used in classifying vegetation alliances at Naval Air Station Fallon (adapted from Sawyer et al. 2009).

Dominant Species	Alliance Described in MCV2?	Alliance Membership Rules
Achnatherum hymenoides	Yes	>50% Relative cover in herbaceous layer, but usually is sparsely vegetated sandy areas
Allenrolfea occidentalis	Yes	>2% Absolute cover, no other shrub >=
Atriplex canescens	Yes	>2% Absolute cover and >50% Relative cover
Atriplex confertifolia	Yes	>2% Absolute cover, no other shrub >
Bromus tectorum	Yes	>30% Relative cover in herbaceous layer
Distichlis spicata	Yes	>50% Relative cover in herbaceous layer, no other grass >
Ephedra nevadensis	Yes	>=2% Absolute cover and usually >2 cover of any other shrub
Ephedra viridis	Yes	>=1% Absolute cover and >30 Relative cover in shrub layer
Ericameria nauseosa	Yes	>=2% Absolute cover or >25% Relative cover
Chrysothamnus viscidiflorus	No	same as *Ericameria nauseosa*
Leymus cinereus	Yes	>50% Relative cover in herbaceous layer
Lycium shockleyi	No	based on *L. andersonii*, which has similar habitat; >50% relative cover in shrub layer
Poa secunda	Yes	>50% Relative cover in herbaceous layer
Salsola tragus	Yes	Vegetation is strongly dominated (>90% relative canopy cover) by invasive, exotic annual forb species.
Sarcobatus baileyi	No	same as *Sarcobatus vermiculatus*
Sarcobatus vermiculatus	Yes	>2% Absolute cover, no other shrub >
Suaeda moquini	Yes	>2% Absolute cover, no other shrub <=

2.2.4 Integration with 2007 Mapping

Although the 2007-08 mapping effort used a similar hierarchical scheme based on dominant species, the terminology of 'alliances' and 'associations' was not in wide use at the time. Therefore, part of the integration of the two mapping efforts was to update the previously mapped areas with the new terminology. In addition, while the vegetation map developed from the 2007-08 surveys aided greatly in assigning alliance names to neighboring polygons in the 2014-15 survey areas, some changes in the 2007-08 map were necessary. There were a number of polygons located at the edges of the 2007-08 survey areas that were deemed too small to be included in the final map, but which adjoined larger polygons in the current survey areas. Therefore, to make the two maps match more accurately and seamlessly, the affected 2007-08 polygons were matched to the 2014-15 polygons and re-assigned to the appropriate alliance.

Rather than maintain separate GIS layers for the 2007-08 and 2014-15 mapping areas, the end result of the integration process was a single GIS layer for each range that encompasses both datasets. Internally to each range's GIS layer, a data field is included to identify which mapping effort provided the data for describing that polygon. All polygon identification numbers in the 2007-08 data were maintained throughout the integration process so as to maintain linkages with field datasheets and spreadsheets used in that survey effort.

Finally, rather than combine all of the individual range layers into a single GIS layer, which might prove cumbersome to use, the individual layers were imported into an ESRI ArcGIS geodatabase. Having a single geodatabase containing all of the vegetation map data, covering all ranges and both survey efforts, will simplify use and maintenance of the data.

2.3 Results

Section 2.3.1 provides a brief overview of the 2014-15 vegetation mapping. More detailed descriptions of the alliances and associations are provided in Section 2.3.2.

2.3.1 Summary of 2014-15 Mapping

Over the course of 2014-15 field seasons, a total of 229 polygons were visually assessed for the vegetation mapping efforts (Map 2-1). Altogether, a total of 2,683 polygons were delineated (Table 2-4). Table 2-5 presents the distribution and acreages of the vegetation alliances mapped within the 2014-15 survey areas. The vegetation mapping results for each parcel are depicted on Map 2-2 through Map 2-7. See Appendix B for datasheets completed during the 2014-15 field efforts. On the maps, alliances are depicted as colored polygons and the associations within each alliance are depicted by two-letter codes.

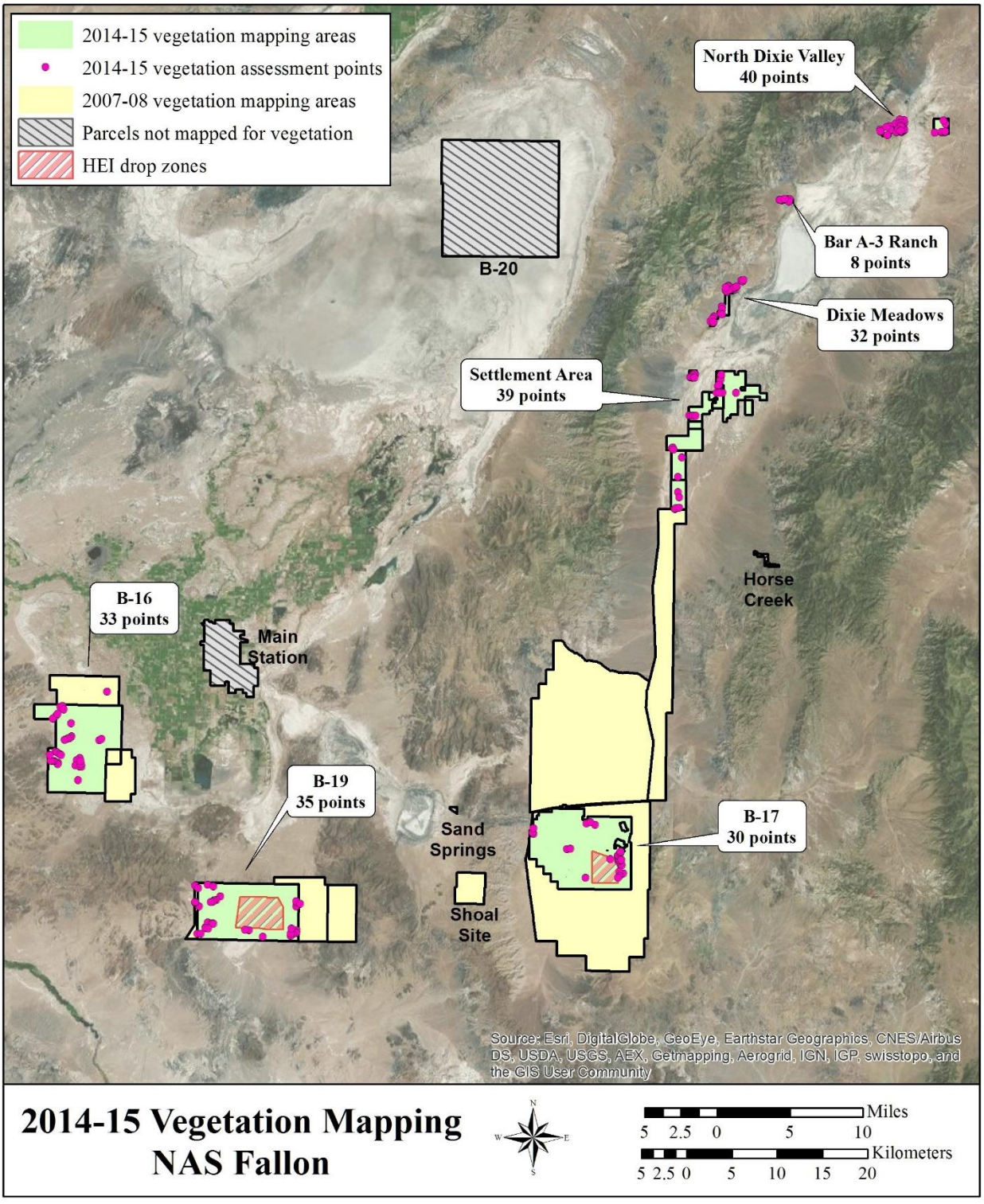
Table 2-4. Total acreage mapped and number of polygons delineated in each parcel in 2014-15.

Survey Parcel	Acreage	# Polygons Delineated
B-16	17,411	678
B-17	21,314	529
B-19	17,334	464
Dixie Valley	12,897	1,012
Totals	**68,956**	**2,683**

A total of 36 vegetation alliances (plus an additional five mapping units with little or no classifiable vegetation) were mapped during the 2014-15 mapping process, including 14 herbaceous alliances, 18 shrub alliances, and four alliances dominated by trees (including small stands of non-native tamarisk and olives). Within these alliances a total of 86 unique associations were mapped. An additional 12 cover types were defined that contained little or no classifiable vegetation, such as playas, dunes, and disturbed areas.

Alkaline scrub alliances, dominated by shrubs of the family Chenopodiaceae, cover 40,661.8 acres (59.0%) of the mapping area. Chenopod shrubs, primarily species of *Sarccobatus* and *Atriplex*, which tend to favor the alkaline soils typical of the valley floors and lower slopes near playas (NatureServe 2015). By far the most widespread alliance was the Bailey's Greasewood (*Sarcobatus baileyi*) Alliance, which covered approximately 27,437.4 acres (39.8%) of the survey area. The Black Greasewood (*Sarcobatus vermiculatus*) Alliance was the second most widespread alliance, representing 10,925.8 acres (15.9%) of the survey area.

As the terrain grades upwards, away from the playas, other shrub species replace the chenopods as the dominants, although Bailey's greasewood and *Atriplex* species can still be prominent as well. The upland scrubs cover approximately 8,542.3 acres (12.4%) of the survey area and are mostly dominated by shrubs of the family Asteraceae (4,344.4 acres, 6.3%) or Ephedraceae (2,964.7 acres, 4.3%). The Nevada Ephedra (*Ephedra nevadensis*) Alliance is the largest upland shrub alliance, covering 2,573.2 acres (3.7%) of the survey area, and is found primarily on the dunes of B-19. The second largest upland shrub alliance was the Rubber Rabbitbrush (*Ericameria nauseosa*) Alliance, covering 1,682.5 acres (2.4%) of the survey area, and occurs in all four survey areas in varying amounts.



Map 2-1. Vegetation mapping assessment points in 2014-15 at Naval Air Station Fallon.

Table 2-5. Vegetation alliances mapped (in acres) at Naval Air Station Fallon in 2014-15.

Vegetation Communities	B-16	B-17	B-19	Dixie Valley	Total	%
Herbaceous Wetlands				**573.4**	**573.4**	**0.80**
Arid West Interior Freshwater Emergent Marsh				**550.9**	**550.9**	**0.80**
Clustered Sedge (*Carex praegracilis*) Alliance*				124.2	124.2	0.18
Creeping Spike Rush (*Eleocharis macrostachya*) Alliance				222.7	222.7	0.32
Bottlebrush Squirreltail (*Elymus elymoides*) Alliance*				1.3	1.3	<0.01
American Bulrush (*Schoenoplectus americanus*) Alliance				113.7	113.7	0.16
Western Bluegrass (*Poa secunda*) Alliance*				89.0	89.0	0.13
Western North American Ruderal Wet Shrubland, Meadow & Marsh				22.5	22.5	0.03
Baltic Rush (*Juncus balticus*) Alliance				3.5	3.5	0.01
Common Reed (*Phragmites australis*) Alliance				16.5	16.5	0.02
Poverty Weed (*Iva axillaris*) Alliance*				2.5	2.5	<0.01
Grasslands (and other herbaceous types)	**30.0**	**464.7**	**652.6**	**232.6**	**1,379.8**	**2.00**
Great Basin & Intermountain Dry Grassland			**208.5**		**208.5**	**0.30**
Indian Ricegrass (*Achnatherum hymenoides*) Alliance			208.5		208.5	0.30
Warm & Cool Desert Alkali-Saline Wetland				**195.5**	**195.5**	**0.28**
Salt Grass (*Distichlis spicata*) Alliance				135.1	135.1	0.20
Basin Wildrye (*Leymus cinereus*) Alliance				60.4	60.4	0.09
Western North American Cool Semi-Desert Ruderal Grassland	**30.0**	**464.7**	**444.1**	**37.1**	**975.8**	**1.42**
Cheatgrass (*Bromus tectorum*) Alliance		409.3	412.4	37.1	858.9	1.25
Russian Thistle (*Salsola tragus*) Alliance	30.0	55.3	31.6		117.0	0.17
Alkaline Scrubs	**11,207.3**	**13,293.2**	**7,872.1**	**8,289.2**	**40,661.8**	**58.97**
Warm & Cool Desert Alkali-Saline Wetland	**4,284.6**		**2,500.3**	**4,919.0**	**11,703.9**	**16.97**
Alkali Seepweed (*Suaeda moquini*) Alliance	35.5			660.2	695.8	1.01
Black Greasewood (*Sarcobatus vermiculatus*) Alliance	4,249.1		2,426.5	4,250.2	10,925.8	15.85
Iodine Bush (*Allenrolfea occidentalis*) Alliance			73.8	8.6	82.5	0.12
Great Basin Saltbrush Scrub	**6,922.7**	**13,293.2**	**5,371.8**	**3,370.2**	**28,957.9**	**42.00**
Bailey's Greasewood (*Sarcobatus baileyi*) Alliance*	6,891.4	13,019.0	5,371.8	2,155.2	27,437.5	39.79
Fourwing Saltbush (*Atriplex canescens*) Alliance	31.3	114.8		1,181.3	1,327.4	1.93
Shadscale (*Atriplex confertifolia*) Alliance		159.4		17.0	176.4	0.26
Torrey's Saltbush (*Atriplex torreyi*) Alliance*				16.7	16.7	0.02
Upland Scrubs	**1,032.8**	**2,585.7**	**4,573.0**	**350.8**	**8,542.3**	**12.39**
Great Basin & Intermountain Dwarf Sagebrush Shrubland & Steppe		**821.4**			**821.4**	**1.19**
Black Sage (*Artemisia nova*) Alliance		821.4			821.4	1.19
Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe		**174.8**			**174.8**	**0.25**
Big Sagebrush (*Artemisia tridentata*) Alliance		174.8			174.8	0.25
Great Basin & Intermountain Dry Shrubland	**1,032.8**	**1,589.5**	**4,573.0**	**350.8**	**7,546.1**	**10.94**
Bud Sage (*Picrothamnus desertorum*) Alliance*		52.0			52.0	0.08
Four-Flowered Cotton-Thorn (*Tetradymia tetrameres*) Alliance		19.0	1,527.0		1,546.0	2.24
Green Ephedra (*Ephedra viridis*) Alliance		391.5			391.5	0.57
Nevada Ephedra (*Ephedra nevadensis*) Alliance		26.1	2,547.1		2,573.2	3.73
Rubber Rabbitbrush (*Ericameria nauseosa*) Alliance*	1,032.8	297.0	9.6	343.1	1,682.5	2.44
Rubberweed (*Ericameria nana*) Alliance		125.9			125.9	0.18
Yellow Rabbitbrush (*Chrysothamnus viscidiflorus*) Alliance			485.9	7.7	493.6	0.72
White Burrobush (*Hymenoclea salsola*) Alliance*		440.9	3.4		444.3	0.64
Winter Fat (*Krascheninnikovia lanata*) Alliance		237.1	0.0		237.1	0.34

Vegetation Communities	B-16	B-17	B-19	Dixie Valley	Total	%
Woodlands		**14.2**		**48.3**	**62.5**	**0.08**
Intermountain Singleleaf Pinyon - Utah Juniper - Western Juniper Woodland		**14.2**			**14.2**	**0.02**
Singleleaf Pinyon (*Pinus monophylla*) Alliance		14.2			14.2	0.02
Southwest Riparian Forest				**11.5**	**11.5**	**<0.01**
Fremont Cottonwood (*Populus fremontii*) Alliance				11.5	11.5	<0.01
Interior West Ruderal Flooded & Swamp Forest				**36.8**	**36.8**	**0.05**
Russian Olive (*Elaeagnus angustifolia*) Ruderal Woodland Alliance				19.9	19.9	0.03
Salt Cedar (*Tamarix ramosissima*) Ruderal Temporarily Flooded Shrubland Alliance				16.9	16.9	0.02
Other Cover Types	**5,140.6**	**4,956.3**	**4,236.3**	**3,402.6**	**17,735.9**	**25.73**
Sparsely vegetated	1,645.4	986.3	14.2	3,101.7	5,747.6	8.34
Dunes			2,473.9		2,473.9	3.59
Playas	3,387.5	3,434.7	1,630.7	188.8	8,641.7	12.53
Ponds†				2.8	2.8	<0.01
Developed	2.0	532.4		24.5	558.8	0.81
Roads	105.8	2.9	117.5	84.8	311.8	0.45
Grand Totals	**17,410.8**	**21,314.1**	**17,334.0**	**12,896.9**	**68,955.7**	**100.00**

* Alliance not found in NatureServe database of published alliances.

† Ponded areas support stands of southern cattails (*Typha domingensis*). Although these cattail stands are too small to meet the mapping criteria as a distinct alliance they provide important wildlife habitat.

Herbaceous alliances cover relatively small portions of the survey area, with the largest being the Cheatgrass (*Bromus tectorum*) Alliance, covering only 858.9 acres (1.2%). This alliance occurs primarily on Ranges B-17 and B-19. Some shrubs do occur in these areas of non-native grass, but at very low densities, failing to meet the membership rules described in Table 2-3.

Herbaceous wetlands alliances were mapped only in the Dixie Valley area, especially in Dixie Meadows and the Settlement Area. These alliances typically cover very small areas, just 573.4 acres total (0.8%), and most of the polygons fall below the 2-acre minimum mapping unit used for the non-wetland alliances, but are important features of the NAS Fallon landscape. These alliances are found along the margins of hot springs (Dixie Meadows) and ponded areas (Settlement Area), and are dominated by reeds, sedges, rushes, and grasses representing eight alliances.

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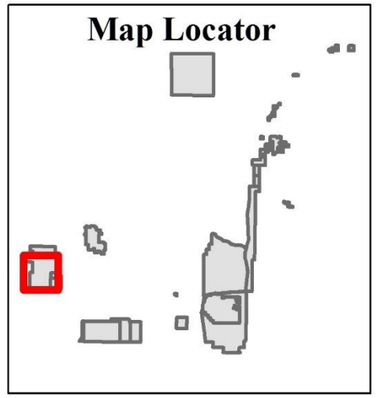

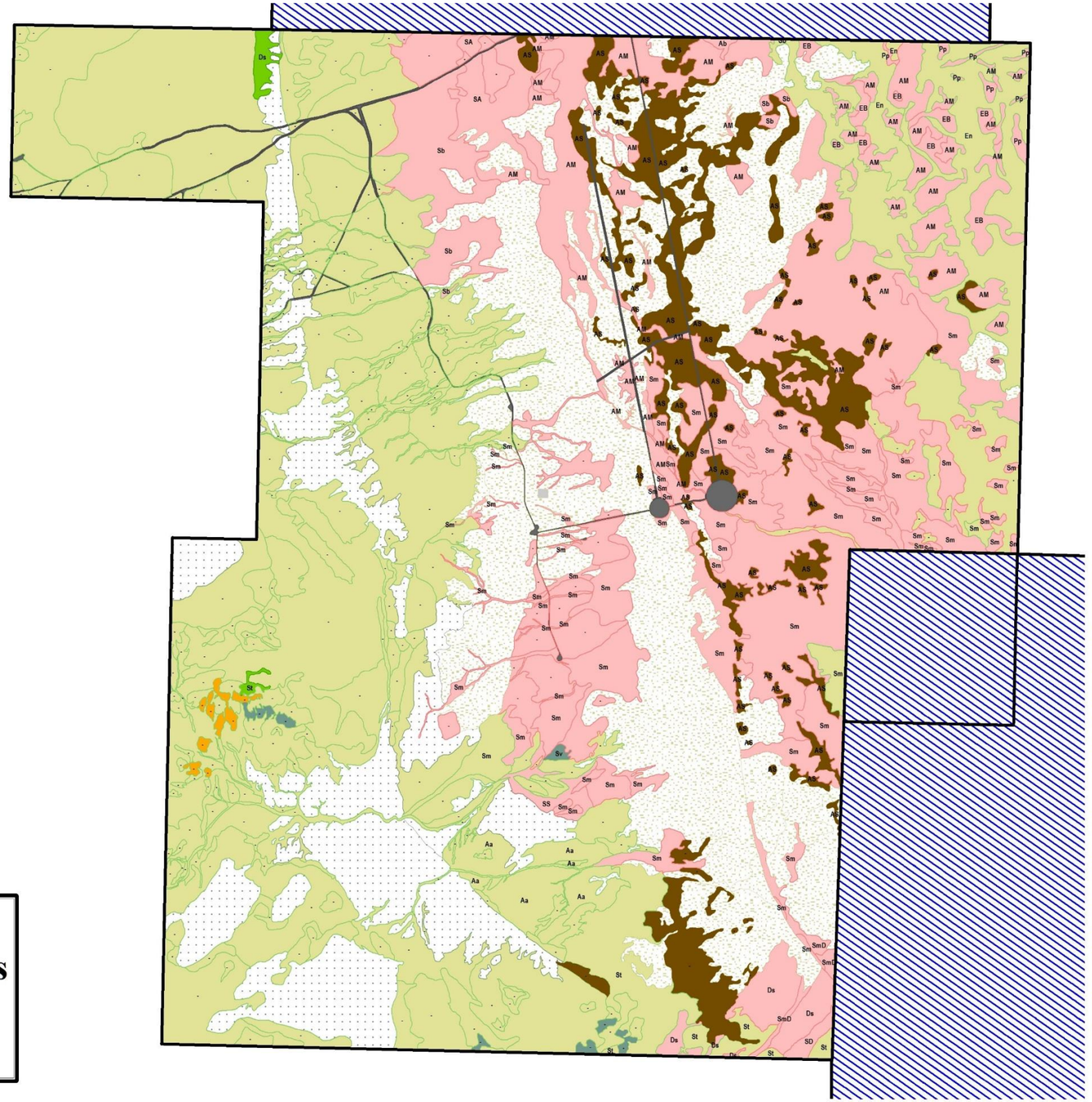

Vegetation Alliances

Herbaceous (non-wetlands)
Russian Thistle
Alkaline scrubs
Fourwing Saltbush
Bailey's Greasewood
Black Greasewood
Alkali Seepweed
Upland scrubs
Rubber Rabbitbrush
Other cover types
Sparsely vegetated
Playas
Developed
Roads
2007-08 mapping areas

Association Components
Aa: Fourwing Saltbush
Ab: Shadscale
AM: Fourwing Saltbush-Alkali Seepweed
AS: Fourwing Saltbush-Black Greasewood
Ds: Flixweed
En: Rubber Rabbitbrush
EB: Rubber Rabbitbrush/Cheatgrass
Pp: Nevada dalea
Sb: Bailey's Greasewood
SA: Bailey's Greasewood/Indian Ricegrass
SS: Bailey's Greasewood-Alkali Seepweed
Sm: Alkali Seepweed
SD: Alkali Seepweed/Flixweed
St: Russian Thistle
Sv: Black Greasewood
- : No associates or co-dominants

NAS Fallon
Vegetation Alliances
2014-15
B-16

N
W E
S

Kilometers
0.5 0.25 0 0.5 1

Map 2-2. Vegetation alliances for B-16 at Naval Air Station Fallon in 2014-15.

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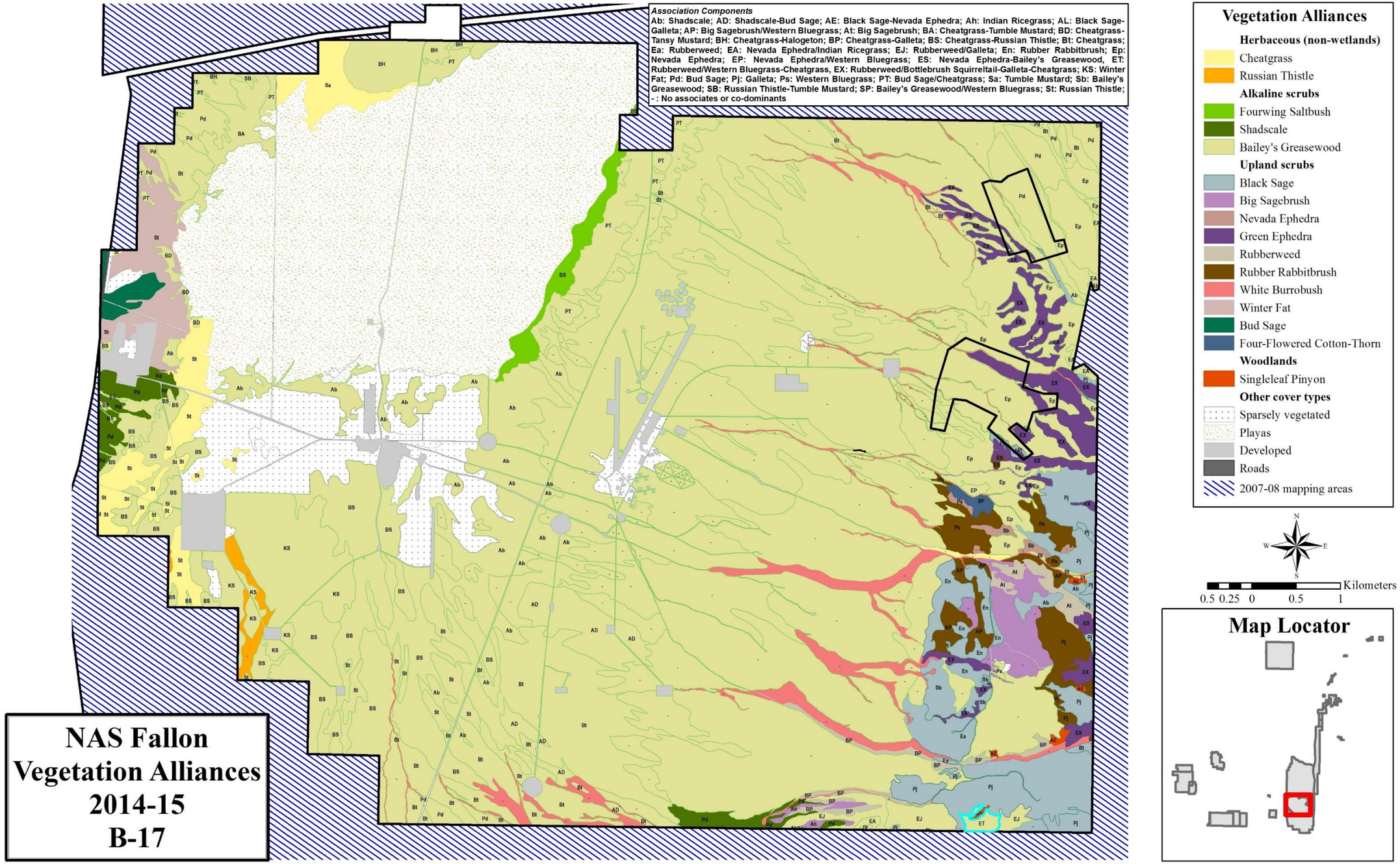

Map 2-3. Vegetation alliances for B-17 at Naval Air Station Fallon in 2014-15.

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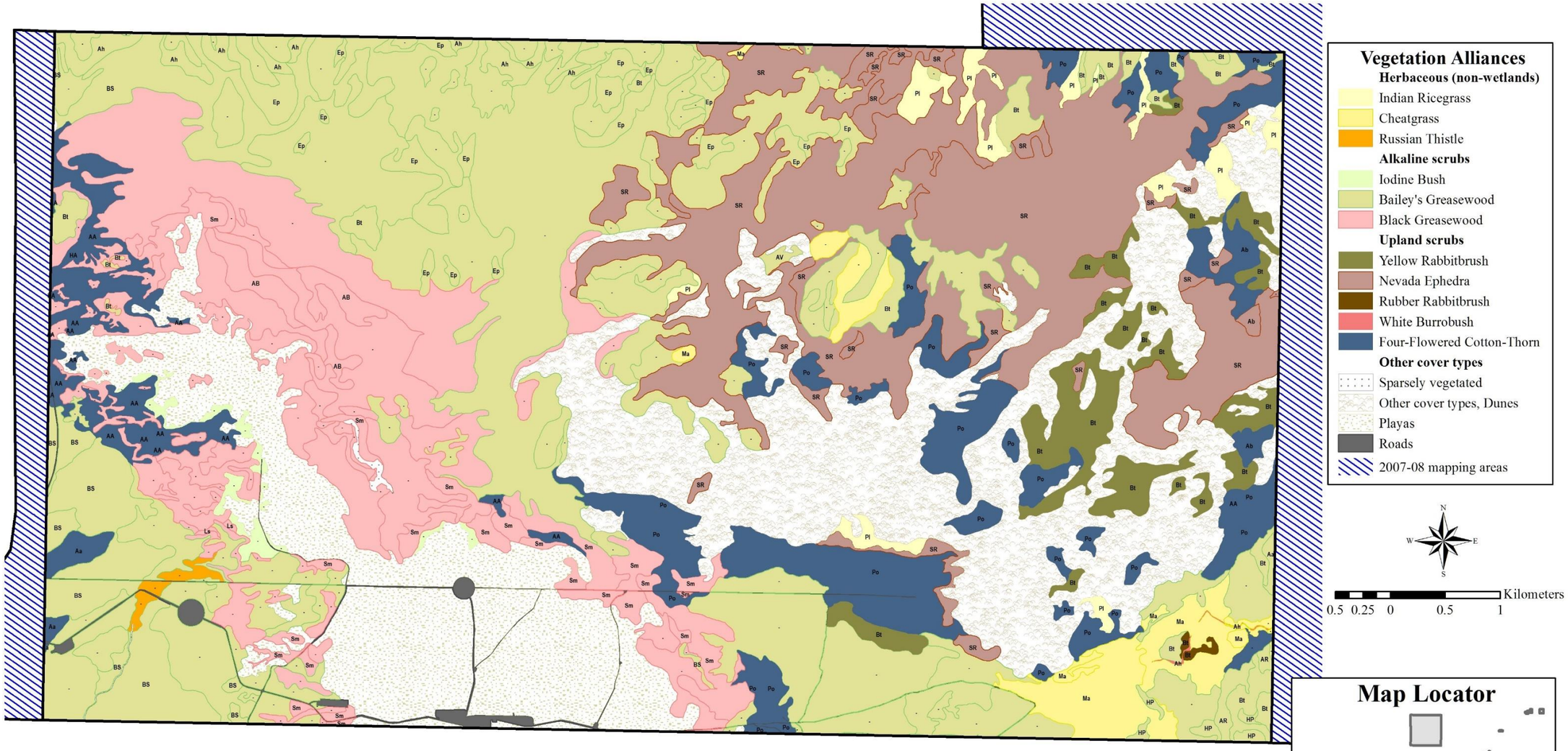

NAS Fallon
Vegetation Alliances
2014-15
B-19

Association Components
Aa: Fourwing Saltbush; AA: Fourwing Saltbush/Indian Ricegrass; Ab: Shadscale; AB: Shadscale-Shockley's Boxthorn; Ah: Indian Ricegrass; AR: Fourwing Saltbush/Russian Thistle; AV: Indian Ricegrass-Winged Dock; BS: Cheatgrass-Russian Thistle; Bt: Cheatgrass; Ep: Nevada Ephedra; HA: White Burrobush/Indian Ricegrass; HP: White Burrobush-Bud Sage/Cheatgrass; Ls: Shockley's Boxthorn; Ma: White-stemmed Stick-leaf; Pl: Lemon Scurfpea; Po: Dotted Indigobush; SR: Bailey's Greasewood/Indian Ricegrass-Winged Dock; - : No associates or co-dominants

Map 2-4. Vegetation alliances for B-19 at Naval Air Station Fallon in 2014-15.

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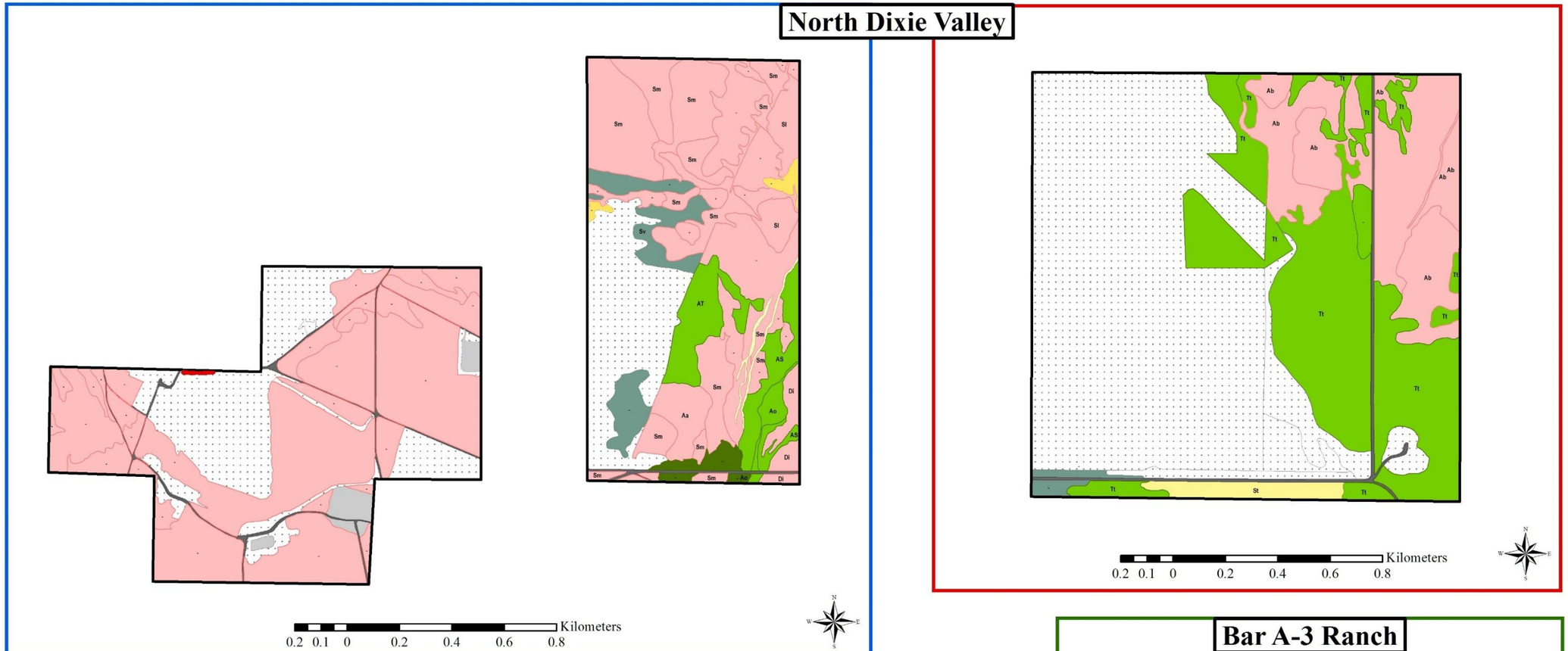

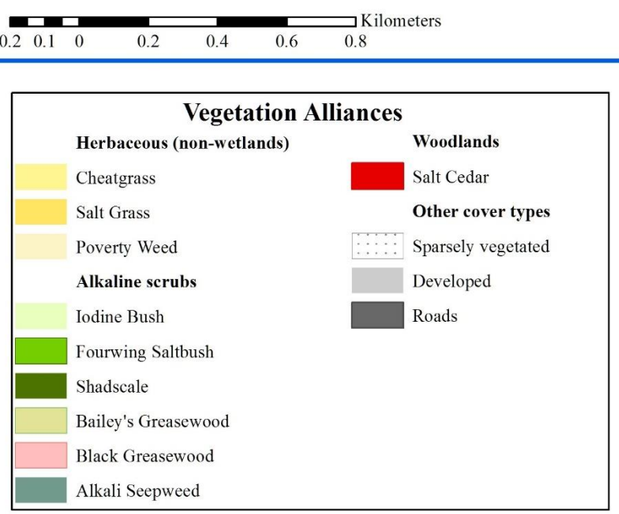

NAS Fallon Vegetation Alliances 2014-15 North Dixie Valley and Bar A-3 Ranch

Vegetation Alliances

Herbaceous (non-wetlands)
- Cheatgrass
- Salt Grass
- Poverty Weed

Alkaline scrubs
- Iodine Bush
- Fourwing Saltbush
- Shadscale
- Bailey's Greasewood
- Black Greasewood
- Alkali Seepweed

Woodlands
- Salt Cedar

Other cover types
- Sparsely vegetated
- Developed
- Roads

Map Locator

Association Components
Ab: Shadscale; Ao: Iodine Bush; AS: Fourwing Saltbush-Black Greasewood; AT: Fourwing Saltbush-Salt Cedar; Di: Saltgrass; Sl: Alkali Seepweed-Saltgrass; Sm: Alkali Seepweed; St: Russian Thistle; Sv: Black Greasewood; Tt: Four-flowered Cotton-thorn
- : No associates or co-dominants

Map 2-5. Vegetation alliances for North Dixie Valley and Bar A-3 Ranch at Naval Air Station Fallon in 2014-15.

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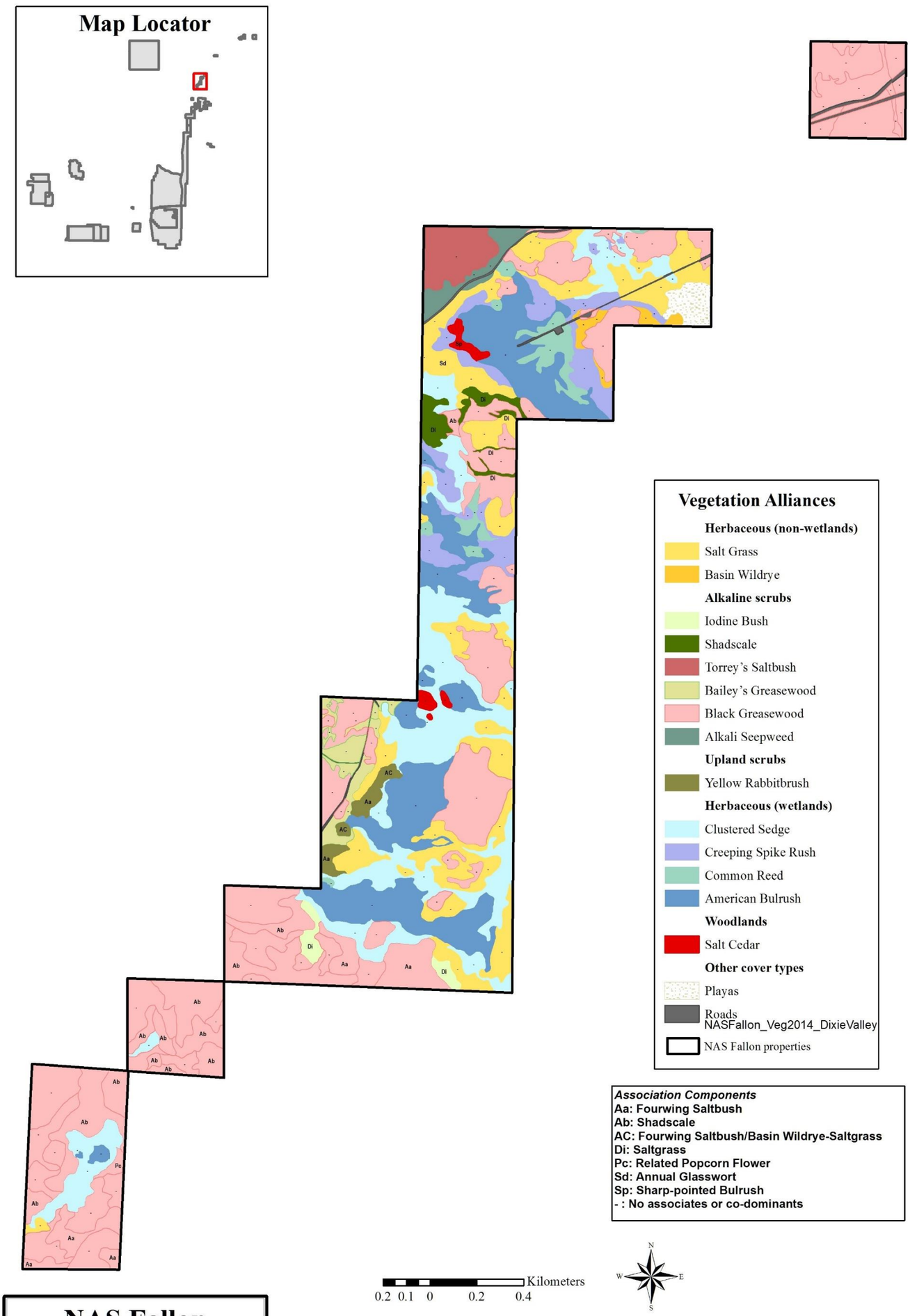
Map 2-6. Vegetation alliances for Dixie Meadows at Naval Air Station Fallon in 2014-15.



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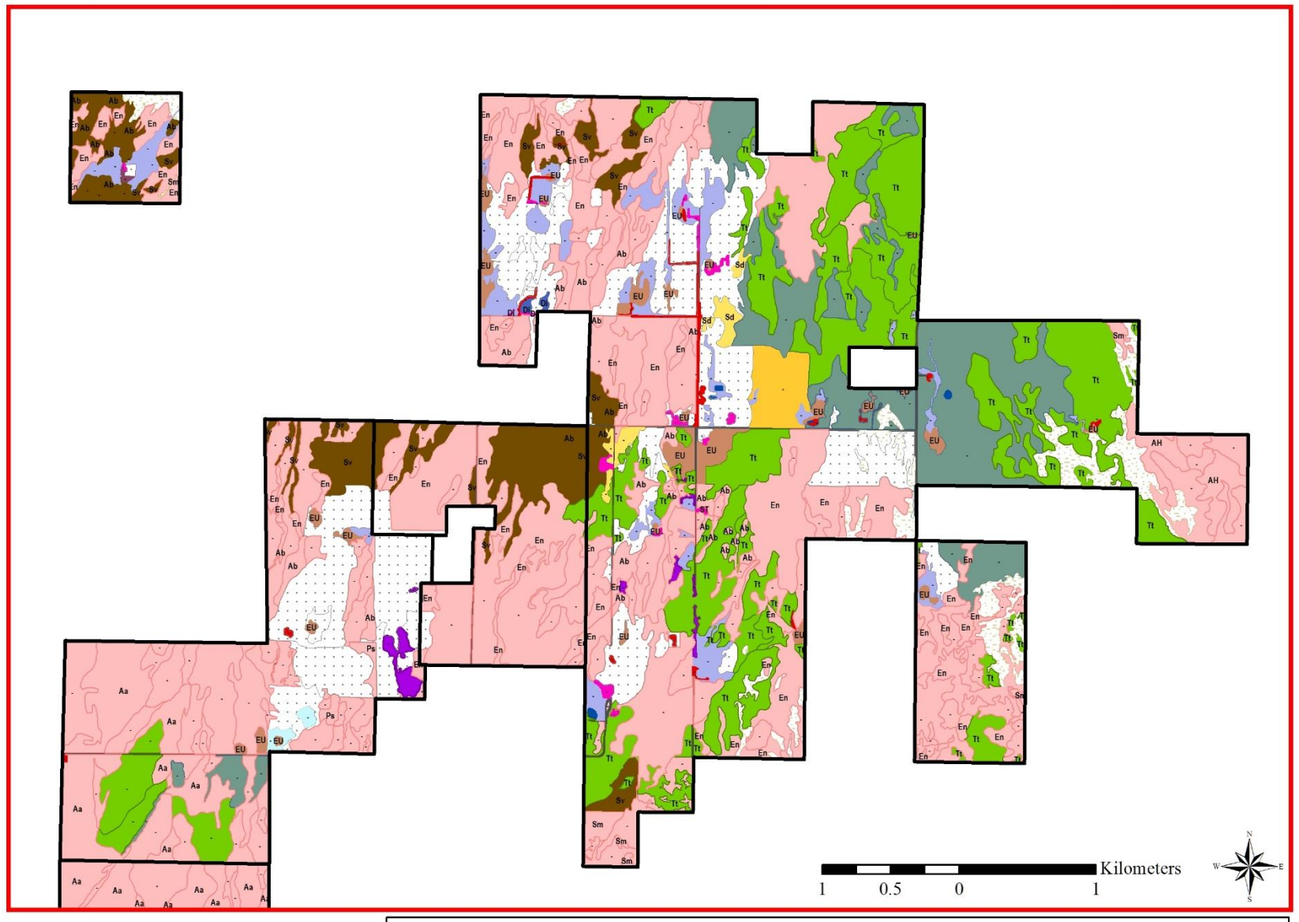

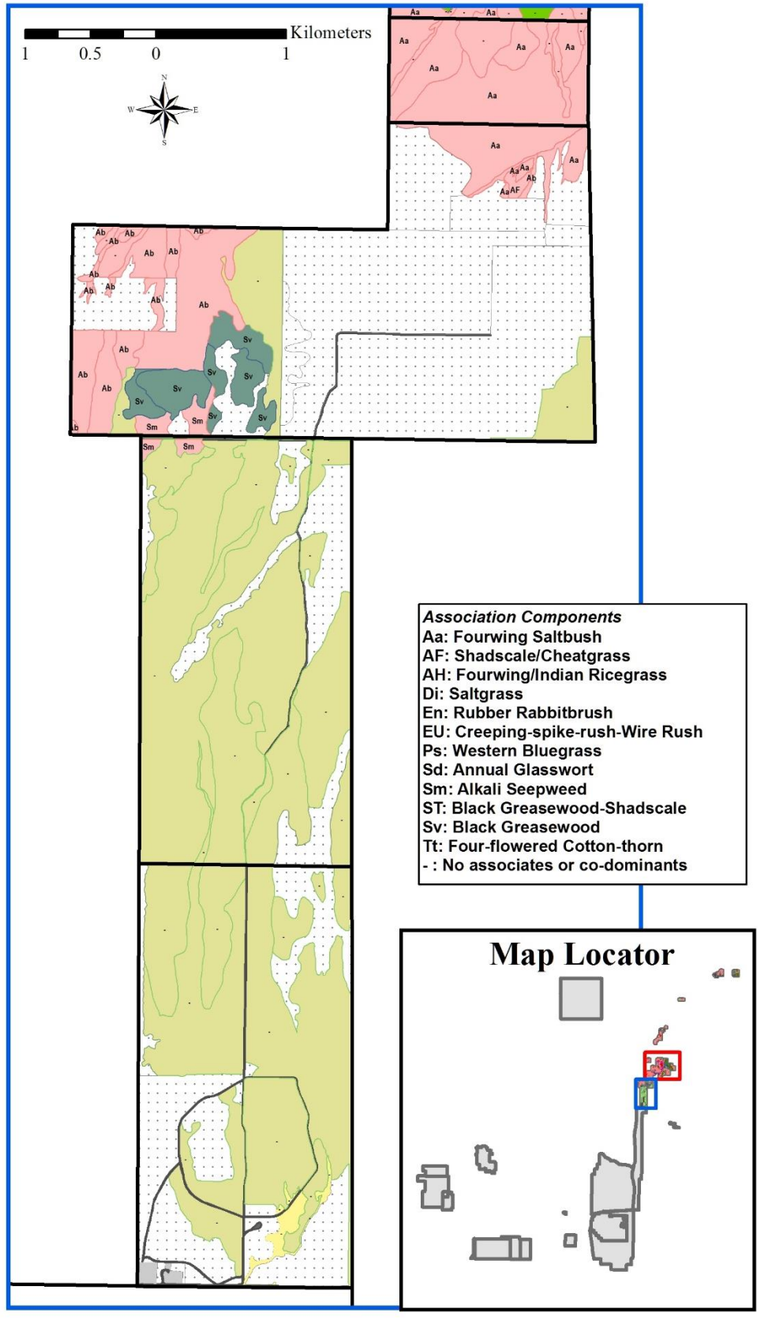

NAS Fallon Vegetation Alliances 2014-15 Settlement Area

Vegetation Alliances

Herbaceous (non-wetlands)
- Salt Grass
- Basin Wildrye

Alkaline scrubs
- Iodine Bush
- Fourwing Saltbush
- Shadscale
- Bailey's Greasewood
- Black Greasewood
- Alkali Seepweed

Upland scrubs
- Rubber Rabbitbrush

Herbaceous (wetlands)
- Clustered Sedge
- Creeping Spike Rush
- Bottlebrush Squirreltail
- Baltic Rush
- Western Bluegrass

Woodlands
- Fremont Cottonwood
- Russian Olive
- Salt Cedar

Other cover types
- Sparsely vegetated
- Playas
- Ponds*
- Developed
- Roads

*Ponded areas support stands of southern cattails (*Typha domingensis*). Although these cattail stands are too small to meet the mapping criteria as a distinct alliance they provide important wildlife habitat.

Map 2-7. Vegetation alliances for the Settlement Area at Naval Air Station Fallon in 2014-15.

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2.3.2 Alliance Descriptions

2.3.2.1 Herbaceous Wetlands

2.3.2.1.1 Arid West Interior Freshwater Emergent Marsh Macrogroup

Clustered Sedge (*Carex praegracilis*) Alliance

This alliance is dominated by clustered sedge (*Carex praegracilis*) with no shrub cover. Total herbaceous cover is 90-95% (two assessment points). Stands are found exclusively on pond margins, springs or wet basins in Dixie Meadows and the Settlement Area. Associated species include Baltic rush (*Juncus balticus*), low arrowgrass (*Triglochin concinna*), and American brooklime (*Veronica americana*).

Associations

Clustered Sedge Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Creeping Spike Rush (*Eleocharis macrostachya*) Alliance

This alliance is dominated by creeping spike rush with little or no shrub cover (Photo 2-1). Associated species include clustered sedge, Baltic rush, western bluegrass (*Poa secunda*), *Cryptantha* sp., related popcorn flower (*Plagiobothrys scouleri*), common sunflower (*Helianthus annuus*), fiddleleaf hawksbeard (*Crepis runcinata*), spiny hopsage (*Grayia spinosa*), rubber rabbitbrush (*Ericameria nauseosa*), and psorothamnus (*Descurainia sophia*). Total herbaceous cover ranges from 70-100% (four assessment points). Stands are found exclusively on pond margins, springs, or wet basins in Dixie Meadows and the Settlement Area.

Photo 2-1. Creeping Spike Rush Alliance.

Associations

Creeping Spike Rush Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Bottlebrush Squirreltail (*Elymus elymoides*) Alliance

This alliance was found in just one location at an old home site in the southern end of the Dixie Valley area on Settlement Road (Photo 2-2). The area was inundated with water from an open water valve on the site (Photo 2-3). Bottlebrush squirreltail (*Elymus elymoides*) dominated the site with 55% cover, with Baltic rush present at 25% cover and an unidentified (too young, lacking identifiable structures) clover (*Trifolium* sp.) at 15% cover. Other associated species included many-flowered monkey-flower (*Mimulus floribundus*), common dandelion (*Taraxacum officinale*), southern cattail (*Typha domingensis*), Great Basin bulrush (*Scirpus nevadensis*), creeping spike rush (*Eleocharis macrostachya*), American bulrush (*Schoenoplectus americanus*), Mexican rush (*Juncus mexicanus*), showy milkweed (*Asclepias speciosa*), curly-leaved dock (*Rumex crispus*), American brooklime, and western bluegrass.

Photo 2-2. Bottlebrush Squirreltail Alliance and open water valve in background (see below).

Photo 2-3. Close-up of open water valve.

Associations

Bottlebrush Squirreltail Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Western Bluegrass (*Poa secunda*) Alliance

This alliance (Photo 2-4) occurs exclusively in the Settlement Area of Dixie Valley where ponds occur. The vegetation is dominated by western bluegrass (85% cover at one assessment point). Other associated species include creeping spike rush, Baltic rush, related popcorn flower, many-flowered monkey-flower, and American brooklime.

Photo 2-4. Western Bluegrass Alliance.

Associations

Western Bluegrass-Creeping Spike Rush-Baltic Rush Association

All polygons within this alliance are further classified as the Western Bluegrass-Creeping Spike Rush-Baltic Rush Association.

American Bulrush (*Schoenoplectus americanus*) Alliance

This alliance is found in marshy areas of the Dixie Meadows and is dominated by American bulrush (Photo 2-5) at 75-85% total cover (two assessment points). Other species present included salt grass (*Distichlis spicata*), desert buttercup (*Ranunculus cymbalaria),* and salt cedar.

Photo 2-5. American Bulrush Alliance with emergent Tamarisk trees.

Associations

American Bulrush Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

2.3.2.1.2 Western North American Ruderal Wet Shrubland, Meadow & Marsh Macrogroup

Poverty Weed (*Iva axillaris*) Alliance

This alliance was found in only one location in a small shallow moist depression on the Bar A 3 parcel in Dixie Valley (Photo 2-6). Poverty weed is the sole dominant species with 65% cover. Other species present included black greasewood, pigweed (*Chenopodium album*), and several dead salt cedar trees.

Photo 2-6. Poverty Weed Alliance.

Associations

Poverty Weed Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Baltic Rush *(Juncus balticus)* Alliance

This type was found in only one location in a shallow moist depression in the Settlement Area of Dixie Valley. Baltic rush was present at 45% cover, with salt grass representing 30% cover.

Associations

Baltic Rush-Salt Grass Association

All polygons within this alliance are further classified as the Baltic Rush-Salt Grass Association.

Common Reed (*Phragmites australis*) Alliance

This alliance was found exclusively at Dixie Meadows (Photo 2-7) where common reed (*Phragmites australis*) was present at nearly 100% cover (one assessment point). No other plant species were observed.

Photo 2-7. Common Reed Alliance.

Associations

Common Reed Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

2.3.2.2 Grasslands (and Other Herbaceous Types)

2.3.2.2.1 Great Basin & Intermountain Dry Grassland Macrogroup

Indian Ricegrass (*Achnatherum hymenoides*) Alliance

This alliance occurs on dune flats among active dunes on B-19 (Photo 2-8). These polygons were mapped from assessment points that were done in 2007-08 (no assessment points were done on this type in 2014-15).

Associations

Indian Ricegrass-Lemon Scurfpea Association

All polygons of this alliance are mapped as the Indian Ricegrass-Lemon Scurfpea Association.

Photo 2-8. Indian Ricegrass Alliance.

2.3.2.2.2 Warm & Cool Desert Alkali-Saline Wetland Macrogroup

Salt Grass *(Distichlis spicata)* Alliance

This alliance occurs in North Dixie Valley, Dixie Meadows, and the Settlement Area on alkaline flats near ponds and seeps and is dominated by salt grass (Photo 2-9). Percent cover of salt grass ranges from 4-80% (six assessment points). Shrub species may be present at very low densities (<1% cover), including rubber rabbitbrush, black greasewood, Bailey's greasewood, and alkali seepweed (*Suaeda moquini*). Other associated species include clustered sedge, common reed, low arrowgrass, annual glasswort (*Salicornia depressa*), common sunflower, and Baltic rush.

Photo 2-9. Salt Grass Alliance.

Associations

Salt Grass Association
Salt Grass-Annual Glasswort Association

One polygon (20.2 acres) of this alliance was mapped as the Salt Grass-Annual Glasswort Association. The remaining 114.7 acres had no other co-dominant species.

Basin Wildrye *(Leymus cinereus)* Alliance

This alliance was mapped in just two locations, which differed greatly in their characteristics and position on the landscape. One location was in the Dixie Meadows area on the edge of a playa, with 95% cover of basin wildrye (*Leymus cinereus*) (Photo 2-10). Other species included clustered sedge and low arrowgrass. The other location was in the Settlement Area and had clearly been subject to some form of ground disturbance (discing or plowing) with 25% cover of wildrye (Photo 2-11). Russian olive trees were scattered throughout much of the area. Other species observed were salt grass, rubber rabbitbrush, Bailey's greasewood, and tall wheatgrass *(Thinopyrum ponticum)*.

Associations

Basin Wildrye Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Photo 2-10. Basin Wildrye Alliance, Dixie Meadows location.

Photo 2-11. Basin Wildrye Alliance, Settlement Area location.

2.3.2.2.3 Western North American Ruderal Wet Shrubland, Meadow & Marsh Macrogroup

Cheatgrass *(Bromus tectorum)* Alliance

This alliance is dominated by cheatgrass (*Bromus tectorum*) (Photo 2-12), a non-native grass. Percent cover of cheatgrass can range from 10-70% (five assessment points) with other grasses present at very low cover (1-10%; Indian ricegrass [*Achnatherum hymenoides*], western bluegrass, annual false wheatgrass [*Eremopyrum triticeum*]). A variety of forbs may be present at low cover (1-20%; white-stemmed stick-leaf *[Mentzelia albicaulis]*, checker fiddleneck *[Amsinckia tessellate]*, Kennedy's milk vetch *[Astragalus lentiginosus var. kennedyi]*, Douglas' mountain hoary pincushion *[Chaenactis douglasii* var. *douglasii]*, Russian thistle [*Salsola tragus*], halogeton [*Halogeton glomeratus*], Lottie's gilia *[Aliciella lottiae]*, smooth desert dandelion *[Malacothrix glabrata]*, and Piper's evening primrose *[Oenothera deltoides* ssp. *piperi]*). Shrubs may also be present but very sparse (1% cover or less; fourwing saltbush [*Atriplex canescens*], shadscale [*Atriplex confertifolia*], sticky rabbitbrush, bud sage [*Picrothamnus desertorum*], Bailey's greasewood, little-leaf horsebush *[Tetradymia glabrata]*, and four-flowered cotton-thorn [*Tetradymia tetrameres*]). The Cheatgrass Alliance occurs primarily on Ranges B-19 (412.4 acres) and B-17 (409.3 acres), with a small amount in North Dixie Valley (37.1 acres).

Photo 2-12. Cheatgrass Alliance/ Cheatgrass-White-Stemmed Stick-Leaf Association.

Associations

Cheatgrass Association
Cheatgrass-White-Stemmed Stick-Leaf Association
Cheatgrass-Tumble Mustard Association
Cheatgrass-Russian Thistle Association

Aside from the alliance type itself, three other associations were mapped in the Cheatgrass Alliance. On B-19, most of the cheatgrass areas were classified as the Cheatgrass-White-Stemmed Stick-Leaf Association, where stick-leaf is present at 10-18% cover (two assessment points). On B-17 most of the Cheatgrass Alliance was classified as either the Cheatgrass-Russian Thistle Association (273.9 acres) or the Cheatgrass-Tumble Mustard Association (125.3 acres). Both of these associations were mapped based upon assessment data collected in 2007-08 in adjacent polygons.

Russian Thistle *(Salsola tragus)* Alliance

This alliance covers only very small areas of all three ranges where Russian thistle is the sole dominant species (10-40% cover, two assessment points) (Photo 2-13). It should be noted that percent cover of Russian thistle in these was likely much lower at the time of the field visits than it would be later in the season since at the time the plants were still very young. Other species associated with this alliance include black greasewood, Bailey's greasewood, Shockley's boxthorn *(Lycium shockleyi)*, alkali seepweed, cheatgrass, Indian ricegrass, halogeton, Piper's evening primrose, evening primrose (*Oenothera deltoides*), Kennedy's milk vetch, Nuttall's tiquilia *(Tiquilia nuttallii)*, transmontane sand abronia *(Abronia turbinata)*, and bighead dustymaiden *(Chaenactis macrantha)*.

Associations

Russian Thistle Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Photo 2-13. Russian Thistle Alliance.

2.3.2.3 Alkaline Scrubs

These vegetation types are generally located in the valley bottoms around playas and are dominated by shrubs of the Goosefoot Family (Chenopodiaceae). Total vegetative cover is highly variable, as is species composition and diversity. These scrub types are the prevalent vegetation type in the survey area, comprising a total of 59% of the lands surveyed in 2014-15. They are divided into two IVC Macrogroups.

2.3.2.3.1 Warm & Cool Desert Alkali-Saline Wetland Macrogroup

Alkali Seepweed *(Suaeda moquini)* Alliance

Most of this alliance is found in Dixie Valley (660.2 acres; North Dixie Valley, Bar A-3 Ranch, Dixie Meadows, and Settlement Area), with a small amount on B-16 (35.5 acres). Alkali seepweed is the dominant shrub species with cover values of 5-35%, with forb and grass cover less than 3% (14 assessment points; Photo 2-14). Other shrub species present at low cover (<15%) include black greasewood, catclaw horsebush (*Tetradymia spinosa*), shadscale, and fourwing saltbush. Herbaceous species associated with this alliance are wedgescale saltweed (*Atriplex truncata*), cheatgrass, broad-flowered chaenactis (*Chaenactis stevioides*), annual false wheatgrass, halogeton, white-stemmed stick-leaf, and Russian thistle.

Photo 2-14. Alkali Seepweed Alliance

Associations

Alkali Seepweed Association
Alkali Seepweed Association, disturbed
Alkali Seepweed-Black Greasewood Association

Most of the areas mapped as the Alkali Seepweed Alliance have no other co-dominant shrub species or a significant herbaceous layer. There are, however, 135 acres mapped as the Alkali Seepweed-Black Greasewood Association, where black greasewood is present at 15% cover (seepweed cover of 20%).

Black Greasewood *(Sarcobatus vermiculatus)* Alliance

As the second largest alliance in the survey area, these lands are dominated by black greasewood (Photo 2-15) at percent cover ranging from 3-45% (62 assessment points). Greasewood may occur in either nearly monotypic stands or in combination with other co-dominant shrub species (e.g. *Atriplex* species, alkali seepweed, rubber rabbitbrush, and sticky rabbitbrush). Forb and grass cover is also highly variable, ranging from <1% cover to 15-20% (Photo 2-16) with a variety of species. The most common grasses include cheatgrass, saltgrass, wildrye, and the most common forbs were wedgescale saltweed, tansy-mustard *(Descurainia sophia)*, white-stemmed stick-leaf, and Russian thistle.

Photo 2-15. Black Greasewood Alliance.

Photo 2-16. Black Greasewood Alliance with salt grass.

Associations

Associations where black greasewood is the sole dominant shrub:

Black Greasewood Association
Black Greasewood/Tansy-mustard Association
Black Greasewood/Saltgrass Association
Black Greasewood/Related Popcorn Flower Association
Black Greasewood/Western Bluegrass Association

Associations where black greasewood is co-dominant with other shrub species:

Black Greasewood-Fourwing Saltbush Association
Black Greasewood-Fourwing Saltbush/Indian Ricegrass Association
Black Greasewood-Fourwing Saltbush-Alkali Seepweed Association
Black Greasewood-Shadscale Association
Black Greasewood-Shadscale/Bromus tectorum Association
Black Greasewood-Shadscale-Shockley's Boxthorn Association
Black Greasewood-Rubber Rabbitbrush Association
Black Greasewood-Rubber Rabbitbrush/Bromus tectorum Association
Black Greasewood-Shockley's Boxthorn Association
Black Greasewood-Dotted Indigobush Association
Black Greasewood-Bailey's Greasewood Association
Black Greasewood-Bailey's Greasewood/Indian Ricegrass Association
Black Greasewood-Bailey's Greasewood-Alkali Seepweed Association
Black Greasewood-Alkali Seepweed Association
Black Greasewood-Alkali Seepweed/Tansy-mustard Association
Black Greasewood-Alkali Seepweed/Saltgrass Association

Almost half (5,385.3 acres, 46%) of the area mapped as the Black Greasewood Alliance has no other co-dominant shrub species or significant herbaceous layer. Only 70 acres of these areas are mapped as a shrub/herbaceous association, where the herbaceous is comprised of tansy mustard, salt grass, related popcorn flower, or western bluegrass.

The remaining 54% of the Black Greasewood Alliance was mapped as a co-dominant association with other shrub species, including fourwing saltbush (2,419.4 acres, 20.8%), shadscale (710.1 acres, 6.1%), rubber rabbitbrush (1,100.6, 9.4%), Shockley's boxthorn (3.9 acres, <1%), Nevada dalea (*Psorothamnus polydenius*) (121.4 acres, 1.0%), Bailey's greasewood (110.2 acres, 0.9%), and Alkali seepweed (1,802.3 acres, 15.5%). Some of these areas also have a significant herbaceous layer comprised of Indian ricegrass, cheatgrass, saltgrass, and tansy-mustard**.**

Iodine Bush (*Allenrolfea occidentalis*) Alliance

Small areas mapped as this alliance (Photo 2-17) occur on B-19 and Dixie Valley, where percent cover of iodine bush (*Allenrolfea occidentalis*) ranges from 5-20% (three assessment points). Alkali seepweed, black greasewood, and fourwing saltbush may also occur at low cover. Saltgrass was the only herbaceous species observed.

Photo 2-17. Iodine Bush Alliance.

Associations

Iodine Bush Association
Iodine Bush/Salt Grass Association
Iodine Bush-Alkali Seepweed Association

Most of this alliance had no co-dominant shrubs or significant herbaceous layers associated with it. Only two associations were mapped in this alliance, covering <6 acres, the Iodine Bush-Alkali Seepweed and Iodine Bush/Salt Grass Associations.

2.3.2.3.2 Great Basin Saltbrush Scrub Macrogroup

Bailey's Greasewood *(Sarcobatus baileyi)* Alliance

The Bailey's Greasewood Alliance (Photo 2-18) is the most widespread alliance in areas surveys, comprising 59% of the total area and occurring on all surveyed parcels except North Dixie Valley. This alliance generally occurs between the low-lying basins dominated by black greasewood and the higher elevation hills and mountains dominated by the upland scrubs. Percent cover of Bailey's greasewood ranges from 3-40% (53 assessment points), with a variety of other shrub species present at lower percent cover (fourwing saltbush, shadscale, Nevada ephedra, rubber rabbitbrush, winter fat [*Krascheninnikovia lanata*], Shockley's boxthorn, bud sage, black greasewood, alkali seepweed, and four-flowered cotton-thorn). Percent cover of grasses ranges from 0-15% (Indian ricegrass, cheatgrass, saltgrass, and western bluegrass), as does forb cover (transmontane sand abronia, *Chaenactis* spp., smooth desert dandelion, Piper's evening primrose, winged dock [*Rumex venosus*], and Russian thistle).

Photo 2-18. Bailey's Greasewood Alliance.

Associations

Associations where Bailey's greasewood is the sole dominant shrub:

Bailey's Greasewood
Bailey's Greasewood/Indian Ricegrass Association
Bailey's Greasewood/Indian Ricegrass-Winged Dock Association
Bailey's Greasewood/Cheatgrass Association
Bailey's Greasewood/Cheatgrass-Tansy Mustard Association
Bailey's Greasewood/Cheatgrass-Halogeton Association
Bailey's Greasewood/Cheatgrass-Russian Thistle Association
Bailey's Greasewood/Cheatgrass-Tumble Mustard Association
Bailey's Greasewood/Western Bluegrass Association
Bailey's Greasewood/Russian Thistle Association
Bailey's Greasewood/Russian Thistle-Tumble Mustard Association

Associations where Bailey's greasewood is co-dominant with other shrub species:

Bailey's Greasewood-Fourwing Saltbush Association
Bailey's Greasewood-Fourwing Saltbush/Russian Thistle Association
Bailey's Greasewood-Shadscale Association
Bailey's Greasewood-Shadscale-Bud Sage Association
Bailey's Greasewood-Nevada ephedra Association
Bailey's Greasewood-Nevada ephedra/Indian Ricegrass Association
Bailey's Greasewood-Nevada ephedra/Western Bluegrass Association
Bailey's Greasewood-Rubberweed/Galleta Grass Association
Bailey's Greasewood-Rubberweed/Western Bluegrass-Cheatgrass Association
Bailey's Greasewood-Rubber Rabbitbrush Association
Bailey's Greasewood-White Burrobush-Bud Sage/Cheatgrass Association
Bailey's Greasewood-Winter Fat/Russian Thistle Association
Bailey's Greasewood-Bud Sage Association
Bailey's Greasewood-Alkali Seepweed Association

More than 85% of the area mapped as the Bailey's Greasewood Alliance has no other co-dominant shrub species, and 70% has no significant herbaceous layer. In those areas where a significant herbaceous layer was found the species composition varied greatly, yielding ten distinct associations, including grass species (Indian ricegrass, cheatgrass, and western bluegrass) and forb species (tansy mustard, halogeton, winged dock, Russian thistle, and tumble mustard *[Sisymbrium altissimum]*).

The remainder of the Bailey's Greasewood Alliance was mapped as associations where other shrub species were co-dominant, fourwing saltbush (307.7 acres, 1.2%), shadscale (989.7 acres, 3.8%), Nevada ephedra (1,189.5 acres, 4.6%), rubber weed *(Ericameria nana)* (136.5 acres, 0.5%), rubber rabbitbrush (62.9 acres, 0.2%), white burrobush (*Hymenoclea salsola*) (28.4 acres, <1%), winter fat (470.8 acres, 1.8 %), bud sage (364.2 acres, 1.4%), and alkali seepweed (100.8 acres,<1%). Some of these areas also have a significant herbaceous layer, comprised of Indian ricegrass, western bluegrass, cheatgrass, galleta grass *(Pleuraphis jamesii)*, and Russian thistle.

Fourwing Saltbush *(Atriplex canescens)* Alliance

Stands of this alliance (Photo 2-19) occur mostly at Dixie Valley (North Dixie Valley, Settlement Area), with small areas also on Ranges B-16 and B-17. Percent cover of fourwing saltbush ranges from 2-30% (seven assessment points). Other shrub species present include iodine bush, Bailey's greasewood, black greasewood, and alkali seepweed. Non-native salt cedar may occur as well. Herbaceous species may be present at low cover (0-15%), including Indian ricegrass, wedgescale saltweed, cheatgrass, salt grass, halogeton, and Russian thistle.

Photo 2-19. Fourwing Saltbush Alliance, with salt cedar trees (mid-ground).

Associations

Associations where fourwing saltbush is the sole dominant shrub:

Fourwing Saltbush Association
Fourwing Saltbush /Cheatgrass-Russian Thistle Association
Fourwing Saltbush/Tansy Mustard Association
Fourwing Saltbush/Russian Thistle Association

Associations where fourwing saltbush is co-dominant with other shrub species:

Fourwing Saltbush-Iodine Bush Association
Fourwing Saltbush-Black Greasewood Association
Fourwing Saltbush-Black Greasewood-Salt Cedar Association
Fourwing Saltbush-Four-flowered Cotton-Thorn Association

Approximately 83% of the area mapped as this alliance was mapped as having at least one co-dominant shrub species with the Fourwing Saltbush-Four-flowered Cotton-Thorn Association being by far the most extensive (1045.4 acres, 80% of the alliance total).

Shadscale *(Atriplex confertifolia)* Alliance

Only 176.4 acres of this alliance were mapped, most of it on B-17 (159.4 acres) and the rest in Dixie Valley (North Dixie Valley, Dixie Meadows). Shadscale is dominant with 20-30% cover (two assessment points) (Photo 2-20). Other shrub species present may include black greasewood, alkali seepweed and rubber rabbitbrush. Herbaceous species associated with this alliance include salt grass and clasping-leaf pepperweed (*Lepidium perfoliatum*).

Photo 2-20. Shadscale Alliance.

Associations

Shadscale Association
Shadscale/Salt Grass Association
Shadscale-Bud Sage Association

Most of this alliance was mapped as the Shadscale-Bud Sage Association, representing 90% of total alliance area.

Torrey's Saltbush *(Atriplex torreyi)* Alliance

This alliance was found in only one location at the north end of Dixie Meadows (Photo 2-21). Torrey's saltbush was present at 15%, with alkali seepweed at 3% cover. Other shrub species present included sticky rabbitbrush and bud sage. Grass and forb cover was very low (<1% each) and included cheatgrass, desert trumpet (*Eriogonum inflatum*), bighead dustymaiden, dodder (*Cuscuta* sp.), and desert mallow (*Sphaeralcea ambigua*).

Associations

Torrey's Saltbush Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Photo 2-21. Torrey's Saltbush Alliance.

2.3.2.4 Upland Scrubs

2.3.2.4.1 Great Basin & Intermountain Dwarf Sagebrush Shrubland & Steppe Macrogroup

Black Sage *(Artemisia nova)* Alliance

This alliance occurs entirely in the hills and mountains of B-17 (Photo 2-22) where black sage is present at 8-25% cover (three assessment points). Other shrub species present include shadscale, rubber rabbitbrush, Bailey's greasewood, Nevada ephedra, and rubber weed. Herbaceous species present include galleta grass, cheatgrass, western bluegrass, and desert trumpet.

Photo 2-22. Black Sage Alliance.

Associations

Associations where black sage is the sole dominant shrub:

Black Sage Association
Black Sage/Cheatgrass Association
Black Sage/Galleta Grass Association

Associations where black sage is co-dominant with other shrub species:

Black Sage-Shadscale Association
Black Sage-Rubber Weed Association
Black Sage-Rubber Rabbitbrush Association
Black Sage-Bailey's Greasewood Association

The largest association mapped in this alliance was the Black Sage/Galleta Grass Association (504 acres, 66.2% of alliance).

2.3.2.4.2 Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe Macrogroup

Big Sagebrush *(Artemisia tridentata)* Alliance

This alliance is very limited in extent, occurring only in the mountainous areas of B-17 where percent cover of big sagebrush ranges from 12-18% (three assessment points). Other shrub species occurring at low cover include rabbitbrush, Nevada ephedra, and little-leaf horsebush. Percent cover of grasses and forbs is generally low (<5%), with species including Indian ricegrass, western bluegrass, cheatgrass, *Chaenactis* spp., desert mallow, *Eriogonum* spp., Lottie's gilia, and white-stemmed stick-leaf.

Associations

Big Sagebrush Association
Big Sagebrush/Indian Ricegrass Association

Most of these areas have no other co-dominant shrubs species or significant herbaceous layer, with only 22 acres mapped as the Big Sagebrush/Indian Ricegrass Association.

Photo 2-23. Big Sagebrush Alliance.

2.3.2.4.3 Great Basin & Intermountain Dry Shrubland Macrogroup

Yellow Rabbitbrush *(Chrysothamnus viscidiflorus)* Alliance

Most of this alliance occurs on B-19, with small areas in Dixie Meadows. Yellow rabbitbrush is dominant with 15-30% cover (three assessment points). Fourwing saltbush and Nevada ephedra occur at low cover. Grass species present at 2-15% cover include cheatgrass, basin wildrye, Indian ricegrass, and salt grass. Forb species include smooth desert dandelion, lemon scurfpea (*Psoralidium lanceolatum*), *Chaenactis* spp., Piper's evening primrose, bird's nest buckwheat (*Eriogonum nidularium*), small stephanomeria (*Stephanomeria exigua*), and Mexican rush.

Photo 2-24. Yellow Rabbitbrush Alliance.

Associations

Yellow Rabbitbrush/Cheatgrass Association
Yellow Rabbitbrush-Fourwing Saltbush Association
Yellow Rabbitbrush-Fourwing Saltbush Basin Wildrye-Salt Grass Association

The majority of this alliance is mapped as the Yellow Rabbitbrush/Cheatgrass Association (486 acres), with only small amounts (<8 acres total) of other types.

Nevada Ephedra *(Ephedra nevadensis)* Alliance

This alliance is primarily found on the dune lands of B-19 (2547 acres), with just 12 acres in the hills of B-17, where Nevada ephedra is present at 4-20% (five assessment points) (Photo 2-25). Other shrub species present at 3-7% cover are fourwing saltbush, shadscale, rubber rabbitbrush, and Bailey's greasewood. Grasses and forbs may be present with percent cover as high as 10% each. Species include western bluegrass, Indian ricegrass, cheatgrass Russian thistle, halogeton, desert trumpet, white-stem stick-leaf, *Chaenactis* spp., Piper's evening primrose, lemon scurfpea, smooth desert dandelion, and Lottie's gilia. One striking feature of the flora in some of these areas was the abundant populations of thick stemmed wild cabbage (*Caulanthus crassicaulis* var. *crassicaulis*).

Associations

Associations where Nevada ephedra is the sole dominant shrub:

Nevada Ephedra Association
Nevada Ephedra/Western Wildrye Association

Associations where Nevada ephedra is co-dominant with other shrub species:

Nevada Ephedra-Shadscale Association
Nevada Ephedra-Bailey's Greasewood Association
Nevada Ephedra-Bailey's Greasewood/Indian Ricegrass-Winged Dock Association

Almost all of this alliance was mapped as the Nevada Ephedra-Bailey's Greasewood/Indian Ricegrass-Winged Dock Association (2,536 acres), with only 23 acres mapped as other types.

Photo 2-25. Nevada Ephedra Alliance.

Green Ephedra (*Ephedra viridis*) Alliance

This alliance occurs entirely in the hills and mountains of B-17 and was mapped based on assessments points done in 2007-08 (no assessments points were done on this type in 2014-15). Green ephedra (*Ephedra viridis*) generally occurs on rocky slopes with grasses (bottlebrush squirreltail, galleta grass, and cheatgrass) (TDI 2008).

Associations

Green Ephedra-Rubber Rabbitbrush/Bottlebrush Squirreltail-Galleta Grass-Cheatgrass Association

This is the only association mapped in this alliance.

Rubber Weed *(Ericameria nana)* Alliance

Small areas (126 acres) of this alliance occur on B-17 and were mapped based on assessments points done in 2007-8 (no assessments points were done on this type in 2014-15). Big sagebrush is prominent in some areas. Cheatgrass and galleta grass may also be present.

Associations

Rubber Weed/Cheatgrass-Galleta Grass
Rubber Weed-Big Sagebrush

Two associations were mapped within this alliance, the Rubber Weed/Cheatgrass-Galleta Grass Association where rubber weed is the sole dominant shrub with a significant grass layer, and the Rubber Weed-Big-Sagebrush Association where rubber weed is co-dominant with big sagebrush.

Rubber Rabbitbrush *(Ericameria nauseosa)* Alliance

This alliance occurs in all four survey areas, with the largest extent on B-16. Rubber rabbitbrush is the dominant shrub species (Photo 2-26) with percent cover ranging from 5-50% (15 assessment points). Other shrub species may be present at cover values up to 8%, including little sagebrush (*Artemisia arbuscula* ssp. *arbuscula*), big sagebrush, fourwing saltbush, shadscale, Nevada ephedra, rubber rabbitbrush, Bailey's greasewood, and black greasewood. Percent cover of grasses may be as high as 40%, and forbs contributing up to 10% cover. Grass species include salt grass, galleta grass, basin wildrye, and western bluegrass.

Associated forb species include clustered sedge, Baltic rush, tansy-mustard, Russian thistle, halogeton, *Chaenactis* spp., desert mallow, *Eriogonum* spp., and white-stem stick-leaf.

Photo 2-26. Rubber Rabbitbrush Alliance.

Associations

Associations where rubber rabbitbrush is the sole dominant shrub:

Rubber Rabbitbrush Association
Rubber Rabbitbrush/Cheatgrass Association
Rubber Rabbitbrush/Galleta Grass Association
Rubber Rabbitbrush/Western Bluegrass Association

Associations where rubber rabbitbrush is co-dominant with other shrub species:

Rubber Rabbitbrush-Big Sagebrush/Western Bluegrass Association
Rubber Rabbitbrush-Fourwing Saltbush-Black Greasewood Association
Rubber Rabbitbrush-Shadscale Association
Rubber Rabbitbrush Black Greasewood Association
Rubber Rabbitbrush-Nevada Ephedra-Bailey's Greasewood Association

In approximately 20% of these areas there are no other co-dominant shrubs species, although some areas do have a significant grass component. The bulk of the alliance, however, has a complex mix of shrub species representing five distinct associations.

White Burrobush *(Hymenoclea salsola)* Alliance

This alliance occurs primarily in the washes (Photo 2-27) of B-17 and was mapped based on assessments points done in 2007-08 (no assessments points were done on this type in 2014-15). White burrobush is the dominant shrub species with little or no significant herbaceous layer.

Associations

White Burrobush Association
White Burrobush/Cheatgrass Association

There was only a small amount (8.5 acre) of this alliance area where cheatgrass cover was high enough to warrant mapping as an association. Otherwise no other co-dominant species were present.

Photo 2-27. White Burrobush Alliance.

Winter Fat *(Krascheninnikovia lanata)* Alliance

This alliance was found only on the flats west of the playa on B-17 (Photo 2-28). Overall vegetative cover in this area was very low, with winter fat present at 5% cover (one assessment point). Other species present were bud sage and Russian thistle.

Associations

Winter Fat/Russian Thistle Association

Russian thistle was present in these areas at approximately 10% cover.

Photo 2-28. Winter Fat Alliance.

Bud Sage *(Picrothamnus desertorum)* Alliance

Only 52 acres of this alliance were mapped, all of it on west edge of B-17. Bud sage was present at 5% cover, with fourwing saltbush at 2% cover (Photo 2-29). Other species present at very low cover (<1% total) were cheatgrass, Russian thistle, and Lottie's gilia. There was, however, one individual sand cholla (*Grusonia pulchella*), a sensitive species, found in this area.

Associations

Bud Sage Association

The only association mapped in this type was the alliance type itself with no co-dominant species.

Photo 2-29. Bud Sage Alliance.

Four-Flowered Cotton-Thorn *(Tetradymia tetrameres)* Alliance

This alliance occurs almost entirely on B-19 (Photo 2-30), where cotton-thorn is the dominant shrub species at 8-15% cover (four assessment points). Other shrub species may also be prominent (up to 15% cover) such as fourwing saltbush, shadscale, Nevada ephedra, rabbitbrush, Shockley's boxthorn, Bailey's greasewood, and black greasewood. Percent cover of grasses (western bluegrass, cheatgrass, and Indian ricegrass) and forbs (Russian thistle, Piper's evening primrose, lemon scurfpea, winged dock, smooth desert dandelion, common sunflower, Wilcox's eriastrum [*Eriastrum wilcoxii*], and *Astragalus* spp.) may be as high as 10% and 20%, respectively.

Photo 2-30. Four-Flowered Cotton-Thorn Alliance.

Associations

Associations where four-flowered cotton-thorn is the sole dominant shrub:

Four-Flowered Cotton-Thorn Association

Associations where four-flowered cotton-thorn is co-dominant with other shrub species:

Four-Flowered Cotton-Thorn-Fourwing Saltbush Association
Four-Flowered Cotton-Thorn- Fourwing Saltbush/Indian Ricegrass Association
Four-Flowered Cotton-Thorn-Shadscale Association
Four-Flowered Cotton-Thorn- White Burrobush/Indian Ricegrass Association
Four-Flowered Cotton-Thorn-Dotted Indigobush Association
Four-Flowered Cotton-Thorn-Bailey's Greasewood/Western Bluegrass Association

Cotton-thorn was sole dominant shrub species on just 15 acres of this alliance. Otherwise a variety of other shrub species were mapped as co-dominant, and in some areas grasses, especially Indian ricegrass, represented an associated herbaceous layer.

2.3.2.5 Woodlands

2.3.2.5.1 Intermountain Singleleaf Pinyon - Utah Juniper - Western Juniper Woodland Macrogroup

Singleleaf Pinyon (*Pinus monophylla*) Alliance

This alliance occurs exclusively in the upper elevations of the mountains on B-17 and was mapped based on assessments points done in 2007-08 (no assessments points were done on this type in 2014-15). Only small areas occur in the 2014-15 survey area where singleleaf pinyon (*Pinus monophylla*) (Photo 2-31) is the dominant overstory with a shrub understory comprised of Utah juniper (*Juniperus osteosperma*), black sagebrush and green ephedra on rocky steep slopes with low herbaceous cover (<5%) (TDI 2008).

Photo 2-31. Singleleaf Pinyon tree in B-17 in 2015.

Associations

Singleleaf Pinyon/Black Sage-Green Ephedra Association
Singleleaf Pinyon/Black Sage/Galleta Grass Association

All areas of this alliance were mapped as having black sage co-dominant with singleleaf pinyon, as well as green ephedra and galleta grass.

2.3.2.5.2 Southwest Riparian Forest Macrogroup

Fremont Cottonwood (*Populus fremontii*) Alliance

Several small stands of Fremont cottonwood (*Populus fremontii*) were mapped in Dixie Valley (Settlement Area), where Fremont cottonwood is the dominant overstory species. Willows (*Salix* spp.) may also be present in these small isolated stands of cottonwoods. These polygons were drawn directly

from the aerial photo, field notations, and a hand drawn map provided by A. Keyzers; no assessments points were done for this type.

Associations

Fremont Cottonwood Association
Fremont Cottonwood/Salt Grass Association

Two of the polygons mapped as this alliance also had a significant cover of salt grass.

2.3.2.5.3 Interior West Ruderal Flooded & Swamp Forest Macrogroup

In the Dixie Valley area small stands of non-native trees such as Russian olive and salt cedar occur. Although these stands are very small (<37 acres total, in 31 polygons) they were included in the vegetation map to provide NAS Fallon land managers with information on their location (additional GIS data on other, more widely dispersed locations of these species was also created and provided to NAS Fallon).

Russian Olive (*Elaeagnus angustifolia*) Alliance

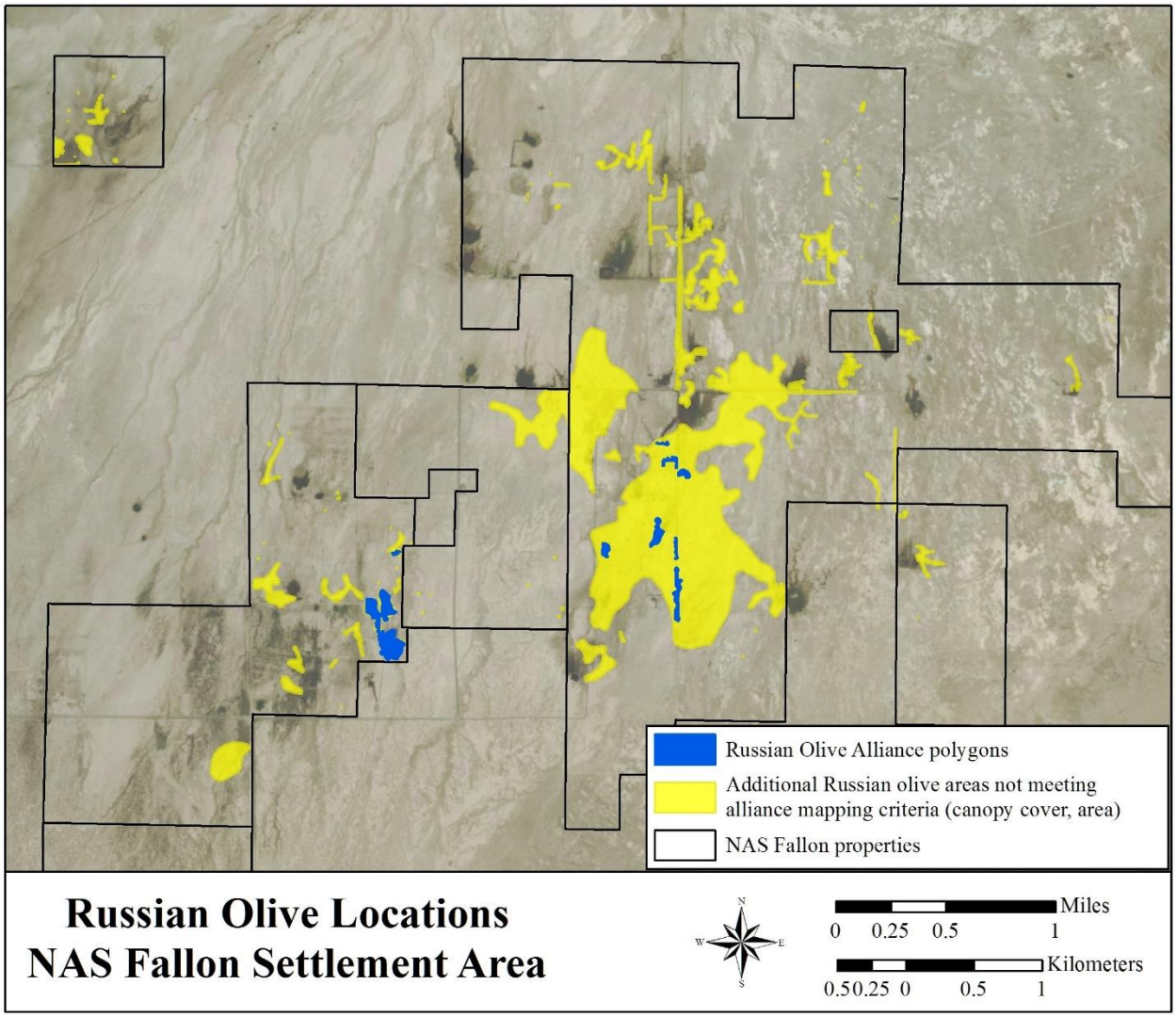
Russian olive groves (Photo 2-32) occur in a matrix with either the Black Greasewood Alliance or in lands mapped as disturbed with sparse shrubs or non-native herbaceous species. Originally planted at the Settlement Area, these trees have been spreading outward into the surrounding habitat and are of concern to NAS Fallon land managers (A. Keyzers, pers. comm. 2015). Although only 20 acres of the Settlement Area was mapped as this alliance, Russian olives are much more widespread in the area at low densities insufficient to meet mapping criteria (canopy cover, area) as this alliance. Map 2-8 depicts the broader extent of Russian olives in the survey area.

Photo 2-32. Russian Olive Alliance.

Associations

Russian Olive Association
Russian Olive/Black Greasewood-Shadscale Association

One polygon (0.8 acres) of this alliance had an understory of black greasewood and shadscale.



Map 2-8. Russian olive locations in the Settlement Area mapped in 2014-15.

Salt Cedar *(Tamarix ramosissima)* Alliance

Stands of salt cedar (Photo 2-33) occur throughout Dixie Valley, including North Dixie Valley, Dixie Meadows, and the Settlement Area. These stands are generally small, with little or no presence of other species. Salt cedar is a highly invasive species and NAS Fallon has engaged in efforts to eliminate the species (A. Keyzers, pers. comm. 2015) Several stands of dead salt cedar, targeted by weed control efforts, were seen but were not included in the vegetation mapping. Although only 17 acres of this alliance was mapped in 2014-15, salt cedar is much more widespread in the area at low densities insufficient to meet mapping criteria (canopy cover, area) as this alliance. Map 2-9 depicts the broader extent of salt cedar in the survey area.

Associations

Salt Cedar Association
Salt Cedar/Sharp-Pointed Bulrush Association

One polygon (2.5 acres) of this alliance had an understory of sharp-pointed bulrush (*Schoenoplectus pungens*).

Photo 2-33. Salt Cedar Alliance.

2.3.2.6 Other Cover Types

Dunes

Active sand dunes cover approximately 2,474 acres of B-19. These areas typically have little or no vegetative cover aside from scattered grasses (ricegrass and western bluegrass) and a few shrubs.

Playas

Playas with little or no vegetative cover comprise approximately 8,641.7 acres (12.5%) of the project area on B-16 (3,387.5 acres), B-17 (3,434.7 acres), B-19 (1,630.7 acres), and Dixie Valley (188.8 acres). Playas have clay soils and are seasonally wet. Bailey's greasewood, black greasewood, and alkali seepweed are the most commonly seen shrubs in these area but at low cover (<2%).

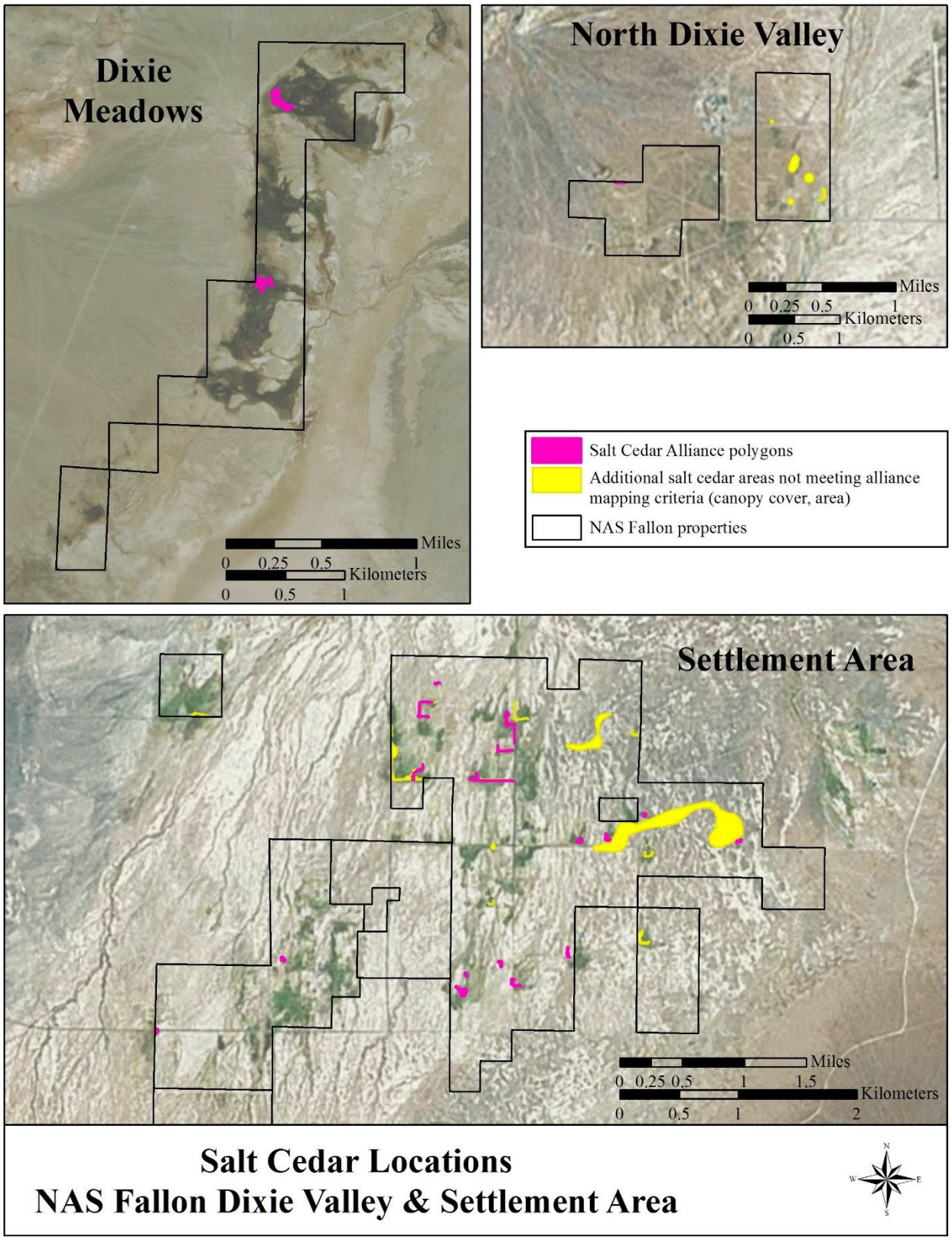
Sparsely Vegetated Areas

Barren Hills (Badlands), Rocky Hills, Washes

These areas are very sparsely vegetated ecosites on badlands, rocky steep slopes, and sandy washes. The few plants that do occur in these areas are typical of the surrounding alliances and so may include a variety of species.

Disturbed Lands

Areas with very sparse vegetation apparently due to land use history, including some current military use but primarily historic land use associated with the settlements, agriculture, and cattle grazing. They are found at both Dixie Valley and B-17 and generally support sparse non-native grasses and forbs (e.g. cheatgrass, Russian thistle, halogeton) but may also support sparse native forbs (e.g. *Atragalus* spp., evening primrose) or shrubs (e.g. Bailey's greasewood, bud sage, *Atriplex* spp.).



Map 2-9. Salt cedar locations in North Dixie Valley, Dixie Meadows, and Settlement Area mapped in 2014-15.

2.3.3 Integration with 2007-08 Vegetation Map

Most of the alliances mapped in 2014-15 had also been included in the 2007-08 mapping (23 of 37 total alliances), especially the main scrub types. In fact, all of the alliances which were not included in the 2007-08 map were either the wetland types from Dixie Valley or special alliances seen in only one or a few places in 2014-15. Therefore, with the 2007-08 vegetation map as a starting point, much of the 2014-15 survey area could be classified based on the data collected previously. Not only could neighboring polygons be extended into the 2014-15 mapping area, but the assessment points could also be used to classify polygons which were not directly adjacent to one another. This greatly reduced the number of new assessment points needed for the 2014-15 mapping effort, which could be concentrated in areas further away from the areas mapped in 2007-08.

Although a slightly different classification scheme had been used in the 2007-08 mapping, for the most part, those classifications translated directly into the alliances defined by the membership rules adopted for the 2014-15 mapping (refer to Table 2-3). Appendix C presents the full alliance summary table for all areas mapped in 2007-08 and 2014, as well as maps of the integrated data.

While the main changes to the 2007-08 map were the bordering areas where polygons were cropped out and reclassified to match adjacent polygons in the new mapping areas, there was one exception. During a visit to the northern portion of B-16 in 2014, a discrepancy was noted by the field crew in the vegetation map in that area. A large portion of the area appeared in the GIS layer as dominated by rubber rabbitbrush, totaling over 1,700 acres; however, the 2014 crew observed that most of the area would be more appropriately classified as the Bailey's Greasewood Alliance. Although rabbitbrush was certainly a significant contributor, it did not appear to be the most dominant species over such a large extent. An examination of the 2007-08 map and the assessment points from those surveys discovered the source of the error. One 2007 assessment point did indeed classify the area in question as dominated by Bailey's greasewood; however, a vegetation transect was done later in that field effort which showed rabbitbrush as having a higher percent cover, and that data was applied to vegetation map. What was not noticed at the time was that although the assessment point and the transect were fairly far apart, they were in fact located in a single very large, complex polygon.

In fact, the transect had been completed within a small patch where rabbitbrush was indeed the dominant shrub, which became apparent when examining a much higher resolution aerial photo than had been available for the earlier surveys. Small polygons of rabbitbrush occur throughout the area among the more prevalent Bailey's greasewood, and when the transect data had been applied to the GIS layer a much greater area was misclassified. Although that parcel of B-16 was not included in the vegetation mapping areas for the 2014-15 surveys, a quick re-visit was made in 2015 to re-assess the area and correct the earlier errors.

2.4 Discussion

Generally, there was little difficulty in applying vegetation data to most of the delineated polygons, although some difficulties were encountered. Dixie Valley and B-17 proved to be the most difficult parcels due to the size, variability, and number of resulting polygons within those two areas. The biggest problem was finding roads by which to access the remote sections of the parcels, particularly in the mountainous areas.

While Bailey's greasewood is clearly the most widespread and dominant shrub species within the project area, the variety of other co-dominant or dominant species makes for a highly complex mosaic of vegetation communities. Most of the plant communities are also further divided among two or more ecosites based on topography (e.g. hill slopes, sandy flats, washes) and soil substrates (e.g. sand, gravelly sand, rocky, desert pavement). Such complexity provides a wide variety of wildlife habitats.

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3.0 Rare Plant Surveys

The purpose of this project was to survey for and document occurrences of sensitive plant species at Ranges B-16, B-17, and B-19 over the course of two field seasons in 2014-15.

3.1 Methods

3.1.1 List of Focus Species

Although there are no federally or state listed rare plants known to occur in the vicinity of NAS Fallon, both the Nevada Natural Heritage Program (NNHP) and Nevada Native Plant Society (NNPS) maintain lists of plant species they consider sensitive at some level. Table 3-1 provides a list of all sensitive or special status flora that have the potential to occur within the survey area. This list includes species known from the general region for which suitable habitat is known to occur, expected to occur, or has a reasonable potential to occur.

Table 3-1. Special status plant species known to occur or with the potential to occur at Naval Air Station Fallon.

Species	Common Name	Form	NNHP Rank[2]	NNPS Rank[3]	Global Rank	State Rank	Blooming Period
Astragalus porrectus	Lahontan milkvetch	Perennial forb	Watch list	T	G3?	S3?	May-June
Astragalus pseudiodanthus	Tonopah milkvetch	Perennial forb	At-Risk List	D	G2Q	S2	May-June
Astragalus pterocarpus	winged milkvetch	Perennial forb	Watch list	D	G3	S3	May-June
Camissonia nevadensis	Nevada suncup	Annual forb	Watch list	D	G3	S3	Apr.-May
Eriogonum beatleyae	Beatley buckwheat	Perennial forb	At-Risk List	D	G2Q	S2	June-July
Eriogonum lemmonii	Lemmon buckwheat	Annual forb	Watch list	D	G3?	S3?	May-June
Eriogonum rubricaule	Lahontan Basin buckwheat	Annual forb	Watch list	D	G3	S3	May-Oct.
Grusonia pulchella[1]	sand cholla	Cactus	At-Risk List	D	G4	S2S3	May-June
Helianthus deserticola	dune sunflower	Annual forb	At-Risk List	D	G2G3Q	S3	May-July
Linanthus arenicola	dune linanthus	Annual forb	Watch list	D	G3G4	S3	Mar.-Apr.
Mentzelia candelariae	Candelaria blazingstar	Perennial forb	Watch list	D	G3?Q	S3?	May-June
Mentzelia inyoensis	Inyo blazingstar	Perennial forb	At-Risk List	W	G2	S1	Apr.-Oct.
Oryctes nevadensis	oryctes	Annual forb	At-Risk List	W	G2G3	S2S3	May-June
Penstemon arenarius	Nevada dune beardtongue	Perennial forb	At-Risk List	W	G2G3	S2S3	May-June
Penstemon palmeri var. macranthus[1]	Lahontan beardtongue	Perennial forb	At-Risk List	W	G4G5T2?	S2?	May-June
Phacelia glaberrima	Reese River phacelia	Annual forb	Watch list	D	G3?	S3?	May-June
Psorothamnus kingii[1]	Lahontan indigobush	Perennial forb	At-Risk List	W	G3	S3	June-Oct.

1. Known to occur within the project footprint. Sand cholla was seen in the northwest corner of B-16 in 1997. Lahontan indigobush is documented on B-16 in records on the NNHP Rare Plant Atlas maps. Lahontan beardtongue has been observed at B-17, B-19, and Horse Creek.
2. Taxa considered at-risk and actively inventoried by NNHP typically include those with federal or other Nevada agency status, and those with Global and/or State ranks 1-3, indicating some level of imperilment. A separate Watch List contains taxa that could become at risk in the future.
3. NNPS Ranking Codes: D: Delisted, dropped from consideration, no longer of concern. T: Threatened, believed to meet the ESA definition of Threatened but not formally listed. W: Watch List species, potentially vulnerable to becoming Threatened or Endangered.

3.1.2 Field Methods

Field personnel developed search images based on visits to known locations of the plant, herbarium specimens, photographs, and descriptions in published floral treatments (e.g. Flora of North America [Flora of North America Editorial Committee 1993], Intermountain Flora [Cronquist et al. 2012], and Jepson Manual [Baldwin et al. 2012]). Surveys were conducted by visual sweeps along walking meandering transects. Survey routes were determined in the field and subsequently mapped. The distance between observers was determined by the terrain and the vegetation community present at each survey location. This distance was based on target species visibility and, once established, surveyors navigated in semi-parallel rows. Because the terrain, and thus the search distance, often changed over the course of the survey, surveyors were continuously shifting to account for the differences and to ensure efficient and thorough passes. Since road access is limited in some survey areas, field teams occasionally hiked a considerable distance from the nearest drivable road.

On each survey date, the area(s) targeted for that day was searched by two or three biologists conducting visual sweeps along walking transects. The survey routes were determined by the field crews when arriving on site, and were directed in such a way as to efficiently and thoroughly cover the assigned area for that day. Field crew members would fan out so as not to cover the same area and yet not so far apart that an area might be missed. An irregular, meandering path was walked by each team member while keeping parallel with one another as much as possible and maintaining the general heading determined for a given route. In narrow areas, a simple “up-and back” route was sufficient, and in wider areas multiple passes were conducted. Special care was taken to look at any areas that appeared especially promising, for instance when an otherwise dense, tall patch of non-native grasses were interrupted by patches of more open habitat or moist depressions.

Detailed color aerial photo maps were used to keep track of which areas had been searched and which were still needed to search. A complete list of all plant species seen was recorded for each day of field surveys (in some cases when two different areas were surveyed on a given day a separate list was compiled for each area). Any plants not readily identified in the field were collected and brought back to the office for identification. Vigilance was also maintained for any potential incidental encounters of other rare plant species not on the list or species of potential management concern (e.g., a new non-native, invasive).

3.1.3 Data Collection

The route walked each day by each surveyor was recorded on a hand-held Garmin E-Trex Global Positioning System (GPS) unit, or was noted on the field maps in as much detail as possible and later digitized into a GIS layer along with the recorded survey tracks.

Whenever an individual or small patch (<10 individuals) of a target species was located, its location was mapped and a GPS coordinate was obtained. When larger patches of plants were located, the perimeters of the patches were mapped and the number of individual plants within the patch counted (for smaller patches <50 individuals in less than 0.1 acres) or estimated (for large patches greater than 0.1 acres with more than 50 individuals). Additional information describing the location including the slope, aspect, and associated vegetation was also recorded.

A Trimble GeoXH Series unit was used to map the observed species of interest with sub-meter accuracy and geographic data was provided in State Plane U.S. Survey Feet. Obtainable imagery and data layers,

such as roads, watersheds, and survey locations, were provided by the GIS Point of Contact at the Station. Arc GIS software by ESRI was used to produce maps for this report and for all field mapping efforts. GIS products and GPS products supported geo-referencing, electronic mapping, and field results. Photographic documentation was performed when appropriate.

Since there is always potential for an unexpected find, a running list of plant species encountered daily was recorded during the rare plant surveys. In this way, field crews did not focus exclusively on species listed in Table 3-1.

3.1.4 Survey Schedule

Surveys were timed to coincide with the blooming periods of the target species. Most of the species included in the surveys are typically in bloom from May through June; therefore, this time period was the focus of the surveys. The timing of this effort was also dependent on climatic conditions that influence the phenological cycles of plants locally at the Station. A total of three survey passes were conducted in all areas to capture seasonally blooming species throughout the survey period.

The first phase of the survey effort took place in 2014. The surveys targeted species that are subject to rainfall events and those that have early blooming periods. Survey times were based on an assessment of plant life stages and took place when focal species had the greatest potential for detection. The first set of surveys took place in early June 2014 and the phenology of local vegetation determined the timing of subsequent visits.

A subsequent survey effort was performed during June 2015. Beyond covering additional portions of the Station to expand the coverage of this focused effort, this effort also re-evaluated locations with the highest potential for rare plant occurrence.

The combined surveys accounted for annual fluctuations in plant presence caused by weather patterns and resulted in a more comprehensive dataset.

3.1.5 Survey Areas

Focused rare plant surveys occurred in Ranges B-16, B-17, and B-19 (refer to Map 1-2). All selected survey areas were chosen so that a representative sub-sample of the remaining un-surveyed vegetation communities at the Station would be covered, prioritizing locations with potential for sensitive plants. Given the extensive nature of the survey area, the limited budget, the related survey limitations due to access and training activity closures, that some cover types covering large areas support few plant species, and the fact habitat for special status species may not exist on site, field crews used their best professional judgment to maximize survey coverage and increase the potential for finding special status plants.

3.2 Results

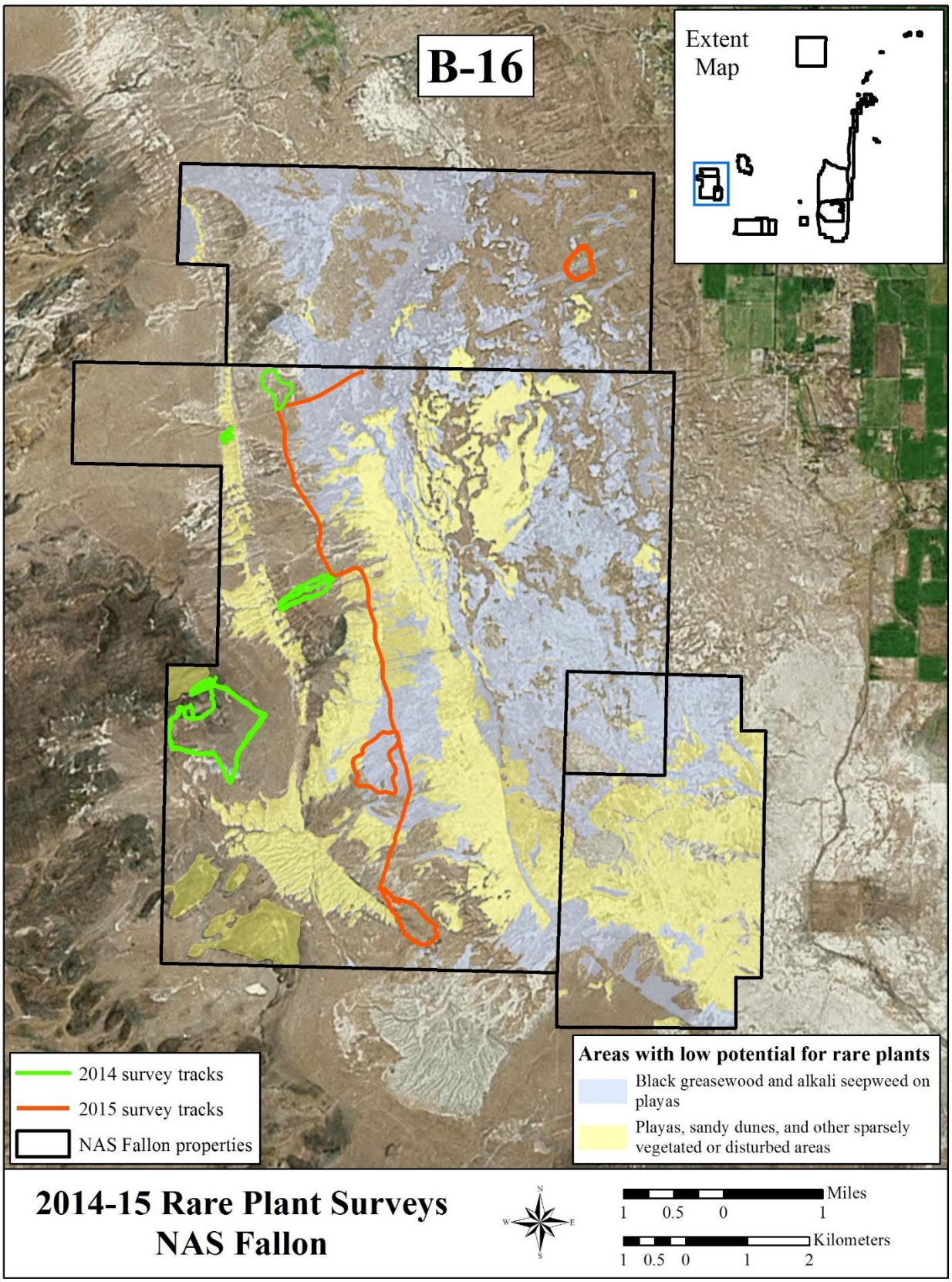
Table 3-2 presents the complete list of survey dates, personnel, and areas surveyed; surveys were conducted on a total of 12 field days, for a total of 24 person-days. In addition to the mandatory Explosive Ordnance Disposal (EOD) escorts, the two-person TDI crew was accompanied by the Station biologist, Ms. Anna Keyzers. Ms. Keyzers contributed greatly to the survey effort by joining the crew, thus increasing the area covered during each survey day.

Table 3-2. List of rare plant survey dates and personnel.

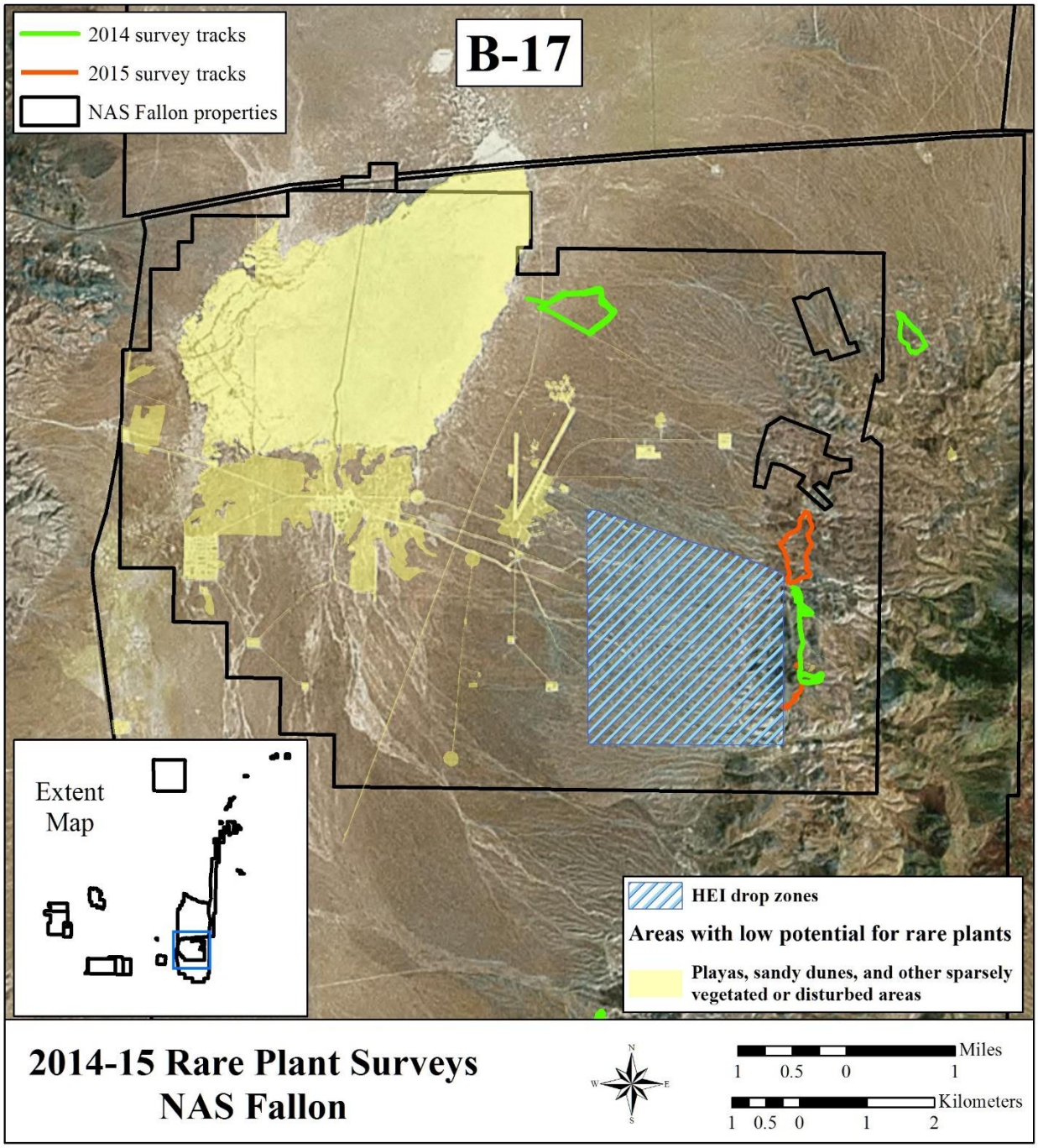
Survey Date		TDI Personnel
2014	6/11	Scott Snover & Joseph Kean
	6/12	Scott Snover & Joseph Kean
	6/13	Scott Snover & Joseph Kean
	6/14	Scott Snover & Joseph Kean
	6/15	Scott Snover & Joseph Kean
	6/16	Scott Snover & Joseph Kean
2015	6/2	Scott Snover & Joseph Kean
	6/3	Scott Snover & Joseph Kean
	6/4	Scott Snover & Joseph Kean
	6/5	Scott Snover & Joseph Kean
	6/6	Scott Snover & Joseph Kean
	6/7	Scott Snover & Joseph Kean

Over the course of the 2014-2015 field seasons, a total of 194 distinct plant species (including sub-species and varieties) was recorded. Of these, 27 represent additions to the NAS Fallon species list. See Appendix D for the datasheets completed during the 2014-15 field efforts. See Appendix E for the list of species observed.

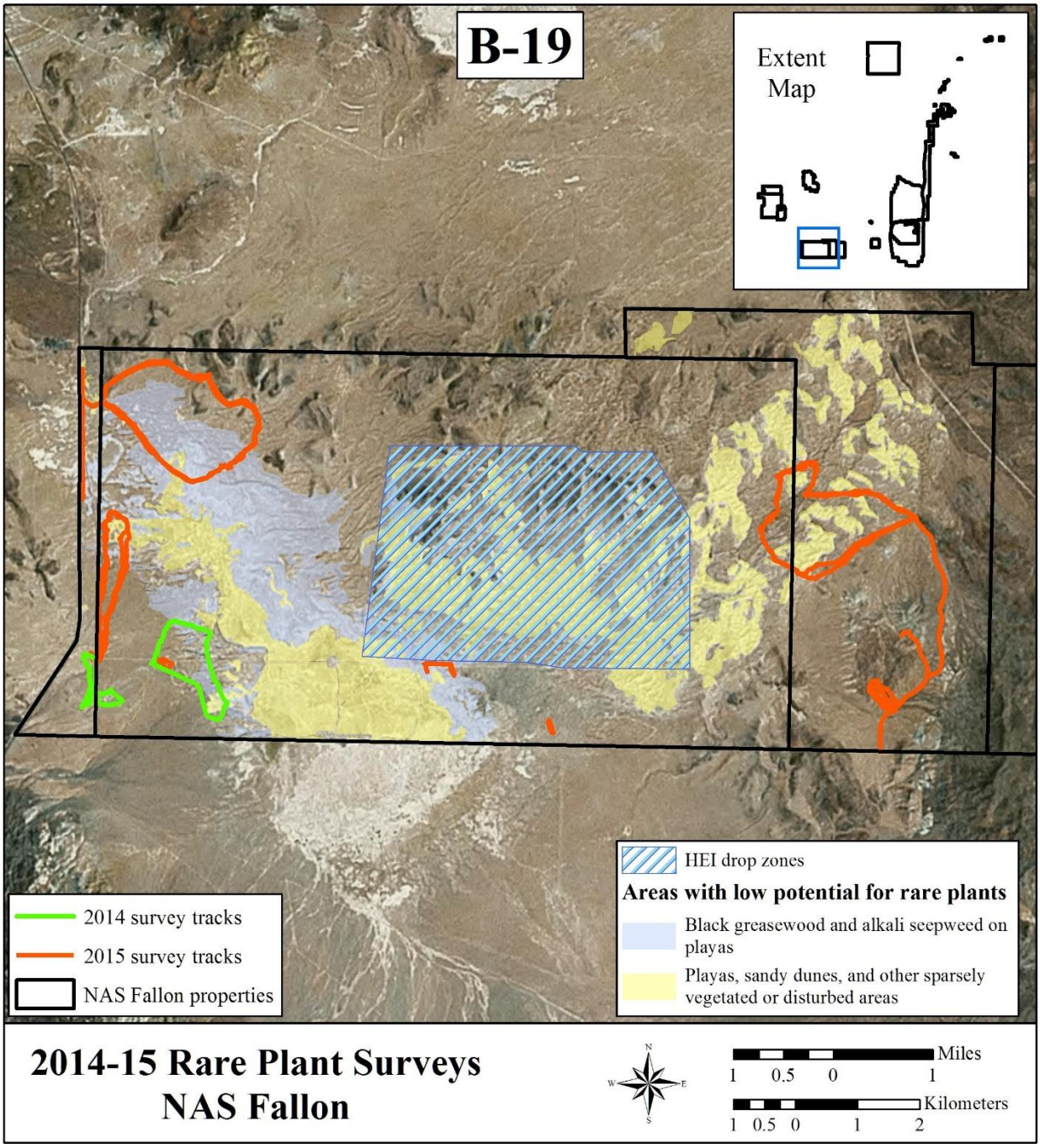
The survey routes for each of the individual training areas covered in this study are presented in Map 3-1, Map 3-2, and Map 3-3. These maps present the paths of the survey team, two TDI personnel and the Station biologist. Each line represents the meandering route that the team took to cover as much area as possible, within project constraints, while also targeting unique environmental settings that may offer habitat suitable for rare plant species.



Map 3-1. Rare plant survey tracks in 2014-15 on B-16 at Naval Air Station Fallon.



Map 3-2. Rare plant survey tracks in 2014-15 on B-17 at Naval Air Station Fallon.



Map 3-3. Rare plant survey tracks in 2014-15 on B-19 at Naval Air Station Fallon.

3.2.1 Rainfall Prior to and During Survey Periods

Rainfall patterns play a key role in initiating and promoting plant growth, especially annuals. Figure 3-1 shows the monthly rainfall patterns in the NAS Fallon area prior to and during the 2014-15 field seasons (Data Source: Weather Underground, Fallon, Nevada data accessed August 2015). The winter-spring rainfall totals that preceded both field seasons were above average (Figure 3-1), indicating that floristic conditions were favorable for the survey efforts.

In 2014, the rare plant surveys were conducted within weeks of the major rain events for the year whereas, 2015 efforts were conducted during and almost immediately after that year's major rain events.

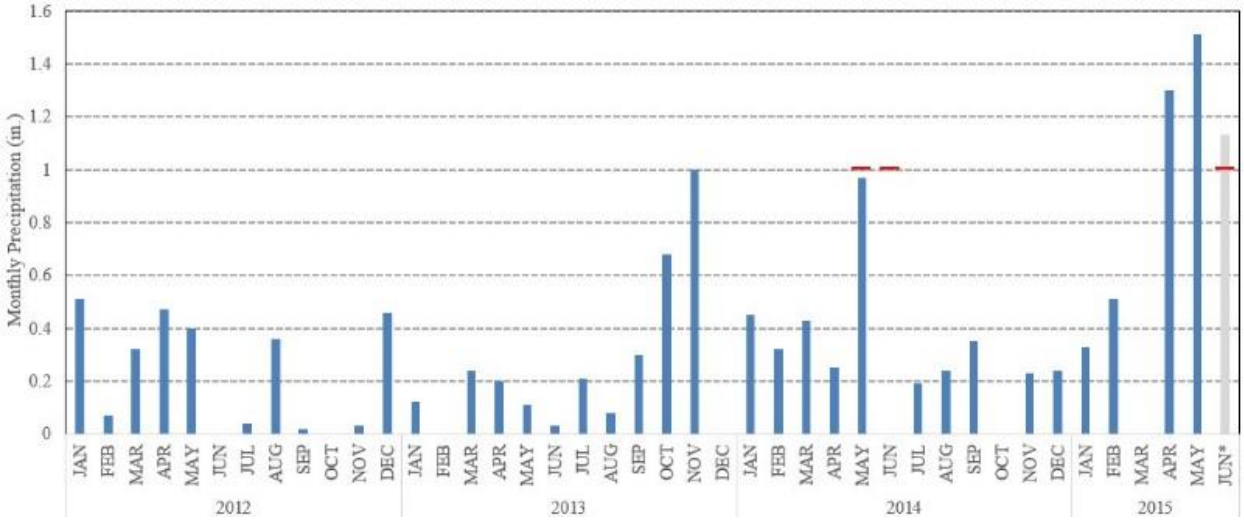


Figure 3-1. Monthly rainfall patterns at Naval Air Station Fallon from 2012-15. The red markers indicate when the field surveys in 2014 and 2015 occurred. *The June 2015 rains shown here occurred during the 2015 survey period but would have had little effect on the observed vegetation conditions at that time. (Data Source: Weather Underground August 2015).

3.2.2 Species Accounts

Three species of sensitive plants were located during the survey effort: sand cholla, Nevada oryctes (*Oryctes nevadensis*), and Lahontan indigobush (*Psorothamnus kingii*) (Table 3-3). A fourth sensitive plant species, Nevada suncup (*Camissonia nevadensis*), was detected in the Dixie Valley area during the vegetation mapping surveys.

Table 3-3. Sensitive plant species encountered at Naval Air Station Fallon in 2014-15.

Species	Common Name	Distribution
Camissonia nevadensis	Nevada suncup	One location in Dixie Meadows
Grusonia pulchella	sand cholla	Throughout Ranges B-16, B-17, B-19
Oryctes nevadensis	Nevada oryctes	One location at B-19
Psorothamnus kingii	Lahontan indigobush	Three locations at B-19

3.2.2.1 Sand Cholla (*Grusonia pulchella*)

Sand cholla (Photo 3-1) is a native perennial herb in the Cactaceae family that typically occurs in Creosote Bush Scrub and Sagebrush Scrub on the borders of dry lakes and sandy flats at elevations between 1,500-1,700 m. The typical blooming period is May-June, noting that flowering is highly variable and juvenile forms can also occasionally flower (Baldwin et al. 2012).

Photo 3-1. Sand cholla (Grusonia pulchella) found at B-16 in June 2015.

Sand cholla is considered a sensitive species by various agencies and organizations. Although the NNPS dropped sand cholla from its sensitive species list, the species is still on the At-Risk List of the NNHP (NNHP 2015). In addition, the BLM lists the species as Sensitive. As a cactus species, this sensitive plant also falls under general protection rules of the State of Nevada.

Sand cholla was the most widespread sensitive plant species that was encountered during the focused rare plant surveys with a total of 55 individuals observed during the course of the study throughout various habitat types. The occurrences were mapped at B-16, B-17, and B-19; some of the plants encountered were observed occurring as individuals while others were encountered as part of small populations (Map 3-4).

The ecosites where this species was found varied greatly, occurring in a variety of vegetation types, soil types, and terrain (Table 3-4; Photo 3-2-Photo 3-5). Associated species included many shrub species (fourwing saltbush, shadscale, Bailey's greasewood, black greasewood, alkali seepweed, four-flowered cotton-thorn), grasses (Indian ricegrass, cheatgrass), and forbs (transmontane sand abronia, smooth desert dandelion, evening primrose, winged dock, Russian thistle, small stephanomeria).

Table 3-4. Ecosite characteristics of sand cholla locations at Naval Air Station Fallon in 2014-15.

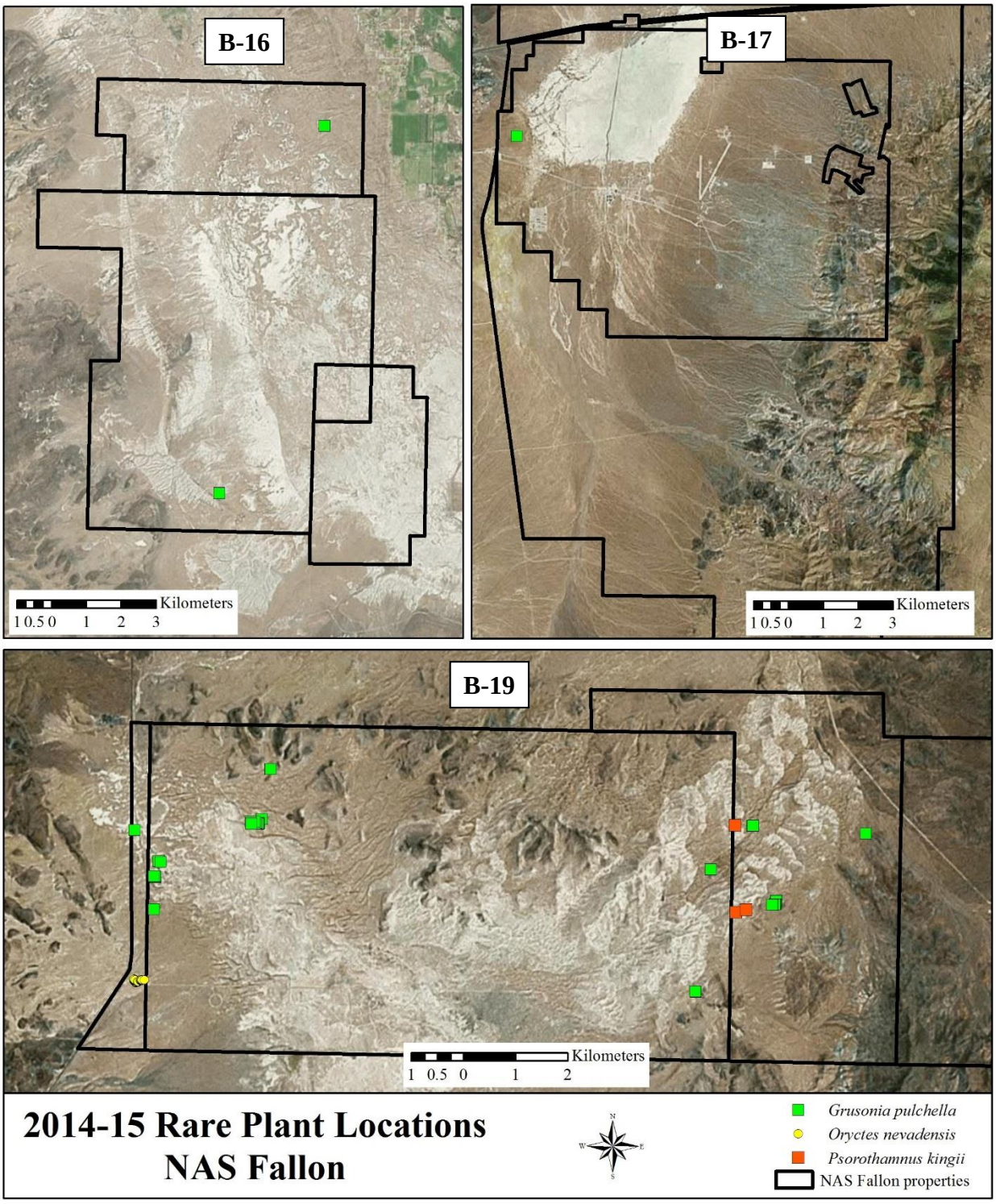
Vegetation Alliances	Soil Types	Terrains
Cheatgrass Alliance	Theon very gravelly sandy loam 8-30% slopes	Hill slope below edge of dune, gravelly sandy, rocky (basaltic)
Nevada Ephedra Alliance	Dune land-Isolde assoc.	Sandy dunes
Winter Fat Alliance	Bluewing-Inmo assoc.	Flat, loamy gravelly, <1% shrub cover
Bailey's Greasewood Alliance	Isolde-Dune land-Pirouette assoc.	Sandy dunes
	Theon very gravelly sandy loam 8-30% slopes	*Not Recorded*
	Hawsley sand 2-8% slopes	▪ West facing slope, loamy gravelly sand ▪ Sandy dunes, 15% shrub cover
	Appian-Playas assoc.	▪ In gullied land on loamy silty sand, surface rocks ~40% (up to 30 centimeters diameter). ▪ Low mounds, sandy soils
Black Greasewood Alliance	Isolde-Parran-Appian assoc.	▪ Foot slope of sandy dune ▪ Sandy dunes
Four-Flowered Cotton-Thorn Alliance	Isolde-Parran-Appian assoc.	Sandy dunes
	Dune land-Isolde assoc.	West facing slope, loamy gravelly sand

Photo 3-2. Sand cholla habitat, B-16, southern location (see Map 3-4).

Photo 3-3. Sand cholla habitat, B-16, northern location (see Map 3-4).

Photo 3-4. Sand cholla habitat, B-17 (see Map 3-4).

Photo 3-5. Sand cholla habitat, B-19, eastern location, north of playa (see Map 3-4).



Map 3-4. Rare plant locations at Naval Air Station Fallon in 2014-15.

3.2.2.2 Nevada Oryctes (*Oryctes nevadensis*)

Nevada oryctes (Photo 3-6) is a native annual herb in the Solanaceae family that typically occurs in Creosote Bush Scrub and Sagebrush Scrub on sandy soils and dunes at elevations between 1200-1500 m. The typical blooming period is April-June, primarily in May. The species is considered seriously threatened by grazing (Baldwin et al. 2012).

Photo 3-6. Nevada oryctes (*Oryctes nevadensis*) found at B-19 in June 2014.

Nevada oryctes is on special status species lists from several agencies. The BLM lists the species as Sensitive, NNPS has Nevada oryctes on its Watch list, and the species is classified as Moderately Vulnerable according to the Climate Change Vulnerability Index (CCVI) Score. This species is also on the At-Risk List of the NNHP (NNHP 2015).

Nevada oryctes was the most numerous sensitive plant species that was encountered during the focused rare plant surveys with a total of 67 individuals observed during the course of the study. That said, Nevada oryctes was only found at B-19; all of the plants encountered were part of a large population in one general location (Map 3-4).

3.2.2.3 Lahontan Indigobush (*Psorothamnus kingii*)

Lahontan indigobush (Photo 3-7) is a native perennial herb in the Fabaceae family that typically occurs in sand-flats and hollows in dunes at elevations between 1300-1400 m. The typical blooming period is June–August (Cronquist et al. 2012).

Lahontan indigobush is considered a sensitive species by various agencies and organizations. This species is on the NNPS Watch List, the NNHP At-Risk List, and the CCVI Scores Lahontan indigobush as Moderately Vulnerable (NNHP 2015).

Photo 3-7. Lahontan indigobush (*Psorothamnus kingii*) specimen collected from dunes on B-19 on May 7, 2015.

Lahontan indigobush was observed at three individual locations within B-19 (Map 3-4). The species develops cordlike rhizomes that grow through sandy substrates at varying depths to varying distances (Cronquist et al. 2012). Given the nature of this species' morphology, it is nearly impossible to determine the exact number of individuals that were encountered.

3.2.2.4 Nevada Suncup (*Camissonia nevadensis*)

Nevada suncup is a native annual herb in the Onagraceae family that typically occurs in open, sandy, gravelly, or clay slopes and flats shadscale or big sagebrush habitats at elevations between 1200-1600 m (NNHP 2015). The typical blooming period is April-May.

Although the NNPS has dropped Nevada suncup from its Watch list, the species is on the Watch List of the NNHP (NNHP 2015).

Nevada suncup was found in just one location as an incidental observation during vegetation mapping surveys in the Dixie Meadows survey area (Map 3-5). A single individual was collected for later identification in order to establish the species list for the polygon being mapped. Since that parcel was not included in the rare plant survey protocol, no effort was expended to return to that area to investigate in greater detail or determine the population extent and size. The habitat the specimen was collected from was fairly extensive, so it is likely that more of this species could occur there.

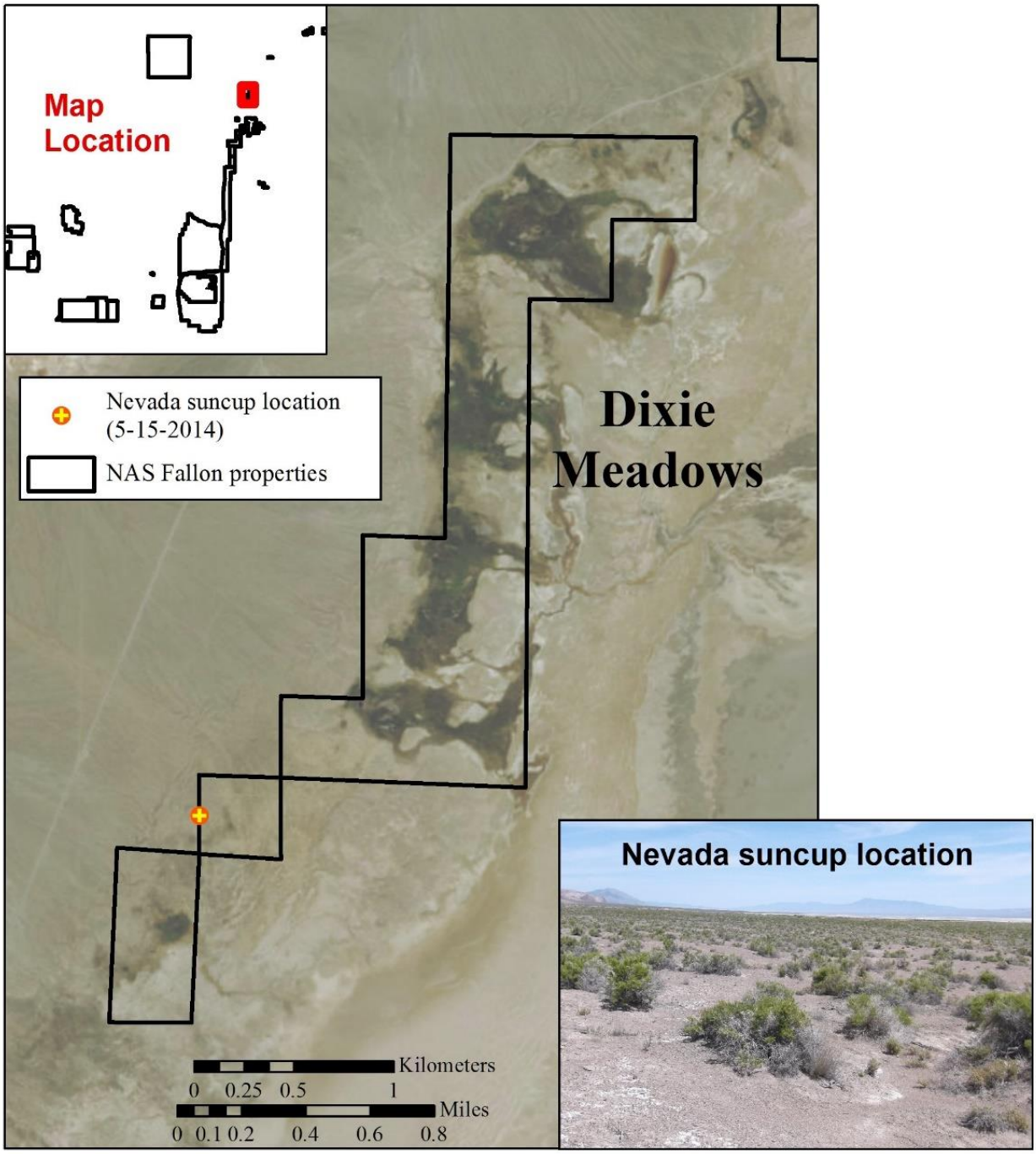
3.3 Discussion

Of the three sensitive plant species that were encountered during the performance of the survey effort, sand cholla was by far the most widespread. This species was found within nearly every vegetation community type encountered on NAS Fallon in all ranges surveyed (see Table 3-3). There were several instances in which this species was encountered when not specifically targeted; it was simply stumbled upon within habitat that wasn't initially considered suitable.

According to the NNHP, this species has not yet received the comprehensive attention of a systematic statewide survey effort in Nevada. That said, it has already been dropped from the sensitive species list of the NNPS.

Given the extensive range of sand cholla on NAS Fallon as well as the plant's ability to occur in habitat conditions of varying quality, the population of this species at the Station appears to be quite healthy. This species was not found in high density but was more commonly found in small groups of less than five individuals. Considering the extensive nature and overall abundance of potential habitat for this species at NAS Fallon, sand cholla is expected to occur at locations throughout the entire Station.

Nevada oryctes was the most numerous of the sensitive plant species encountered during this study. Although this species was encountered in high numbers in 2014, Nevada oryctes was not found anywhere during the 2015 effort despite even revisiting known locations of previously mapped individuals. This is possibly due to survey timing in relation to rain events; there were a few weeks between the rain events and the rare plant survey effort in 2014; however, the window between these activities was abbreviated during the 2015 effort.



Map 3-5. Nevada suncup location at Dixie Meadows, May 2014.

This finding was not entirely surprising considering the species typically only appears during years that offer optimal precipitation and temperature patterns. This strong dependence on seasonal conditions makes inventories for Nevada oryctes difficult. While targeted surveys in some areas have been extensive, they have not been comprehensive and there is a much potential suitable habitat that has not yet been surveyed.

The population of Nevada oryctes encountered on NAS Fallon occurred at only one location on B-19. Based on field observations and general mapping efforts, it appears that there is potential habitat for this species at several locations at the Station. This species seemed restricted to the sandy/dune open areas at

the base of slightly raised rocky outcroppings. From the aerial imagery, it appears that there are several bands of this habitat throughout B-19. The challenging nature of inventories for desert annuals like Nevada oryctes makes this species a prime candidate for future rare plant monitoring programs. Furthermore, the potentially very limited extent of suitable habitat for this unique species on NAS Fallon demands attention. While it is likely this species occurs elsewhere on the Station, the fact this species was discovered at only one location makes this area a valuable natural resource on NAS Fallon.

Lahontan indigobush was found at three separate locations that were all within B-19. The exact number of individuals encountered was not determined given the growth pattern of this species. As mentioned, the species develops rhizomes as part of its propagation strategy which makes identifying individuals nearly impossible without potentially destroying habitat and seriously damaging individuals. Instead, polygons were drawn to represent the extent of the populations that were encountered.

Lahontan indigobush is endemic to Nevada and is considered extremely local and generally speaking, incompletely surveyed. This species is thought to be threatened primarily by recreational vehicle use throughout suitable habitat (NatureServe 2015). While much of the potential habitat for Lahontan indigobush has already been examined, there is a considerable portion of potential habitat that is difficult to access and has not been surveyed (NNHP 2015).

Lahontan indigobush is another species that is strongly tied to unique/specific environmental conditions. The potentially limited extent of suitable habitat for this species on NAS Fallon also demands attention. While it is likely this species occurs elsewhere on the Station, the fact this species was discovered at only three locations makes this habitat type a valuable natural resource on NAS Fallon.

Additional survey efforts would contribute greatly to gaining a better understanding of the status of sensitive species on NAS Fallon. Performing a species-specific population study targeting suitable habitat during optimal conditions is the only way to fully understand the extent of several species at NAS Fallon. The results of the 2014-2015 survey effort could be used to develop monitoring materials and support habitat suitability studies.

Nevada oryctes and Lahontan indigobush would both benefit from more in-depth studies that are flexible enough to account for seasonal differences in conditions. Using established environmental condition parameters for these species, habitat modeling could be implemented to identify areas with the highest potential for each plant species. The result of the modeling effort would be a set of polygons that meet the species-specific habitat requirements at varying levels; habitat quality could be rated as Low, Moderate, High. Combining habitat modeling results and weather observations, a simple monitoring program could be developed that maximizes the likelihood of encountering targeted species in an efficient fashion during survey efforts. In doing so, population dynamics and trends as well as habitat indicators and species management could be based on a richer understanding of the sensitive plant resources at NAS Fallon.

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Appendix A: Sample Datasheets

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Appendix B: Vegetation Mapping Datasheets

For this electronic-only appendix, please refer to the PDF submitted along with the final deliverables.

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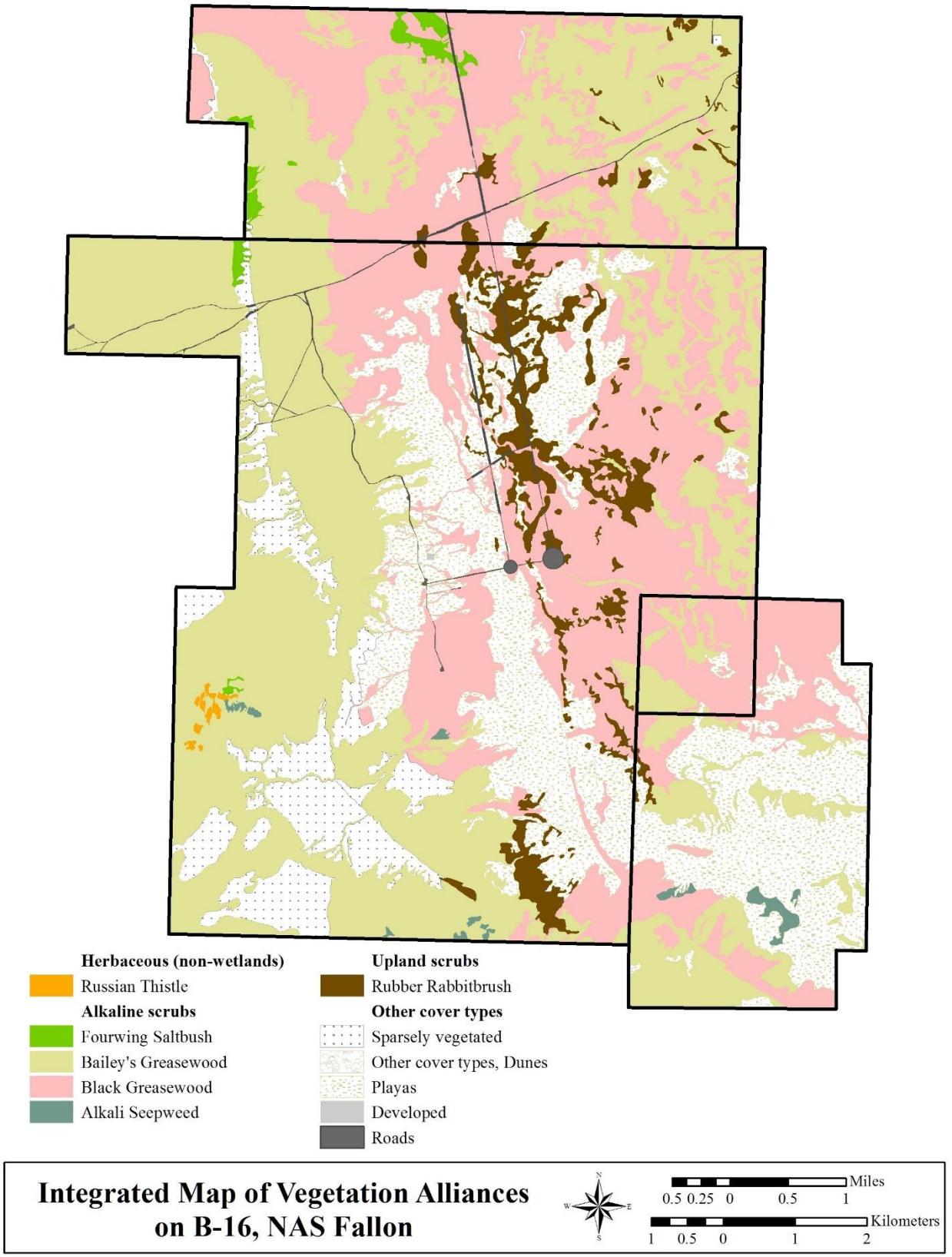
Appendix C: Integrated Vegetation Maps and Summary Table

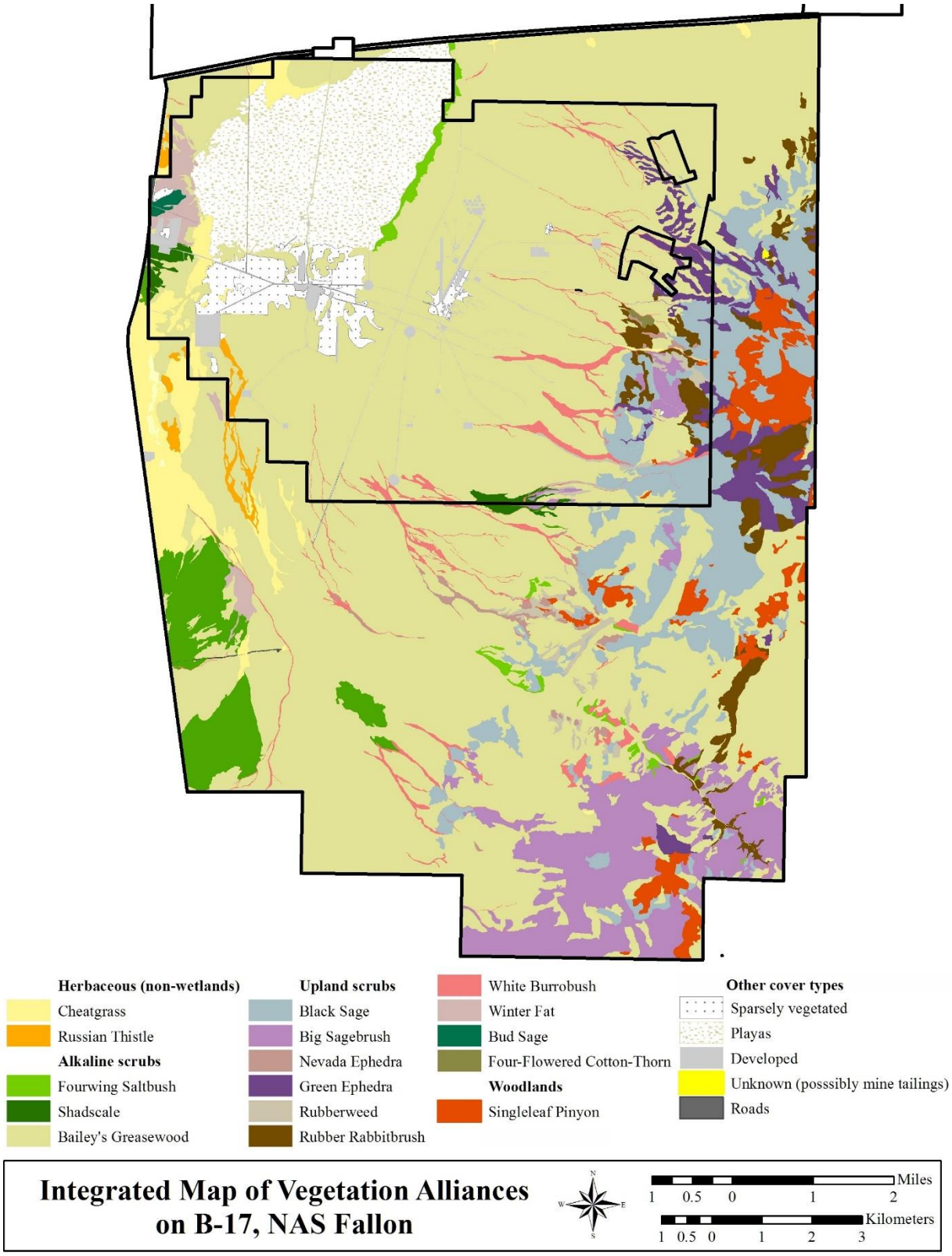
Table C-1. Vegetation alliances at Naval Air Station Fallon.

Alliance Name	2007-08 Mapping Areas	2014-15 Mapping Areas	Grand Total
Herbaceous (wetlands)			
Arid West Interior Freshwater Emergent Marsh			
American Bulrush (*Schoenoplectus americanus*) Alliance	0	113.7	113.7
Bottlebrush Squirreltail (*Elymus elymoides*) Alliance	0	1.3	1.3
Clustered Sedge (*Carex praegracilis*) Alliance	0	124.2	124.2
Creeping-Spike-Rush (*Eleocharis macrostachya*) Alliance	0	222.7	222.7
Western Bluegrass (*Poa secunda*) Alliance	0	90.0	90.0
Western North American Ruderal Wet Shrubland, Meadow & Marsh			
Common Reed (*Phragmites australis*) Alliance	0	16.5	16.5
Poverty Weed (*Iva axillaris*) Alliance	0	2.5	2.5
Wire Rush (*Juncus balticus*) Alliance	0	3.5	3.5
Herbaceous (non-wetlands)			
Great Basin & Intermountain Dry Grassland			
Indian Ricegrass (*Achnatherum hymenoides*) Alliance	415.1	208.5	623.6
Warm & Cool Desert Alkali-Saline Wetland			
Basin Wildrye (*Leymus cinereus*) Alliance		60.4	60.4
Salt Grass (*Distichlis spicata*) Alliance		135.1	135.1
Western North American Cool Semi-Desert Ruderal Grassland			
Cheatgrass (*Bromus tectorum*) Alliance	5,434.5	858.9	6,293.4
Russian-Thistle (*Salsola tragus*) Alliance	4,970.7	117.0	5,087.6
Tumble Mustard (*Sisymbrium altissimum*) Alliance	567.2	0.0	567.2
Alkaline scrubs			
Great Basin Saltbrush Scrub			
Bailey's Greasewood (*Sarcobatus baileyi*) Alliance	8,5233.5	27,437.5	11,2670.9
Fourwing Saltbush (*Atriplex canescens*) Alliance	1,706.3	1,327.9	3,034.2
Shadscale (*Atriplex confertifolia*) Alliance	2,105.9	176.4	2,282.3
Torrey's Saltbush (*Atriplex torreyi*) Alliance	0.0	16.7	16.7
Warm & Cool Desert Alkali-Saline Wetland			
Alkali Seepweed (*Suaeda moquini*) Alliance	63.0	695.8	758.8
Black Greasewood (*Sarcobatus vermiculatus*) Alliance	3,869.6	10,919.4	14,789.0
Iodine Bush (*Allenrolfea occidentalis*) Alliance	0.0	82.5	82.5
Upland scrubs			
Great Basin & Intermountain Dry Shrubland			
Bud Sage (*Picrothamnus desertorum*) Alliance	0.0	52.0	52.0
Four-Flowered Cotton-Thorn (*Tetradymia tetrameres*) Alliance	1,271.5	1,546.0	2,817.6
Green Ephedra (*Ephedra viridis*) Alliance	744.2	391.5	1,135.7
Light-Gray Rabbitbrush (*Ericameria nauseosa*) Alliance	1,045.2	1,682.5	2,727.8
Nevada Ephedra (*Ephedra nevadensis*) Alliance	873.1	2,573.2	3,446.4

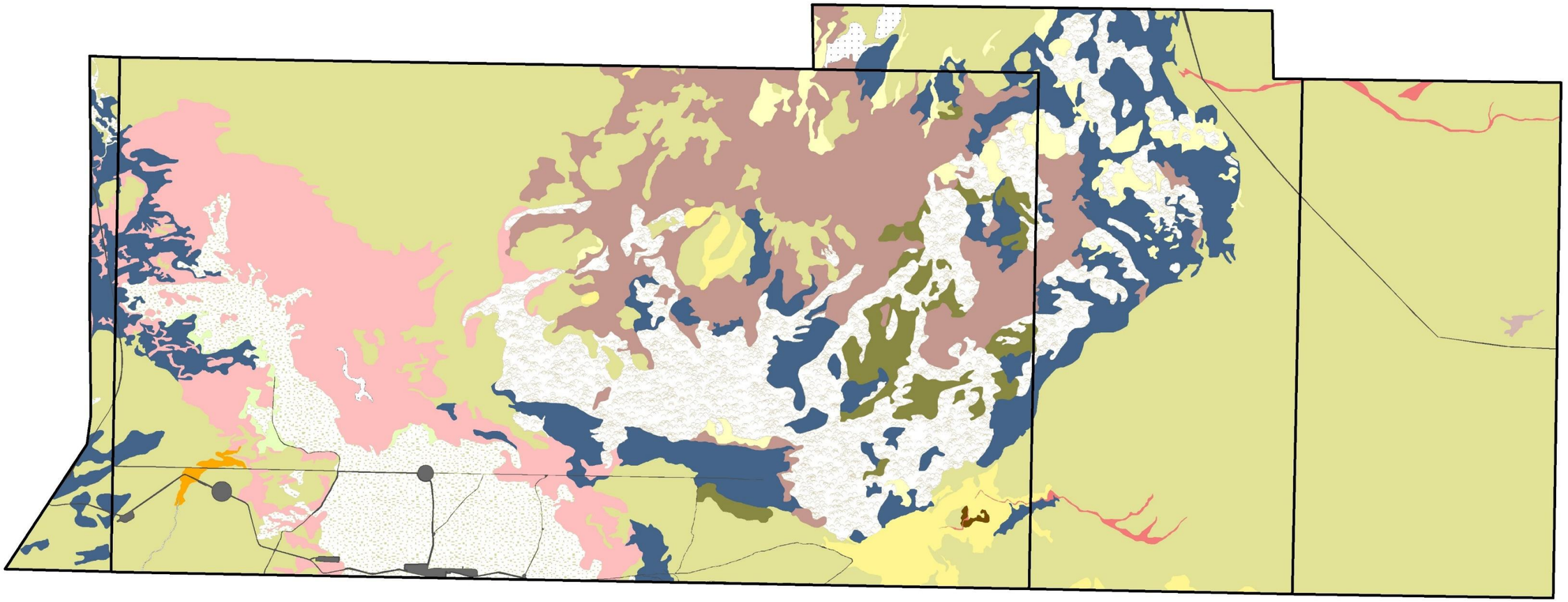
Alliance Name	2007-08 Mapping Areas	2014-15 Mapping Areas	Grand Total
Rubber Weed (*Ericameria nana*) Alliance	258.2	125.9	384.2
Sticky Rabbitbrush (*Chrysothamnus viscidiflorus*) Alliance	2.9	493.6	496.5
White Burrobush (*Hymenoclea salsola*) Alliance	2,287.5	444.3	2,731.8
Winter Fat (*Krascheninnikovia lanata*) Alliance	123.3	237.1	360.4
Great Basin & Intermountain Dwarf Sagebrush Shrubland & Steppe			
Black Sage (*Artemisia nova*) Alliance	3,319.7	821.4	4,141.0
Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe			
Wyoming Big Sagebrush (*Artemisia tridentata*) Alliance	5,471.0	174.8	5,645.7
Woodlands (native trees)			
Intermountain Singleleaf Pinyon - Utah Juniper - Western Juniper Woodland			
Singleleaf Pinyon (*Pinus monophylla*) Alliance	1,134.4	14.2	1,148.6
Southwest Riparian Forest			
Fremont Cottonwood (*Populus fremontii*) Alliance	12.9	1.0	13.9
Woodlands (non-native trees)			
Interior West Ruderal Flooded & Swamp Forest			
Russian Olive (*Elaeagnus angustifolius*) Alliance	0.0	20.7	20.7
Salt Cedar (*Tamarix ramosissima*) Alliance	1.6	16.9	18.5
Other cover types			
Developed	11.4	558.8	570.3
Dunes	589.5	2473.9	3,063.4
Landscaped, non-native trees	0.9	0.0	0.9
Playas	2,250.3	8,641.7	10,891.9
Ponds	0.0	2.8	2.8
Restored slope, no dominants	1.2	0.0	1.2
Roads	500.3	311.8	812.1
Sparsely vegetated, barren hills	28.1	1,168.8	1,196.9
Sparsely vegetated, rocky hills		488.4	488.4
Sparsely vegetated, sandy washes		2.4	2.4
Sparsely vegetated, disturbed lands	83.6	4,094.7	4,178.3
Unknown, possibly mine tailings	4.9	0.0	4.9
Totals	*124,381.4*	*68,955.5*	*193,337.0*



Map C-1. Vegetation alliances on all parcels of B-16.



Map C-2. Vegetation alliances on all parcels of B-17.



Herbaceous (non-wetlands)
- Indian Ricegrass
- Cheatgrass
- Russian Thistle

Alkaline scrubs
- Iodine Bush
- Bailey's Greasewood
- Black Greasewood

Upland scrubs
- Yellow Rabbitbrush
- Nevada Ephedra
- Rubber Rabbitbrush
- White Burrobush
- Four-Flowered Cotton-Thorn

Other cover types
- Sparsely vegetated
- Other cover types, Dunes
- Playas
- Roads

Integrated Map of Vegetation Alliances on B-19, NAS Fallon

N W E S

0.5 0.25 0 0.5 Miles

0.5 0.25 0 0.5 1 Kilometers

Map C-3. Vegetation alliances on all parcels of B-19.

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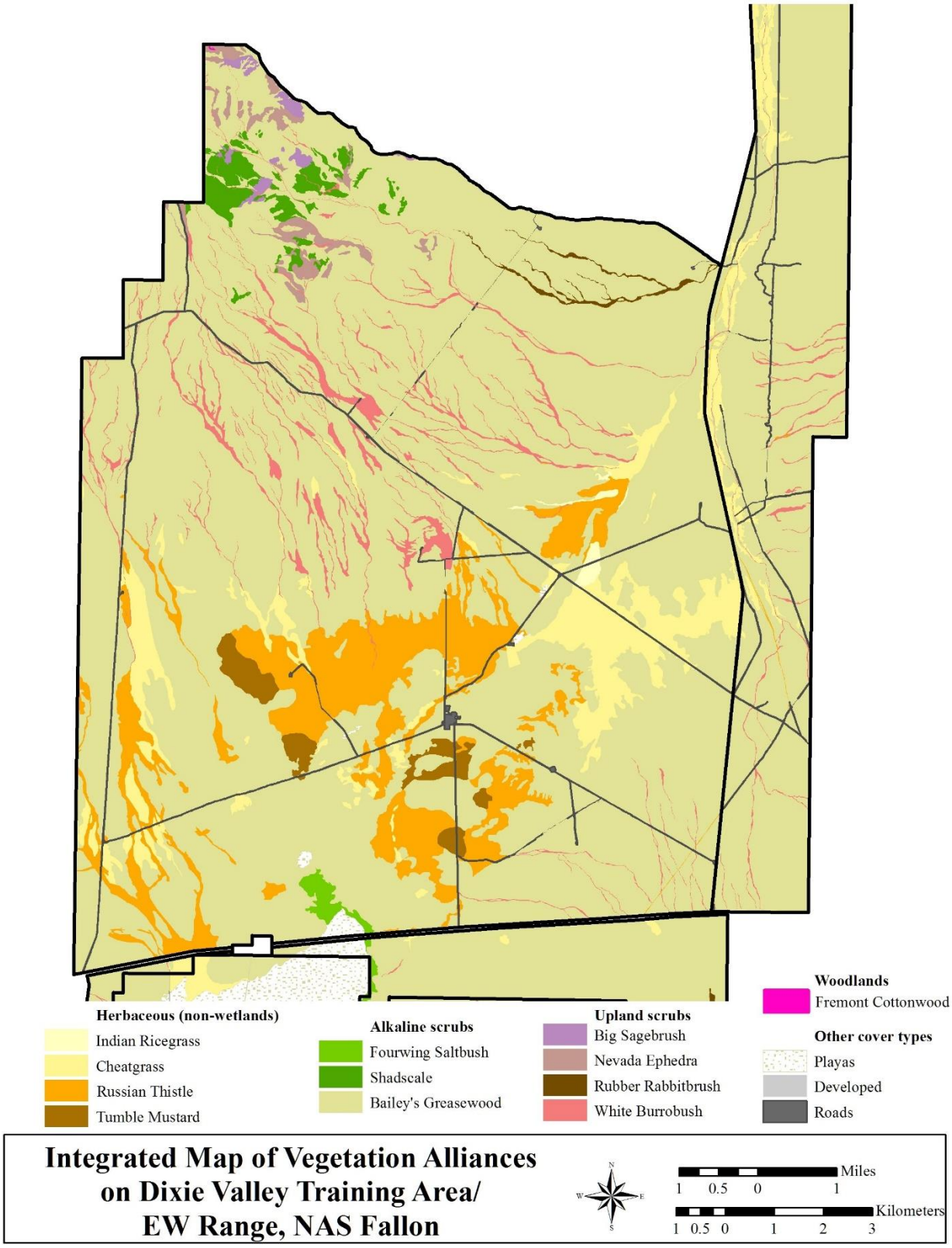
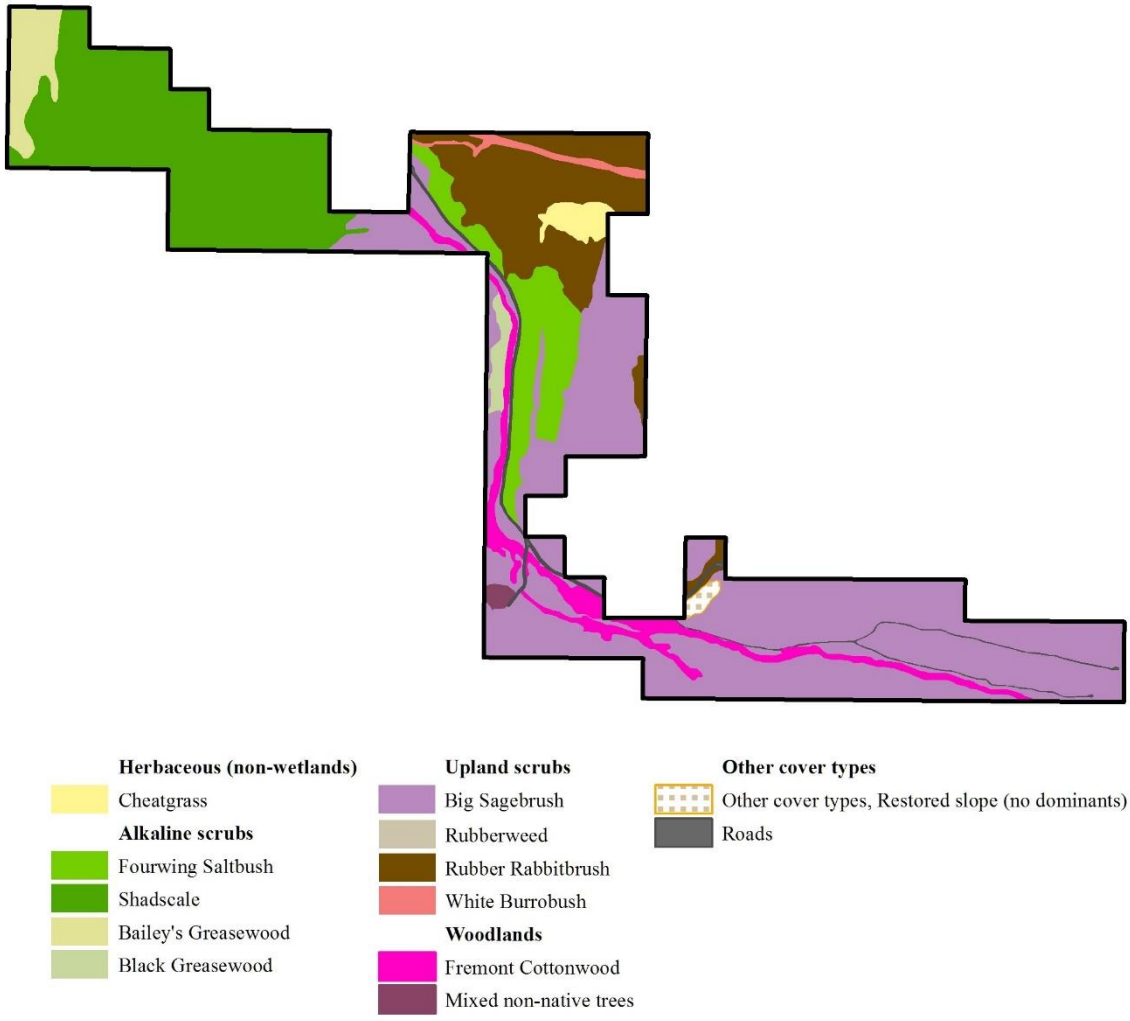
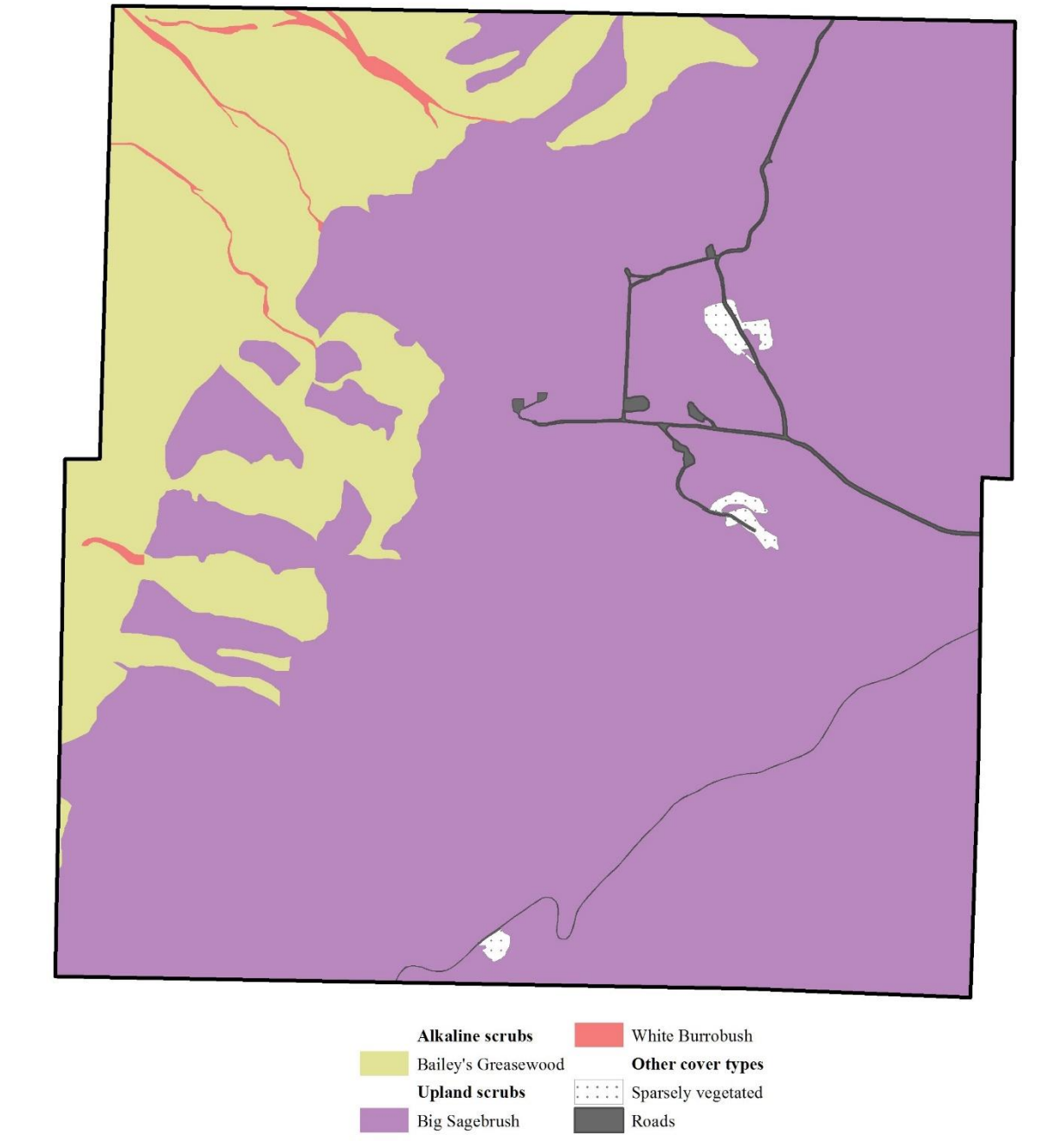


Map C-4. Vegetation alliances on all parcels of Dixie Valley Training Area/EW Range.



Map C-5. Vegetation alliances at Horse Creek.



Map C-6. Vegetation alliances on the Shoal Site.

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Appendix D: Rare Plant Survey Datasheets

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Appendix E: Plant Species Observed in 2014-15

Scientific Name	Common Name	Exotic Species	Addition to Fallon List	Dixie Valley	B-16	B-17	B-19
GYMNOSPERMS							
Cupressaceae							
Juniperus osteosperma	Utah juniper					X	
Ephedraceae							
Ephedra nevadensis	Nevada ephedra						X
Ephedra viridis	green ephedra					X	
Pinaceae							
Pinus monophylla	singleleaf pinyon					X	
MONOCOTS (Aquatic)							
Typhaceae							
Typha domingensis	southern cattail			X			
MONOCOTS (Sedges & Rushes)							
Cyperaceae							
Carex praegracilis	clustered sedge			X			
Eleocharis macrostachya	creeping-spike-rush			X			
Schoenoplectus americanus	American bulrush			X			
Schoenoplectus pungens var. longispicatus	sharp-pointed bulrush			X			
Scirpus nevadensis	Great Basin bulrush		Y	X			
Juncaceae							
Juncus balticus	wire rush			X			
Juncus mexicanus	Mexican rush		Y	X			
Juncaginaceae							
Triglochin concinna var. debilis	low arrowgrass			X			
MONOCOTS (Lilies)							
Alliaceae							
Allium atrorubens var. atrorubens	pale-red onion			X			
MONOCOTS (Grasses)							
Poaceae							
Achnatherum hymenoides	Indian ricegrass			X	X	X	X
Achnatherum speciosum	showy needlegrass					X	
Achnatherum thurberianum	Thurber's needlegrass					X	
Agropyron desertorum	desert crested wheatgrass					X	
Blepharidachne kingii	king desertgrass					X	
Bouteloua barbata	annual grama					X	
Bromus rubens	foxtail brome	E		X			
Bromus tectorum	cheatgrass brome	E		X	X	X	X
Deschampsia elongata	slender hairgrass		Y	X			
Distichlis spicata	salt grass			X			

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Elymus elymoides spp. elymoides	bottlebrush squirreltail			X			X
Eremopyrum triticeum	annual false wheatgrass	E		X			
Hesperostipa comata var. comata	needle and thread grass					X	X
Leymus cinereus	basin wildrye			X		X	
Leymus triticoides	creeping wildrye					X	
Phragmites australis	common reed			X			
Pleuraphis jamesii	galleta or curlygrass					X	X
Poa secunda	western bluegrass			X	X	X	X
Polypogon monspeliensis	rabbit's foot beardgrass	E		X			
Thinopyrum ponticum	tall wheatgrass	E		X			
DICOTS							
Asclepiadaceae							
Asclepias fascicularis	narrow-leaved milkweed					X	
Asclepias speciosa	showy milkweed			X			
Asteraceae							
Ambrosia acanthicarpa	annual burweed				X		X
Artemisia tridentata ssp. tridentata	Wyoming big sagebrush					X	
Artemisia tridentata ssp. wyomingensis	Wyoming big sagebrush					X	
Brickellia microphylla var. microphylla	little-leaved brickellbush					X	
Brickellia oblongifolia var. linifolia	narrow-leaved brickellia					X	
Chaenactis douglasii var. douglasii	Douglas' mountain hoary pincushion			X	X	X	X
Chaenactis macrantha	bighead dustymaiden		Y	X	X	X	X
Chaenactis stevioides	broad-flowered chaenactis			X			
Chaenactis xantiana	Xantus' chaenactis				X	X	X
Chaetadelpha wheeleri	Wheeler's chaetadelpha			X			
Chorisiva nevadensis			Y		X		
Chrysothamnus viscidiflorus ssp. viscidiflorus	sticky rabbitbrush			X	X	X	X
Cirsium neomexicanum	New Mexico thistle					X	
Crepis acuminata ssp. acuminata	long-leaved hawksbeard					X	
Crepis occidentalis ssp. conjuncta	western hawksbeard					X	
Crepis runcinata var. andersonii	Anderson's meadow hawksbeard			X			
Dicoria canescens	desert dicoria						X
Ericameria nauseosa var. hololeuca	light-gray rabbitbrush			X	X	X	X
Eriophyllum pringlei	Pringle's woolly sunflower		Y			X	
Glyptopleura marginata	carveseed		Y				X
Gutierrezia sarothrae	broom snakeweed			X		X	
Helianthus annuus	common sunflower			X	X	X	X
Hymenoclea salsola var. salsola	white burrobush			X	X	X	X
Iva axillaris var. robustior	poverty weed			X			
Lactuca serriola	prickly lettuce	E			X		
Layia glandulosa	whitedaisy tidytips		Y			X	

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Layia platyglossa	coastal tidytips					X	
Malacothrix glabrata	smooth desert dandelion			X	X	X	X
Malacothrix sonchoides	sow-thistle desert dandelion			X			X
Pectis papposa	many-bristle fetid-marigold					X	
Picrothamnus desertorum	bud sage			X	X	X	X
Prenanthella exigua	egbertia				X	X	X
Stephanomeria exigua	small stephanomeria			X	X	X	X
Taraxacum officinale	common dandelion	E		X			
Tetradymia glabrata	little-leaf horsebush				X		X
Tetradymia spinosa	catclaw horsebush			X	X		X
Tetradymia tetrameres	four-flowered cotton-thorn			X			X
Boraginaceae							
Amsinckia tessellata	checker fiddleneck			X	X	X	X
Cryptantha circumscissa	western cryptantha			X	X	X	X
Cryptantha humilis	low oreocarya					X	
Cryptantha micrantha	small cryptantha				X		X
Cryptantha nevadensis	Nevada cryptantha					X	
Cryptantha pterocarya	wing-nut cryptantha				X		
Pectocarya setosa	moth combseed		Y		X		
Plagiobothrys kingii	Great Basin popcornflower		Y			X	
Plagiobothrys scouleri var. hispidulus	related popcorn flower			X			
Tiquilia nuttallii	Nuttall's tiquilia				X		X
Brassicaceae							
Cardaria pubescens	hairy whitetop			X			
Caulanthus crassicaulis var. crassicaulis	thickstemed wild cabbage						X
Caulanthus major var. nevadensis	Nevada slender wild cabbage						X
Descurainia sophia	tansy-mustard	E		X	X	X	X
Lepidium densiflorum var. pubicarpum	hairy-fruited common pepperweed			X	X		
Lepidium flavum var. flavum	yellow pepperweed		Y	X			
Lepidium perfoliatum	clasping-leaf pepperweed	E		X			
Lepidium virginicum var. pubescens	hairy Virginia pepperweed				X		
Malcolmia africana	African mustard		Y	X			
Nasturtium officinale	water cress			X			
Sisymbrium altissimum	tumble mustard	E		X	X	X	X
Stanleya elata	tall prince's plume					X	
Stanleya pinnata	golden prince's plume					X	X
Thelypodium flexuosum	spreading thelypody			X		X	
Cactaceae							
Grusonia pulchella	sand cholla				X	X	X
Opuntia polyacantha var. erinacea	grizzlybear prickly pear					X	X

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Capparaceae							
Cleome lutea	yellow beeplant			X			
Cleome sparsifolia	sparsely flowered beeplant				X		
Caprifoliaceae							
Symphoricarpos longiflorus	desert snowberry		Y		X	X	
Chenopodiaceae							
Allenrolfea occidentalis	iodine bush			X			X
Atriplex argentea var. argentea	silverscale saltweed				X		
Atriplex canescens	fourwing saltbush			X	X	X	X
Atriplex confertifolia	shadscale			X	X	X	X
Atriplex truncata	wedgescale saltweed			X	X		
Chenopodium album	pigweed, lamb's quarters	E		X			
Chenopodium fremontii	Fremont's goosefoot					X	X
Chenopodium nevadense	Nevada goosefoot					X	
Grayia spinosa	hopsage			X		X	
Halogeton glomeratus	halogeton	E		X	X	X	X
Kochia americana	gray molly			X			
Krascheninnikovia lanata	winter fat				X	X	X
Monolepis nuttalliana	Nuttall's poverty weed					X	
Monolepis pusilla	small povertyweed		Y	X			
Salicornia depressa	annual glasswort			X			
Salsola tragus	tumble weed, Russian-thistle	E		X	X	X	X
Sarcobatus baileyi	Bailey's greasewood			X	X	X	X
Sarcobatus vermiculatus	black greasewood			X	X	X	X
Suaeda moquini	Moquin's seepweed			X	X	X	X
Convolvulaceae							
Convolvulus arvensis	field bindweed	E		X			
Elaeagnaceae							
Elaeagnus angustifolius	Russian olive	E		X			
Euphorbiaceae							
Chamaesyce ocellata ssp. arenicola	desert valley spurge					X	
Fabaceae							
Astragalus geyeri var. geyeri	Geyer's milkvetch		Y	X	X		
Astragalus iodanthus var. iodanthus	Humboldt River milk vetch					X	
Astragalus lentiginosus var. kennedyi	Kennedy's milk vetch				X		X
Astragalus purshii var. purshii	Pursh's wooly-pod					X	
Astragalus serenoi var. serenoi	naked milk vetch			X		X	
Lupinus argenteus var. heteranthus	silver-spurred lupine					X	
Lupinus pusillus var. intermontanus	intermountain annual lupine					X	X
Melilotus albus	white sweet-clover	E					X
Psoralidium lanceolatum	lemon scrufpea						X

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Psorothamnus kingii	king's indigobush						X
Psorothamnus polydenius	dotted indigobush				X		X
Geraniaceae							
Erodium cicutarium	red-stemmed filaree	E		X		X	
Hydrophyllaceae							
Nama aretioides var. multiflorum	purple nama				X	X	X
Phacelia bicolor var. bicolor	two colored phacelia					X	X
Phacelia crenulata crenulata	cleftleaf wildheliotrope		Y			X	X
Phacelia gymnoclada	nakedstem phacelia		Y			X	
Phacelia hastata var. hastata	silverleaf phacelia					X	
Loasaceae							
Mentzelia albicaulis	white-stemmed stick-leaf			X	X	X	X
Mentzelia laevicaulis var. laevicaulis	smoothstem blazingstar		Y			X	
Malvaceae							
Sphaeralcea ambigua ssp. ambigua	desert mallow			X	X	X	X
Nyctaginaceae							
Abronia turbinata	transmontane sand abronia				X		X
Mirabilis alipes	winged four-o'clock				X	X	
Mirabilis laevis var. villosa	desert four-o'clock				X	X	
Onagraceae							
Camissonia nevadensis	Nevada suncup		Y	X			
Chylismia claviformis ssp. integrior	clavate-fruited primrose			X	X		
Chylismia heterochroma	many-colored primrose				X	X	X
Epilobium ciliatum ssp. ciliatum	ciliate willow-herb				X		
Oenothera deltoides ssp. piperi	Piper's evening primrose			X	X	X	X
Orobanchaceae							
Orobanche corymbosa	Rydberg's broom-rape			X	X		X
Papaveraceae							
Eschscholzia minutiflora ssp. minutiflora	pygmy poppy		Y				X
Polemoniaceae							
Aliciella latifolia	broadleaf gilia		Y		X		
Aliciella lottiae	Lottie's gilia				X		X
Aliciella micromeria	sand gilia					X	
Eriastrum wilcoxii	Wilcox's eriastrum			X	X	X	X
Ipomopsis polycladon	spreading gilia			X	X	X	
Linanthus pungens	granite gilia						X
Loeseliastrum depressum	depressed ipomopsis		Y		X		
Navarretia breweri	Brewer's navarretia				X	X	
Phlox hoodii var. canescens	carpet phlox					X	
Phlox stansburyi	Stansbury's phlox					X	

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Polygonaceae							
Chorizanthe brevicornu var. spathulata	brittle spineflower		Y		X		
Chorizanthe rigida	rigid chorizanthe						X
Chorizanthe watsonii	fivetooth spineflower		Y			X	
Eriogonum brachyanthum	short-flowered buckwheat				X		
Eriogonum deflexum var. nevadense	Nevada reflexed buckwheat					X	
Eriogonum heermannii var. heermannii	Heermann's buckwheat					X	
Eriogonum inflatum var. inflatum	desert trumpet			X		X	
Eriogonum maculatum	maculate buckwheat				X	X	X
Eriogonum nidularium	bird's nest buckwheat				X	X	
Eriogonum ovalifolium var. purpureum	white-flowered oval-leaved buckwheat					X	
Eriogonum pusillum	yellowturbans			X	X		X
Eriogonum reniforme	kidneyleaf buckwheat		Y		X		
Oxytheca perfoliata	perfoliate-leaved oxytheca				X		
Polygonum douglasii ssp. douglasii	fall knotweed			X			
Rumex crispus	curly-leaved dock	E		X			
Rumex venosus	winged dock, veiny dock			X	X	X	X
Ranunculaceae							
Delphinium andersonii	Anderson's larkspur					X	
Ranunculus cymbalaria var. saximontanus	desert buttercup			X			
Rosaceae							
Prunus andersonii	desert peach		Y			X	
Rubiaceae							
Galium aparine	cleavers, goose grass					X	
Galium multiflorum	many-flowered bedstraw					X	
Salicaceae							
Populus fremontii	Fremont cottonwood			X			
Scrophulariaceae							
Castilleja minor ssp. minor	annual paintbrush						X
Mimulus floribundus	many-flowered monkey-flower			X			
Mimulus mephiticus	yellow-and-purple monkey-flower					X	
Penstemon speciosus	royal penstemon		Y			X	X
Sairocarpus kingii	least snapdragon		Y			X	
Veronica americana	American brooklime			X			
Solanaceae							
Lycium shockleyi	Shockley's boxthorn			X	X		X
Oryctes nevadensis	Nevada oryctes		Y				X
Tamaricaceae							
Tamarix ramosissima	salt cedar	E		X			