National Park Service
U.S. Department of the Interior

Mojave Desert Inventory and Monitoring Network

Vegetation Classification Report

Great Basin National Park

ON THE COVER

Mount Wheeler (from saddle between Bald Mountain)
Photograph by: Keith Schulz

Vegetation Classification Report: Great Basin National Park

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March 2011

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Please cite this publication as:
Schulz, K. A. and M. E. Hall. 2011. Vegetation Classification Report: Great Basin National Park. Unpublished Report submitted to USDI, National Park Service, Mojave Desert Inventory and Monitoring Network. NatureServe, Western Regional Office, Boulder, Colorado. 30 pp. plus Appendices A-H.

Contents

FIGURES

TABLES

Page

APPENDICES

ACKNOWLEDGMENTS

The production of this vegetation inventory for this large, diverse and rugged national park site required the enthusiasm and energy of many people over several years. The dedication of all involved that helped to produce the product is gratefully acknowledged. We would specifically like to thank the following people for their efforts:

Jeanne Taylor and Alice Chung-MacCoubrey, Vegetation Mapping Coordinators, National Park Service Mojave Desert Inventory & Monitoring Network for project coordination and financial support. Special thanks go to Jeanne, who shepherded this project along and was involved in all phases of the project from classification plot field data collection, field crew trainings, and review of draft and final products.

Drs. Jan Van Wagtendonk and Peggy Moore from U.S. Geological Survey (USGS), and David Charlet, University Nevada Las Vegas (UNLV) for leading the 2003 research and the 2003 field crew members for collecting a significant portion of the vegetation field data.

Special thanks goes to the natural resource staff at Great Basin National Park, especially Tod Williams, Gretchen Baker, Ben Roberts and Bryan Hamilton for sharing local knowledge, biological expertise and logistical and financial support. In addition, the GRBA provided the staff that collected most of the rapid assessment points during the 2009 field season, which greatly enhanced the completeness of the vegetation field sampling and the vegetation classification, which is based on this field data.

The list of people who to thank for their efforts collecting field data during the 2003, 2008 and 2009 field seasons is long and includes Dr. David Charlet and his crew (2003), Ms. Julie Thompson (2008); G. Baker, L. Belica, G. Clifton, B. Eastman, M. Grover, B. Hamilton, M. Horner, N. Lohman, M. Pepper, B. Roberts, J. Reynolds, J. Taylor, D. Watrous, and T. Williams (2009).

From NatureServe, we thank Kristin Snow for formatting report, Mary Russo for data management, and Marion Reid for project planning and coordination.

Also, Dan Cogan, of Cogan Technology Incorporated, graciously provided Figures 2 & 3.

Finally, particular recognition goes to Karl Brown with NPS for prioritizing the need for this project and providing much of the funding. Without the financial support from the NPS Vegetation Inventory Program (NPS VIP) the project would not have been possible.
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INTRODUCTION

National Park Service Vegetation Inventory Program

The National Park Service Vegetation Inventory Program (NPS VIP) was started as a cooperative effort between the NPS and the USGS to classify, describe, and map existing vegetation communities in more than 270 national park units across the United States. The primary objective of the NPS VIP is to produce high-quality plant community classifications, standardized maps and associated data sets of the vegetation currently occurring within national park units. This information fills data gaps and complements a wide variety of resource assessments, park management, and conservation needs. Among its many uses, the NPS VIP products have helped park managers better identify and conserve plant biodiversity, manage exotic and rare species, monitor insect and disease effects, and provide a baseline to examine wildlife habitat relationships and wildland fires.

In 1999, the Director of the NPS approved the Natural Resource Challenge to encourage national parks to focus on the preservation of the nation's natural heritage through science, natural resource inventories, and expanded resource monitoring. The Natural Resource Challenge provided funding for 12 baseline inventories to be completed in each of 270 parks with significant natural resources. The vegetation mapping inventory is considered one of these 12 baseline inventories.

NPS VIP follows well-established protocols that are compatible with other agencies and organizations. This inventory uses the National Vegetation Classification Standard, version 2 (NVCSv2) and the revised United States National Vegetation Classification (rUSNVC). The NVCSv2 is the current Federal Geographic Data Committee (FGDC) approved vegetation classification standard and the rUSNVC represents the current classification of vegetation types that conform to the standards of the NVCSv2. These are the major scientific effort in the taxonomic classification of vegetation in the U.S. Use of a standardized vegetation classification system, such as the NVCSv2 helps ensure data compatibility throughout the NPS and other agencies (FGDC 2008). This is critical for a systematic inventory and classification of the nation's biological resources to foster efficient stewardship and prioritize conservation efforts. In addition, stringent quality control procedures ensure the reliability of the vegetation data and encourage the use of resulting maps, reports, and databases at multiple scales.

The vegetation classification portion of this vegetation mapping project includes the following products delivered by NatureServe (NS):

- Review Legacy Data
- Vegetation plot data
- Vegetation Classification using revised USNVC Hierarchy
- Local descriptions for 23 associations, 22 alliances and 8 groups
- Dichotomous vegetation keys to association level and map class
- Photo-database of all plot photos
- Detailed vegetation classification report

National Vegetation Classification Standard

The NVCSv2 adopted in 2008 by the FGDC and represents years of hard work by the FGDC Vegetation Subcommittee, with members from a several federal agencies, the Ecological Society of America's (ESA)Vegetation Classification Panel, and NS (FGDC 2008). The NVCSv2 is a classification system that provides the standards for classifying vegetation and the rUSNVC is the set of types based on that standard. Thus the standard established guidelines for the development of types but types per se can be updated dynamically over time as new information comes in. The dynamic nature of the standard is an innovative approach that incorporates advancements in the classification so that it reflects the most current scientific understanding of the nation's plant communities.

The NVCSv2 is a hierarchical system that allows for vegetation classification at multiple scales (FGDC 2008). There are eight levels with specific criteria set for each level (Table 1). The upper three levels are based on climate and physiognomic characteristics that reflect geographically widespread (global) topographic and edaphic factors. The middle three levels focus largely on broad sets of diagnostic plant species and habitat factors along regional-to-continental topographic, edaphic, and disturbance gradients. The lower two levels, as in the original NVC, are the alliance and association and are distinguished by differences in local floristic composition. The alliances are broader, physiognomically distinct groups of plant associations sharing one or more differential or diagnostic species (Mueller-Dombois and Ellenberg 1974). These are commonly the dominant(s) found in the uppermost strata of vegetation. The plant association is the base unit of the classification, and following Jennings et al. (2009) is defined as "a vegetation classification unit defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions, and physiognomy."

Content for the rUSNVC is currently maintained by NS and is being peer reviewed through collaboration with federal agencies and ESA (Faber-Langendoen et al. 2009). The content is available to the public and is regularly updated through NatureServe Explorer (2010) (http://www.natureserve.org/explorer) and http://www.usnvc.org.

Currently, content (list of types and descriptions) for the upper levels and middle levels of hierarchy (Formation to Group level) has largely been developed and is undergoing a review process by the Peer Review Broad of the ESA Vegetation Panel. The rUSNVC allows for classification of vegetation at all scales and provides narrative descriptions of many groups, alliances and associations (Faber-Langendoen et al. 2009, 2010). Over 6,000 associations nationwide have been attributed to Group level units and are being screened for levels of confidence before being adopted into the new USNVC. The screening may lead to some deletions or changes in association concepts. However, the alliance level will need significant revision and review to complete the initial content of the NVCSv2. Provisional rUSNVC alliance level units are being developed as part of some ongoing NPS vegetation classification and mapping projects for several park units in the Pacific Island Network (PACN), Grand Canyon NP (GRCA) and this project. However, a more comprehensive effort is needed. Until a comprehensive alliance revision and review is completed, the alliance level will be unevenly developed with possible changes.

Both rUSNVC associations and alliance are commonly used for Map Classes in NPS vegetation mapping projects. Their use within the NPS VIP facilitates effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other federal and state agencies. These vegetation maps and associated ecological information support a wide variety of resource assessment, park management, and planning needs. In addition they can be used to provide a structure for framing and answering critical scientific questions about plant communities and their relationship to environmental conditions and ecological processes across the landscape.

Table 1. Summary of NVCSv2 Revised Hierarchy Levels and Criteria for Natural Vegetation.

Hierarchy Level	Criteria
Upper:	**Physiognomy plays a predominant role.**
L1 - Formation Class	Broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and substrate/aquatic conditions.
L2 - Formation Subclass	Combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate/aquatic conditions.
L3 – Formation	Combinations of dominant and diagnostic growth forms that reflect global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.
Mid:	**Floristics and physiognomy play predominant roles**
L4 – Division	Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant species that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
L5 – Macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms, that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
L6 – Group	Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect regional mesoclimate, geology, substrates, hydrology and disturbance regimes.
Lower:	**Floristics plays a predominant role**
L7 – Alliance	Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
L8 – Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.

Mojave Desert Inventory and Monitoring Network

The Mojave Desert Inventory and Monitoring Network (MOJN) was established to provide an efficient means of carrying out expanded natural resource inventory and monitoring activities for all 7 national park units within the Mojave Desert and the Great Basin (Figure 1). Currently MOJN contains one small park (Manzanar National Historic Site), one large park (GRBA) and five very large parks (Death Valley National Park, Joshua Tree National Park, Lake Mead National Recreation Area, Mojave National Preserve, and Parashant National Monument. Great Basin NP is the only national park in the Great Basin (Figure 1). Data and reports for MOJN projects can be accessed online at: http://science.nature.nps.gov/im/tracking/InventorySearch.aspx

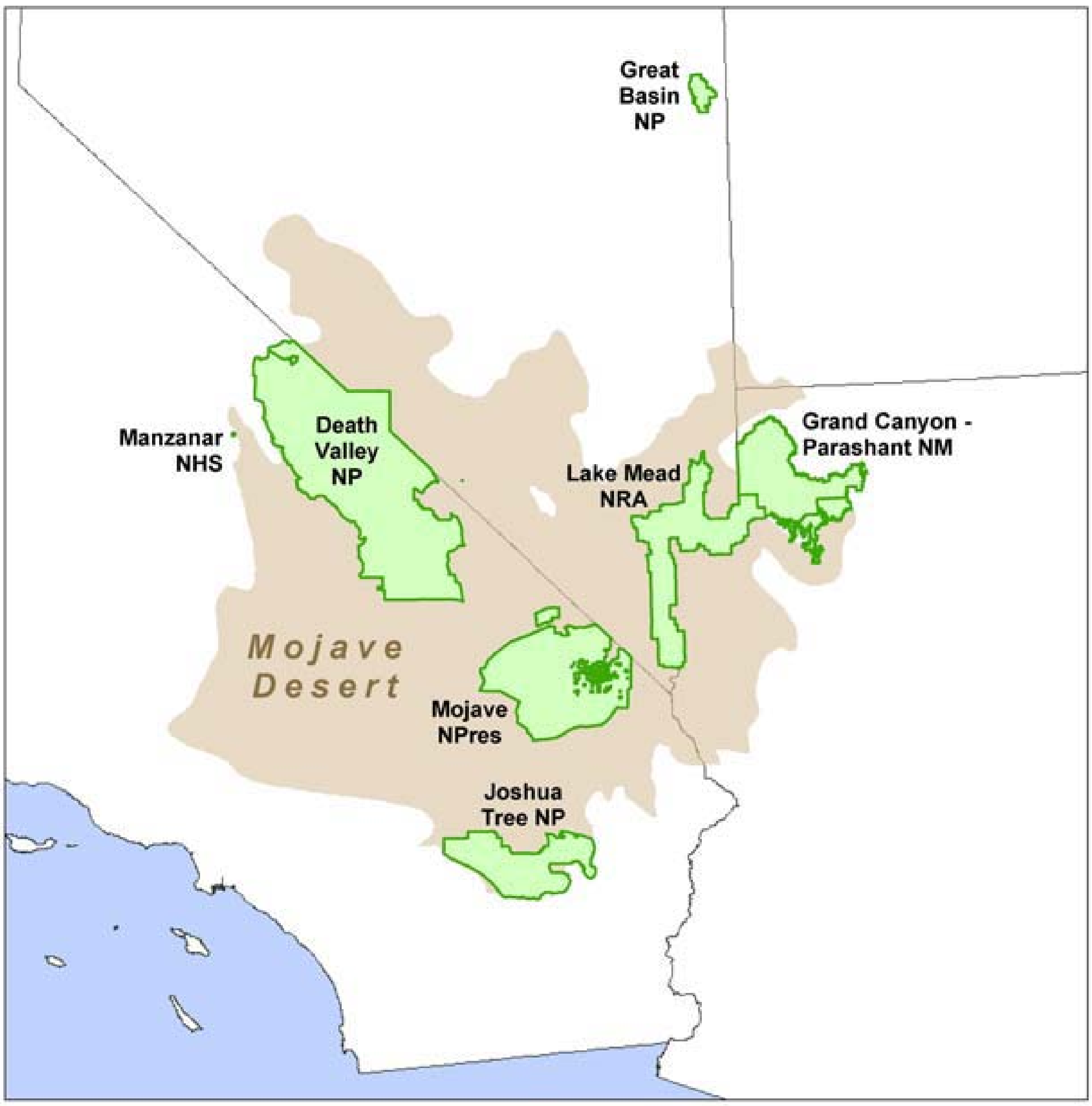

Figure 1. Map of Mojave Desert Network.

Great Basin National Park

Great Basin National Park (GRBA) is located in east-central Nevada and encompasses most of the South Snake Range (Figures 1 & 2). The Snake Range is one of the many isolated, long, and narrow, north-south trending mountain ranges created by major block faulting that typify the Basin and Range physiographic province (Fenneman 1931). Originally the park consists of 31,202 ha (77,100 acres) of mostly mountainous terrain with significant topographic relief and sharp elevation gradients (1,615 to 3,981 meters; 5,295 to 13,063 feet) and is largely surrounded by lower elevation public lands managed by the Bureau of Land Management (BLM) (Figure 2). In 2005 a new 80-acre visitor center along State Route 487 near Baker, Nevada was completed putting the current total area of GBRA at 77,180 acres. Private land abuts the northeastern boundary near the town of Baker, Nevada where a 32 ha (80 acre) NPS administrative site is located. The park was created in 1986 to conserve and protect the scenery, the natural, geologic, historic, and archaeological resources of the park.

Natural Setting

This mountainous park is bounded by the Snake Valley to the east, the Hamlin Valley to the south and the Spring Valley to the west and except for the administration area, includes very little valley bottom. Between the mountains and the valley are broad, gently sloping alluvial fans. Much of the park, especially the southern and eastern portions is made up of sedimentary rocks (limestone, shale, sandstone). Metamorphic and some igneous (granite) rocks are exposed in the high mountains on the west side of the park (NPS 2011). Substrates are variable ranging from unweathered bedrock and shallow, skeletal, coarse textured poorly developed soils to deeper, gravelly or sandy loams and clay loams derived from colluvium or alluvium (USDA-NRCS 2009). Hydrology in the park is complex with both surface water and significant ground water. There are ten perennial streams flowing from the high mountains and then disappearing into the alluvium in surrounding valleys. Much of the southern portion of the park has karst (limestone) geology where surface water percolates into the rock and flows into aquifers leaving the surface dry (NPS 2011). The park has a large elevation gradient, varied topography, geology, soils and hydrology that create a diversity of habitats for plants and animals.

Vegetation

Overview: GRBA is a largely forested mountainous park bounded by valleys to the east, south and west and except for the administrative site, includes little valley bottom vegetation. Vegetation in the administration area near the town of Baker is dominated by basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) shrublands, mixed basin big sagebrush - greasewood (*Sarcobatus vermiculata*) shrublands, and some disturbed vegetation types. On the upper alluvial fan near the lower park boundary, upland vegetation is dominated by big sagebrush shrublands with black sagebrush (*Artemisia nova*) shrublands on shallower soils and pinyon (*Pinus monophylla*) – juniper (*Juniperus osteosperma*) woodlands on rockier sites. The pinyon-juniper woodlands extends into the montane zone, which is dominated by white fir (*Abies concolor*) forests either pure or more often in mixed stands with aspen (*Populus tremuloides*), Douglas-fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*). Curl-leaf mountain mahogany (*Cercocarpus ledifolius*) woodlands and shrublands are also prominent in the montane zone. Ponderosa pine (*Pinus ponderosa*) dominated and codominated woodlands are also present in limited areas. Individual ponderosa pine trees are scattered along drainages especially in the southern extent. Vasey big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) shrublands are

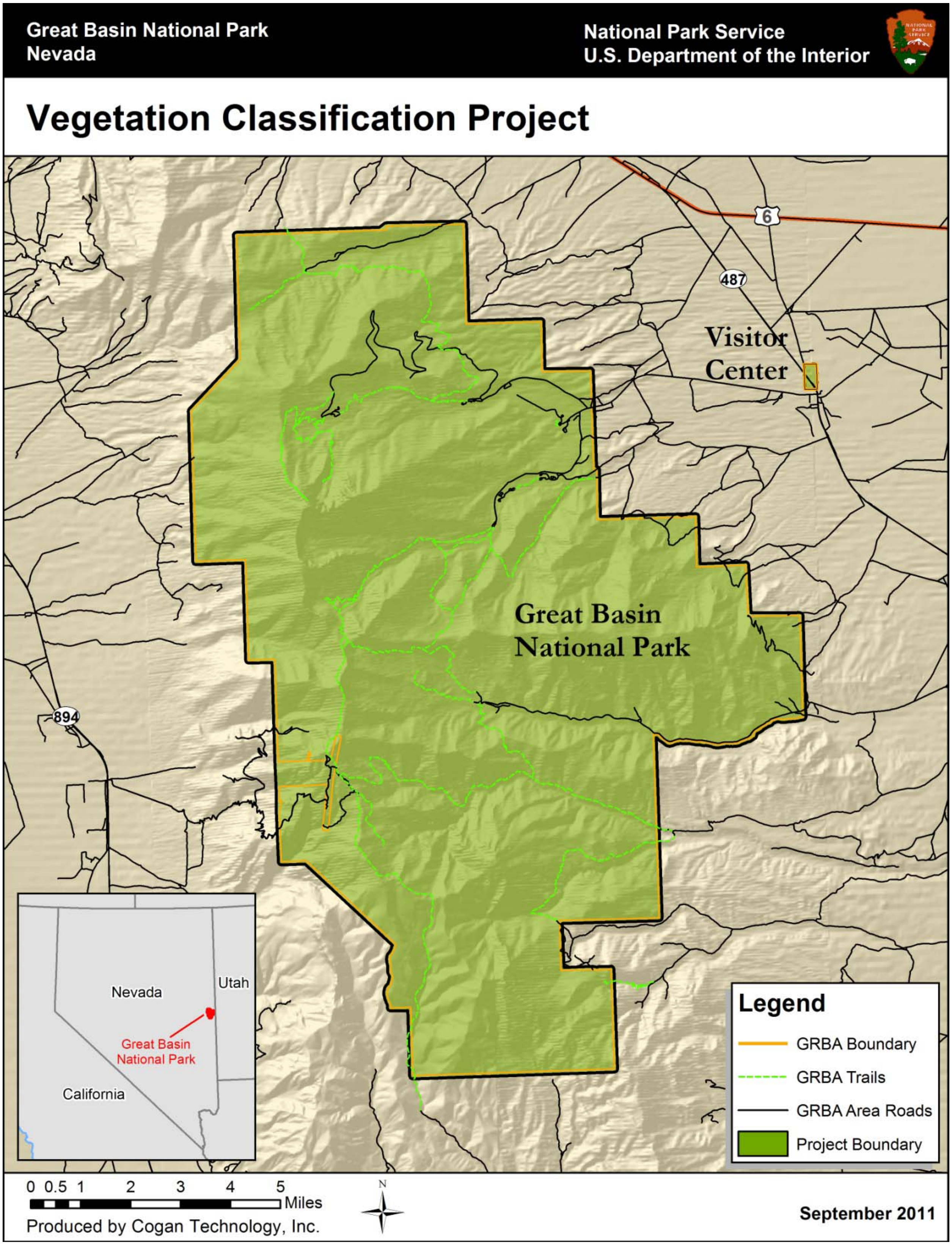

Figure 2. NPS Great Basin National Park location map.

also prominent in the montane zone. As the montane zone transitions to the subalpine zone, Engelmann spruce (*Picea engelmanii*) begins to dominate forests.Limber pine and bristlecone pine (*Pinus longaeva*) stands are prominent especially on isolated high rocky slopes. Sparsely vegetated rocky slopes and outcrops are common at all elevations, and are often dominated by lichens. Alpine vegetation may be dominated by patches of grasses and sedges that sometimes form an alpine turf. On rockier, windswept sites such as upper slopes of mountains, ridges and saddles, cushion plants typically dominate forming fell-fields. Patches of shrubby, wind-sculpted Engelmann spruce and limber pine krummholz is also present near the upper tree-line as are open stands of often ancient bristlecone trees. Some of the bristlecone pines are over 4000 years old and are one of the extraordinary features of the park (Currey 1965, Beasley and Klemnedson 1980, Ferguson 1968, Hiebert and Hamrick 1984).

Riparian and wetland communities account for a relatively small area, but are very important habitats for wildlife. At GRBA, riparian areas tend to be narrow and often have significant facultative wetland species present as well as characteristic obligate wetland species (Smith et al. 1994). Lower elevation riparian forests are often dominated by narrowleaf cottonwood (*Populus angustifolia*) and white fir with water birch (*Betula occidentalis*), chokecherry (*Prunus virginiana*), willow (*Salix* spp.), and Woods' rose (*Rosa woodsii*) shrubs in the understory. Ponderosa pine is present in some of these stands. At higher elevations, narrowleaf cottonwood drops out and aspen is the dominant deciduous tree. Engelmann spruce with aspen is typical of subalpine riparian forests. Herbaceous wetlands are restricted to perennial streams and near seeps and springs and are often dominated by sedges (*Carex* spp.), especially mountain sedge (*C. scopulorum*). Introduced forage species such as Kentucky bluegrass (*Poa pratensis*), crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*) dominate some mesic grasslands and herbaceous layers of some shrub steppe and shrubland communities. Cheatgrass (*Bromus tectorum*), an introduced annual grass often dominates the herbaceous layers of disturbed areas.

Previous vegetation studies: Prior to this project, the vegetation of GRBA and surrounding environs was inventoried in 1988 by researchers from Oregon State University (OSU) (Eddleman and Jaindl 1994). The project area was at a landscape level comprising 236,844 ha (585,234 ac) of the South Snake Range and parts of the surrounding valleys. Eddleman and Jaindl (1994) created a vegetation classification of 43 Potential Native Plant Communities (PNPC) types based on the analysis of 161 plots and information from the literature. Fourteen (14) PNPC were not sampled nor had insufficient data for classifying. Sampling ranged from desert scrub to alpine types with meadow, riparian, and alpine types not sufficiently sampled to classify PNPCs. Unfortunately, the plot data could not be relocated to be analyzed with the recently collected data.

The next major vegetation sampling effort occurred in 2003 as part of the Mapping Fuels for Fire Management Across Multiple Scales: Integrating Remote Sensing, GIS, and Biophysical Modeling project (Keane et al. No date, 2001, van Wagtendonk et al. No date). Both fuels and vegetation data were collected (Charlet 2003). The vegetation data was collected using standard USGS/NPS Vegetation Mapping Program methods (TNC and ESRI 1994b) with the intent that the vegetation data could be used for vegetation classification and mapping when GRBA was mapped as part of what is now called the NPS Vegetation Inventory Program (NPS VIP). Keith Schulz of NS was contracted to train the field crews in the standard methods in June 2003.

A review of Legacy Data was completed by NS in 2008. As a result of this review, it was determined that only the data collected in 2003 by Charlet could be used along with new project data for vegetation analysis and classification. The results of the 2003 sampling effort are summarized in the Field Data collection section of the report.

One other source of legacy data used in this project is from several alpine sites sampled in August 2009 for the Global Observation Research Initiative in Alpine Environments (GLORIA) project (http://www.gloria.ac.at/). Gretchen Baker summarized data from these sites and created five additional alpine plots which were added to the GRBA PLOTS database.

METHODS

The vegetation classification project at GRBA was considered to be in the "medium park" category based on the overall size of the project area and the "large park" category based on limited accessibility of the project area (TNC and ESRI 1994b). The field sampling methods for vegetation mapping suggest a gradsect approach to meet the sampling goal of identifying and characterizing all of the vegetation types across the park (TNC and ESRI 1994b). However, because of a significant amount of legacy vegetation data from the 2003 fuels and vegetation project, we altered the field sampling design and methodology to target and inventory those plant communities not sampled or under-sampled during the 2003 project. NatureServe completed an ecological system gap analysis and sampling design review to serve as a gradsect to guide the sampling (Appendix A). The purpose of this "gap" analysis was to identify additional sampling needed to classify, describe and map all vegetation types at GRBA and to develop a sampling design to target likely locations of under-sampled vegetation types. This was done initially using only the 2003 data for the 2008 field season, and was updated with 2008 data to inform the 2009 sampling. The products from this vegetation sampling and classification effort will be used by Cogan Technology Inc. (CTI) to produce the vegetation map. The vegetation map is being produced following the NPS VIP more recent 12 Step Guidance for NPS Vegetation Inventories (NPS 2009).

Planning, Data Gathering and Coordination

Planning conference calls began on March 13, 2008 and were attended by representatives from NS, NPS VIP, MOJN and GRBA staff. The goals of these calls were to (1) discuss the overall project and initial requirements, (2) discuss availability of existing data, especially from the 2003 work, and what was needed to complete vegetation sampling at GRBA, (3) learn about the management issues and concerns, (4) discuss procedural issues and data management, (5) develop a project scope of work and project timeline for Phase I work and schedule the targeted vegetation sampling in August 2008, and (6) discuss future project needs and funding.

A planning meeting was also held on February 4, 2009 at the MOJN offices in Boulder City, NV to present results from the 2008 field season and discuss the next steps in the project and funding for Phases II and III.

Roles and Responsibilities

MOJN Staff
- Provide oversight and project funding;
- Assist with fieldwork and logistical considerations;
- Work with NS to develop the vegetation classification;
- Review draft and final products

GRBA Staff
- Provide the GRBA plant species list, provide local expertise and other resources;
- Help with overall project planning, facilitation and coordination;
- Collect additional vegetation data in 2009;
- Review final products

NS (Western Regional Office)
- Collect plot, rapid assessment and observation point data in 2008, 2009, and 2010;
- Train GRBA staff in NPS VIP vegetation field data collection methods;
- Work with MOJN to develop a vegetation classification for the study area based on the rUSNVC using quantitative analysis and ecological interpretation of the field data;
- Write methods describing the field portion of this project;
- Write methods describing vegetation classification portion of this project;
- Provide guidance regarding the crosswalk of vegetation types to map units;
- Write 50-60 local descriptions of the vegetation types found at GRBA;
- Write a field key to the vegetation types found at GRBA;
- Write vegetation classification report including methods, results and discussion to be incorporated into final project report.

Field Surveys

The field methods used for developing the classification at GRBA followed the methodology outlined by the USGS/NPS Vegetation Mapping Program methods (TNC and ESRI 1994b) for large sized park units for the 2003 and 2008 field seasons. Plot size and shape requirements were consistent with NPS VMP guidelines (TNC and ESRI 1994b) and were determined by the physiognomy of the community being sampled (Table 2). Measuring tapes were used to establish the circular, square or rectangle sampling area and the plot size and shape was adjusted as needed to sample linear bands of vegetation in drainage bottoms or other confined sites. In 2003, all plots were square, oriented from a base stake that forms the southeast corner and extends north and west 20 m (400 m2). Charlet (2003) has more details on field methods and results for the 2003 sampling effort.

Following the establishment of each plot, Directions to plot and location information (UTM NAD83) and environmental data were recorded on the plot field forms (Appendix B). Environmental data included: elevation, slope, aspect, landform, topographic position, soil texture and drainage, hydrologic (flooding) regime, and evidence of disturbance or wildlife use. Plot size and shape were recorded for all plots.

Table 2. Plot Sizes Used for Classification Sampling at GRBA.

Dominant physiognomy	Plot size	Plot area
Forest: trees have their crowns overlapping, usually forming 60-100% cover, and **Woodland**: open stands of trees with crowns usually not touching. Canopy tree cover 25-60%, OR exceeds shrub, dwarf-shrub, herb, and nonvascular cover.	Circular 11.28 m radius Square 20m x 20 m	400 m^2
Shrubland: shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover, and **Dwarf-shrubland** (e.g., heath): Shrubs less than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeds tree, shrub, herb, and nonvascular cover.	Circular 11.28 m radius Square 20m x 20 m	400 m^2
Herbaceous (e.g., grassland, meadow, marsh): Grasses or forbs dominant, usually forming more than 25% cover OR exceeds tree, shrub, dwarf-shrub, and nonvascular cover.	Circular 11.28 m radius Square 20m x 20 m	400 m^2 or 100 m^2
Nonvascular (e.g., fen, bog, cliff, scree slopes: nonvascular cover dominant, usually forming more than 25% cover.	Circular 11.28 m radius Square 20m x 20 m	400 m^2 or 100 m^2
Sparse vegetation (e.g., rock outcrops, talus slopes, fell-fields): less than 10% total vegetation cover.	Circular 11.28 m radius Square 20m x 20 m	400 m^2 or 100 m^2

The unvegetated surface cover was estimated and recorded as percent cover of bedrock, litter and duff, wood, bare soil, large rocks (>10 cm), small rocks (0.2-10 cm), sand (0.1-2 mm), lichens, and mosses. Next the vegetation was visually divided into strata, with the height and canopy cover of the dominant vegetation estimated for each stratum. Within each stratum, all taxa within the plot area were identified and the canopy cover of each taxon was estimated using cover classes (Table 3).

Table 3. Cover classes and vegetation strata.

Cover scales		Vegetation strata	
T	0–1%	T1	Emergent Canopy:
P	>1–5%	T2	Main Canopy
1	>5–15%	T3	Subcanopy
2	>15–25%	S1	Tall Shrubs
3	>25–35%	S2	Short Shrubs
4	>35–45%	S3	Dwarf-shrubs
5	>45–55%	H1	Herbaceous (Graminoids)
6	>55–65%	H2	Herbaceous (Forbs)
7	>65–75%	H3	Herbaceous (Ferns)
8	>75–85%	H4	Herbaceous (Tree seedlings)
9	>85–95%	A1	Floating-leaved aquatics
10	>95%	A2	Submerged-leaved aquatics

Additional species within the vegetation unit that occurred outside of sampled plots were listed separately to assist with creation of local descriptions (Appendix G). Species that were not identifiable in the field were collected for later identification and specimens were typically destroyed after identification. Species were recorded by scientific name familiar to researchers and a provisional vegetation type was assigned to the plot. Later nonstandard nomenclature was changed to match taxa in USDA PLANTS.

Plot photographs were taken using digital cameras at most sampling points. In 2003 two photographs were taken facing due north from the southeast corner of the 20m x 20m plot, which was where the plot location was measured from. One photo focused on the vegetation and one photo focused on the fuels ground cover (Charlet 2003). In 2008, generally five or six photographs were taken at each plot. Four photographs of the cardinal directions (N, E, S, and W) were taken from the plot center and at least one representative photo was taken of the plot from outside looking in. Photo numbers and azimuths of each photo were recorded on the field form. Information from each photo was entered into the photo database table.

For 2009 and 2010 field survey work, Rapid Assessment (RA) points were used to save field time. This methodology is very similar to standard NPS VIP methods, except: 1) RA points are plotless, so sample area was estimated rather than measured by laying out measuring tapes. Sample areas usually approximated the 400 m^2 plots varied and could represent the entire stand. 2) Cover of individual plant species was estimated for the most abundant and diagnostic species (up to 25 taxa) rather than requiring complete species lists with cover estimates. On species rich plots, searching out and identifying every species (most with less that 1% cover) requires significant time and data are of limited value for classification. 3) Soil texture and soil drainage were not required fields on RA forms.

In addition to the vegetation classification plots and rapid assessments, field crews occasionally collected vegetation and environmental data using observation points. The georeferenced data recorded at observation points reflected the vegetation of an area of variable spatial extent around the point rather than a measured plot, and are less detailed than an RA (Appendix B). These data were intended primarily to support modeling and photo-interpretation of the base imagery by the mapping team but were also used to quickly document locations and some vegetation and environmental characteristics of plant associations either when there were already ample plot data for classification or there was not enough time to for a full plot. Observation points were also useful in documenting locations of ecotonal, highly disturbed or otherwise anomalous vegetation and therefore unlikely to be classified under the rUSNVC. Conditions at each observation point are documented by one or more digital photographs and therefore can be used for photo-point monitoring.

For more detailed information on field sampling, see Appendix C for complete field manuals for 2003 and 2008-2009 field seasons.

Vegetation Data Collection

The goal of the NPS VIP is to sample and classify all the plant communities that occur within a park. Ideally for classification purposes, 3-5 representative plots of each plant community are sampled so some of the inherent variability can be quantified. Multiple samples of plant communities increase confidence if the type repeats on the landscape under similar environmental conditions. Sampling more plots per type is useful for mapping, but is usually at the expense of less common, frequently under-sampled types. Existing rUSNVC associations can be documented with a single plot, but under-sampled new types will be treated as provisional in the rUSNVC. On larger, more diverse parks like GRBA sampling is usually done over two field seasons using a sampling design that identifies all the diversity of biophysical settings to be surveyed and results in 400–500 total plots. Under-sampled and questionable types are targeted during the second field season. Existing vegetation data (legacy data) is also reviewed to assess if it can be incorporated into the classification dataset and reduce the sampling effort or be used as ancillary data.

The GRBA vegetation classification project was different from standard NPS VIP projects in that many of the vegetation plots were sampled for a different research project (fuels study) in 2003 with the balance being collected in 2008-2010. The vegetation plots sampled in 2003 used the standard NPS VIP field methods for collecting vegetation data specifically so the data could be used for classifying the vegetation at a later date.

The project area for this fuels study assessed a significantly larger area than the park environs and included lower elevation lands managed by the Bureau of Land Management (BLM) that surround the park. The GRBA NPS VIP project area on the other hand is limited to the area within the park boundary plus a 1 km buffer. It also includes the Administration Site near Baker, NV. In 2003 a total of 266 vegetation plots were sampled with 108 plots or 40% of the plots being sampled outside the GRBA project area, leaving 158 plots inside the park project area.

The purpose of the data collected in the 2003 study were to correlate fuel loading levels within the major vegetation types with fire regimes across different federal agency lands. Ten sites were randomly selected for sampling from each of the 31 alliances or association level map classes developed by combining some of the 43 map classes from the Eddleman and Jaindl (1994) vegetation map (Charlet 2003). Although appropriate for answering their research question, this stratified random sample design resulted in 8 associations being "over-sampled" for purposed of vegetation classification (>5 plots per association) for a total of 23 "extra" plots of the 158 plots sampled within GRBA boundaries. One association, *Picea engelmannii - (Pinus flexilis) / Carex rossii* Woodland was sampled in 15 sites.

In addition, the majority of the field samples in 2003 were located in the major upland types that burn such as black sagebrush, big sagebrush, pinyon-juniper woodlands, mountain mahogany woodlands, montane forests, and aspen forests. For the most part, few or no plots were sampled in alpine vegetation, grasslands, ponderosa pine woodlands, riparian and wetland types, shrub steppe, sparsely vegetated, disturbed vegetation, and uncommon shrubland and forest communities, such as chaparral, krummholz and avalanche chute shrublands. Also, many more plots were sampled in the more accessible northeastern and eastern central portions of the park with relatively few samples taken in the southern half of their project area (Charlet 2003).

In 2008, the vegetation classification portion of the GRBA NPS VIP project began. NatureServe was contracted to review the legacy data from the park. NS used the large amount field data from the 2003 project to develop a sampling design and conduct a 2-week field sampling to target vegetation types missed or under-sampled in 2003. Although data for 29 plant communities from 37 sites was collected, documenting many of the unsampled wetland, riparian, grassland, shrub steppe, ponderosa pine woodland, squaw apple (*Peraphyllum ramosissimum*) shrubland and alpine associations, it was apparent after initial review that more vegetation sampling was needed to fully characterize the diversity of vegetation at GRBA, especially in the less accessible southern portion of the park.

At the GRBA planning meeting on February 4, 2009, it was decided that GRBA staff would collect much of the necessary additional field data during the 2009 field season. To facilitate data collection, a NS ecologist trained GRBA staff to use the Rapid Assessment (RA) sampling method. The Rapid Assessment method saves time because it is plotless and less time is spent searching out the uncommon species, but the RA data can still be analyzed with data from full plots because the majority of species present are recorded at most sample sites. During the 2009 field season a total of 136 RA and Observation points were collected by largely by the GRBA staff, with MOJN and NS staff contributing some RA points during the field crew training week and a 1-week August site visit. Five of these RA points were created from vegetation data collected during an alpine ecosystem monitoring project by the Global Observation Research Initiative in Alpine Environments (GLORIA) during August 2009. The combined sampling efforts from 2003, 2008, and 2009 produced 331 plots, rapid assessment points and observation points from within the GRBA project area. Figure 3 displays sample site locations within Park boundaries. In Figure 3, it is evident that the 2009 field sampling (RA's) was better distributed than the plot sampling in 2003 and 2008.The combined dataset was analyzed during the spring of 2010 to produce the draft GRBA vegetation classification.

At the May 11, 2010 project update and mapping scoping meeting, GRBA staff reviewed the draft classification and identified several plant communities that were known to occur in the park, but not sampled. Five additional RA and Observation Points were collected during the May 2010 site visit to document plant communities not previously sampled within the project area. In addition, the GRBA administrative site situated to the east of the main park boundary near the town of Baker was added to the project area. During the October 2010 site visit to validate the draft vegetation map, four RA points were collected to characterize plant communities in the Administration Site.

Finally, in 2011 three AA points were used as observation points to document occurrences of three vegetation communities in the park that had been only sampled outside its boundaries. The final number of sample sites inside the project area is 343. Total sample sites both inside and outside GRBA project area in 451. Table 4 summarizes the field sampling results by location, sample type and year of collection.

Table 4. Summary of sample units by type, location and year of collection

Field Season	Total	Plots	Obs.Points	R.A. Points
Inside park boundary				
2003	158	158		
2008	37	35	2	
2009	136		2	134
2010	9		1	8
2011	3		*3	
Number of field samples used in classification	343	193	8	142
Outside park boundary				
2003	108	108		
All Field Samples	451			

* AA points were used to document 3 unsampled types for vegetation classification

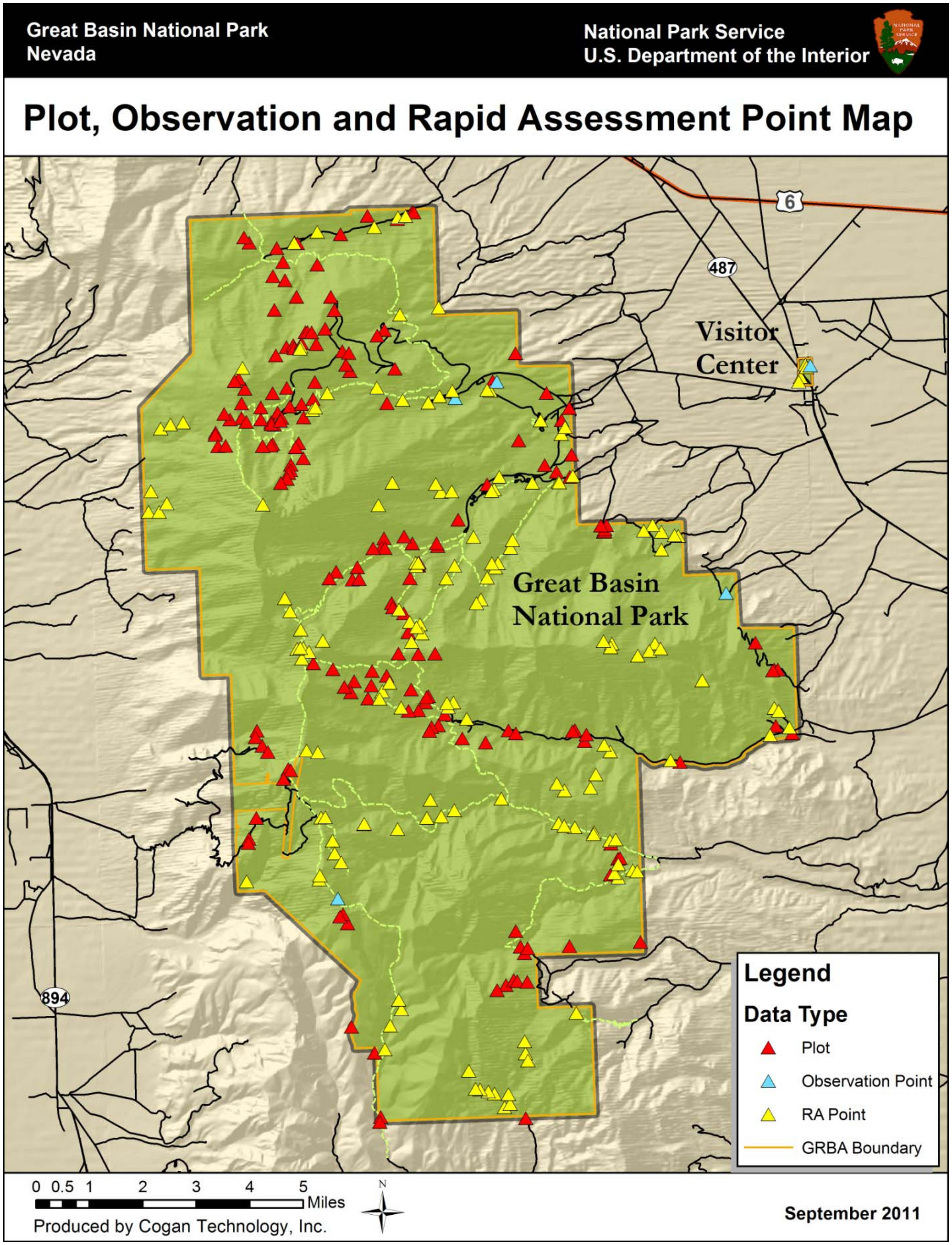

Figure 3. Locations of vegetation sample sites within GRBA boundaries. Several sites occur in the Administrative Site outside the main park boundary near Baker, NV.

Vegetation Classification

The first step in classifying the vegetation at GRBA was to prepare a preliminary classification of types that may occur within the park prior to vegetation sampling in May 2003. NatureServe provided GRBA staff, David Charlet and his field crews a list of 212 USNVC plant associations described from Nevada and Western Utah to use as provisional association names on the field forms when appropriate. Descriptions of many of these associations and alliances were also provided. The preliminary classification covered a broader area than the 2003 project area, but included many types that occur in the park, as well as associations that occur regionally, but were not reported in the South Snake Range and the surrounding basins.

Upon completion of the plot data collection in 2003, field data were entered into Microsoft Excel spreadsheets. These spreadsheets and completed plot forms were sent to NS to be entered into the PLOTS 2.0 database when funding became available in 2007. The PLOTS database is the standard NPS VIP database and uses Microsoft Access. The database mirrors the standard field form with fields and tables that matched all of the data recorded on the field forms. Following data entry, error checking was performed to minimize errors associated with duplicate entries or erroneously selected plant or association names or types. Next, the database was converted to meet NS standards and all of the plant taxonomy was standardized to the USDA Plants database. Unknown species, especially those with high cover were identified and mostly resolved as were other taxonomic issues including grouping subspecies and varieties judged to be ecologically similar. The field data from July 2008, 2009, 2010 and 2011 was similarly entered into the PLOTS database; all digital data were subjected to a second quality check (QC) to eliminate data entry errors. During this second QC, the database was examined, sorted, and queried to find missing data, misspellings, duplicate entries, and typographical errors.

The species lists were carefully examined to make sure that only USDA, NRCS PLANTS Database names and acronyms were used, and that species names and assignments to strata were consistent and logical. Plant lists were compared to the assigned association name for each plot, observation point and rapid assessment to assure correlation. A few minor non-standard species names could not be resolved. This database was used by NS to create a dataset for quantitative and qualitative analysis.

Dataset Preparation

A classification analysis was completed to quantitatively and qualitatively assign plots to the association level within the context of the rUSNVC. Vegetation data from the full vegetation plots and rapid assessments were used in the quantitative analysis, while observation point data were subjectively assigned to rUSNVC associations by NS ecologists.

After standardizing the database, NS found some additional inconsistencies when the field crews assigned taxa to strata. To correct these issues, NS ecologists first, standardized the strata for analysis so that all shrub and herbaceous vegetation (included tree seedlings) were in the proper strata. NatureServe then merged individual taxa into one of four strata (Table 5). For example, black sagebrush (*Artemisia nova*) was listed in both S3 and S2 strata.

Table 5. Conversion of strata from original data to final stratum used in analyses

Original Stratum	Description	Final Stratum	Code
T1	Emergent	Tree	T
T2	Canopy	Tree	T
T3	Subcanopy	Tree	T
S1	Tall Shrub	Shrub	S
S2	Short Shrub	Shrub	S
S3	Dwarf Shrub	Shrub	S
H	Herbaceous	Herbaceous	H
H1	Graminoids	Herbaceous	H
H2	Forbs	Herbaceous	H
H3	Ferns and Allies	Herbaceous	H
H4	Tree Seedlings	Herbaceous	H
N	Nonvascular	Nonvascular	N

Merging individual taxa within a plot meant combining the cover values of two records using the following formula: A + (B*(1-A)). Where A is the cover of the taxon in one occurrence and B is the cover of the taxon in the other occurrence. This formula takes into account the fact that individual plants within the strata being combined will likely shade each other so a simple addition of the cover values is rarely accurate, particularly when the cover values are moderate to high. Open stands tend to have much less species by strata shading.

Species and cover data for all vegetation plots were exported from the PLOTS database in list format for the analysis using the mid-points of the cover class ranges unless a discrete cover value was provided. All species records were retained and used in the analysis. The cover values for species which occurred in more than one stratum of an individual plot were combined to provide a single cover value per species per plot.

Data Analysis

Data analysis of vegetation plots involves both quantitative and qualitative analysis. The GRBA data prior to quantitative analysis in 2010 had multiple expert reviews (qualitative analysis) to create draft classifications to inform sampling design that targeted missing or under sampled vegetation types, first using 2003 data only for the 2008 field season, then adding 2008 data to develop targets for the 2009 field season, and again halfway through the 2009 field season. These expert reviews provided familiarity with the field data and vegetation at GRBA.

After data entry and QC of 133 RA points from the 2009 field season were added to the PLOTS database, quantitative data analysis could begin. Then the dataset was imported into PC-ORD (MacCune and Mefford 1999). The final dataset used in multivariate analysis for the classification had 336 samples and 446 taxa (combinations of taxa and strata). The primary quantitative analytical method was ordination using Nonmetric Multidimensional Scaling (NMS) using Sorensen (Bray-Curtis) distance measure. This ordination method works well with non-normal, discontinuous, percent cover species abundance data (McCune and Grace 2002).

NatureServe ecologists used an analytical, iterative classification process beginning with all GRBA plots and systematically removing outliers and groups of plots that were clearly different at each stage. Data were interpreted through 3- dimensional (Figures 4 & 5) and 2-dimensional (Figure 6) graphical representations. The data behind the outliers and groups were manually analyzed to classify plots to plant association level. Additional quantitative or qualitative analysis was done on larger groups, such as pinyon-juniper woodlands.
The first three runs of the NMS ordination analysis were used to identify and remove outlier plots, which are usually single or pairs of plots strongly dominated by uncommon species such as *Bromus inermis, Hulsea algida, Lomatium, graveolens,* pairs of mixed talus slope shrublands*, Carex scopulorum* dominated wetlands or *Cercocarpus intricatus – Glossipetalon spinescens* shrublands*.* Figure 4 shows a 3-D image of the GRBA plots with outlier plots clearly evident. The first major groups to be identified and removed were alpine vegetation, followed by groups dominated mesic and wet taxa and riparian shrublands dominated by willows.

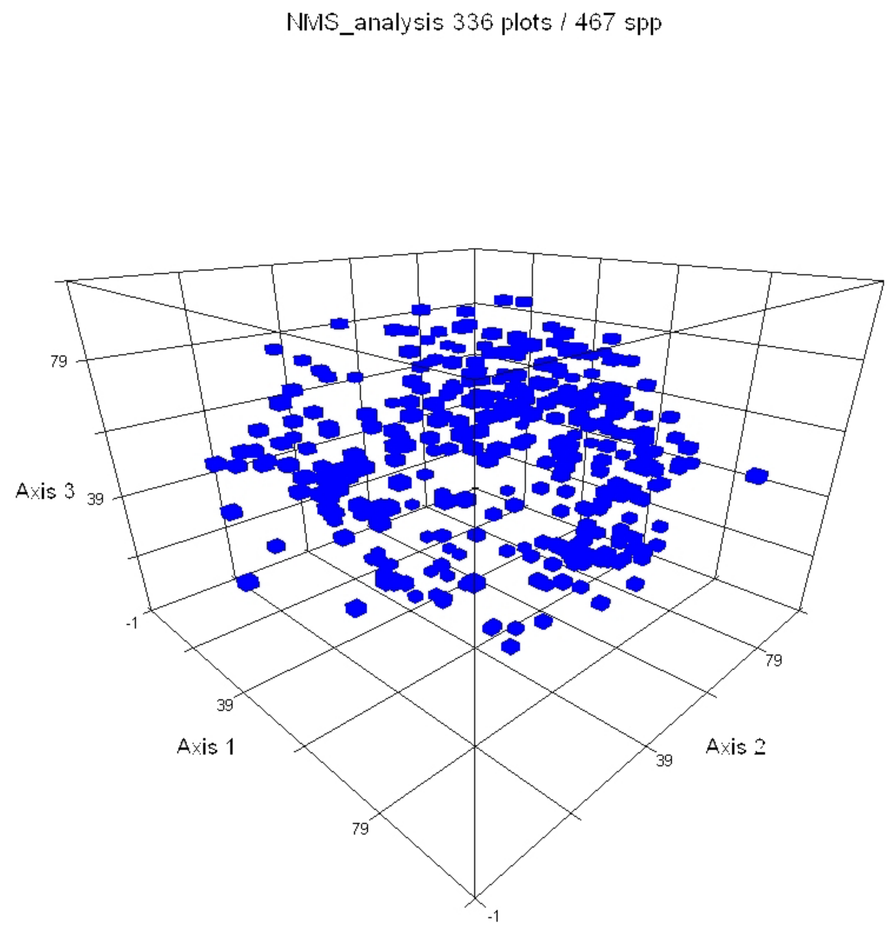

Figure 4. 3-D representation of GRBA dataset using Nonmetric Multidimensional Scaling (NMS) ordination. Note outliers which were identified and removed before underlining grouping could be seen.

Next a large group of pinyon – juniper woodland plots were identified and separated from the remaining plots. Figure 5 unmistakably shows the separation in 3-D space. The 2-D image in Figure 6 of the first and third axes identifies the pinyon-juniper plots that can be removed for further analysis. The remaining major groups include riparian woodlands and shrublands, dry-mesic conifer woodlands, and dry shrublands. The species composition and environmental setting of these and other minor groups was further analyzed and classified to the association level of the rUSNVC. See Table 6 and Appendix D & E for final classification results.

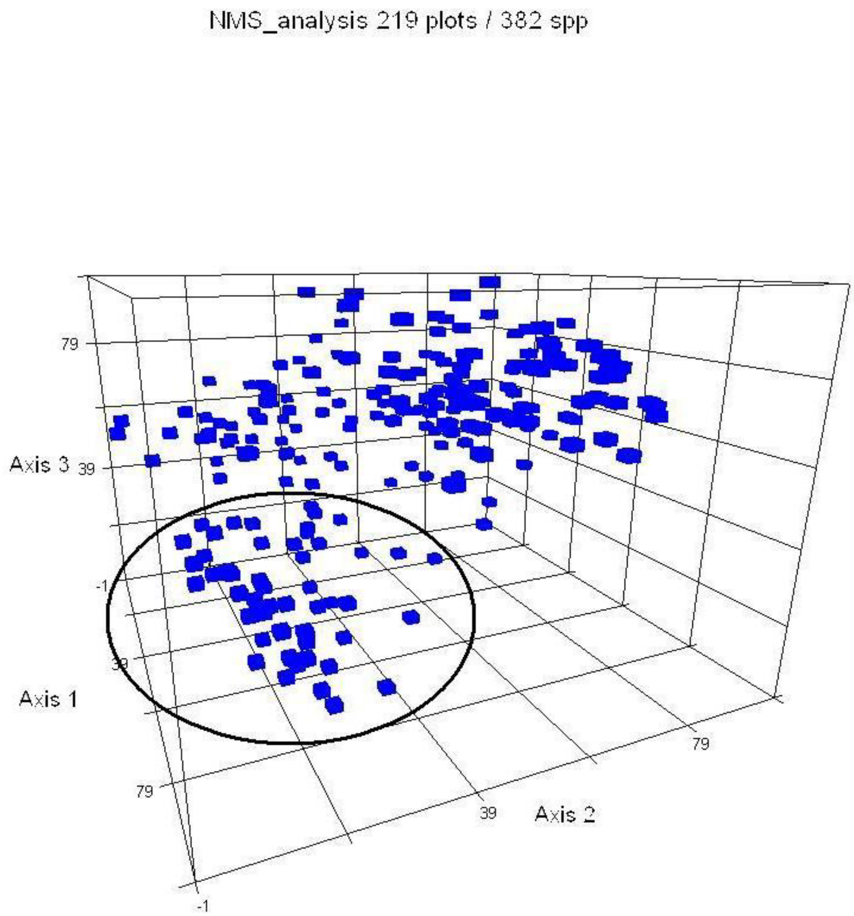

Figure 5. 3-D representation of GRBA dataset using Nonmetric Multidimensional Scaling (NMS) ordination. Note group of pinyon-juniper woodlands clearly identified from remaining unclassified plots.

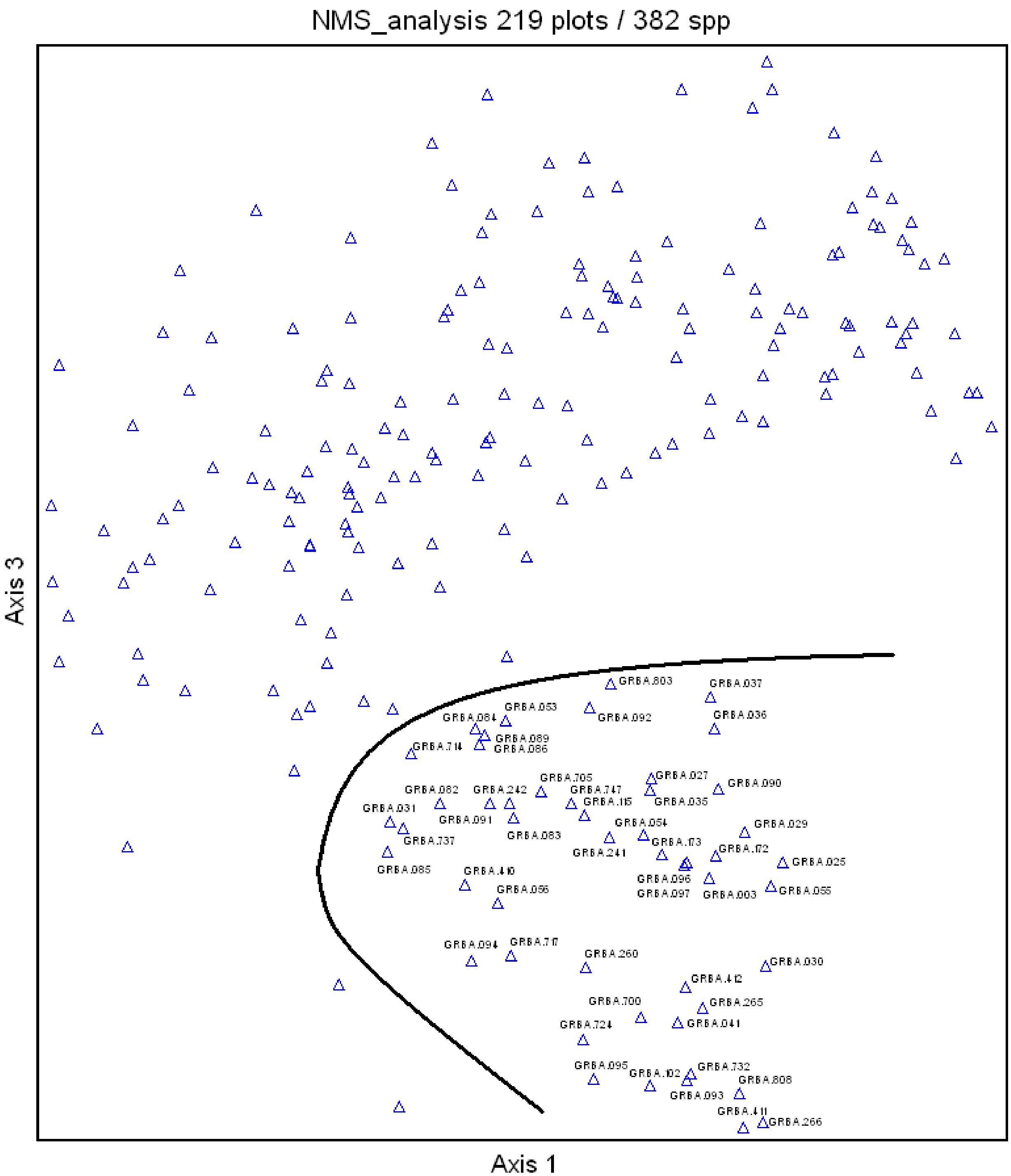

Figure 6. 2-D representation of GRBA dataset using Nonmetric Multidimensional Scaling (NMS) ordination of the first and third axes identifies the pinyon-juniper plots that can be removed for further analysis

RESULTS

Vegetation Classification

There is high diversity of plant communities within GRBA as was expected by the considerable variation in elevation and moisture gradients, as well as a diversity of substrates. The final GRBA classification of the 343 plots, RA points, and observation points from within the park resulted in 136 plant communities (associations or park specials) (Table 6). The vegetation analysis produced 105 rUSNVC associations and 31 Park Special vegetation types. Park Specials represent local plant communities that differ significantly from existing rUSNVC association concepts, but lack enough data to describe a new association. Park Special types are not officially included in the rUSNVC hierarchy, but many times can be linked to the Alliance or Group level for classification and mapping purposes. With additional data and analysis, some of these Park Special plant communities may become new associations or may be subsumed into existing rUSNVC associations. Others sites might be unique vegetation and remain a Park Special. These plant communities can be distinguished by [Park Special] in name or by the element code. Element codes for rUSNVC associations begin with CEGL versus CEPS for park specials. In addition lower confidence associations within the rUSNVC are indicated by [Provisional] in the name. Parenthesizes in the name indicate the species may or may not be present in a given stand. All plant communities are listed in Table 6 with element code and number of plots sampled in GRBA and total number of plots sampled (GRBA & adjacent BLM land). Appendix D list plot codes for by plant community so individual plot data can be referenced in the GRBA PLOTS database.

When GRBA plant communities are summarized by physiognomic class, there are a total of 60 forests and woodlands, 37 shrublands, 4 shrub herbaceous (shrub steppe), 30 herbaceous vegetation types, and five sparsely vegetated types. There were 107 uplands plant communities, 14 riparian woodland and forests, 8 riparian shrublands and 7 herbaceous wetlands. Three samples were unclassified, one because it was ecotonal, and two were observation points that only had species lists and lacked cover data. Diagnostic characteristics of the plant communities in the GRBA vegetation classification are clarified in Appendix F Field Key to the Vegetation of GRBA).

The vast majority of these vegetation types at GRBA are dominated by native species with only 8 of 136 plant communities considered semi-natural or invasive in that they are dominated by introduced plant species or have a stratum, often the herbaceous stratum dominated by introduced plants. These types were mostly the result of historic livestock grazing disturbance such as the rabbitbrush shrubland below the orchards that Absalom Lehman planted near the Lehman Caves Visitor Center; seeding crested wheatgrass in disturbed pastures in the valley bottoms along lower Snake Creek or in the NPS Administrative Area near Baker, or the introduced species dominated understory (usually *Poa pratensis, Bromus inermis*, or other forage species) of aspen and other forest types. The widespread, annual introduced grass, *Bromus tectorum* (cheatgrass) has invaded many stands. In disturbed areas, especially on dryer, lower elevation sites, it may strongly dominate the vegetation forming the *Bromus tectorum* Semi-natural Herbaceous Vegetation (CEGL003019) association. It was sample once outside the park boundaries in 2003, but was documented in the park during the accuracy assessment (AA). Disturbed types are often overlooked and under-sampled by field crews. It is sometimes difficult to separate degraded natural communities from semi-natural communities dominated by introduced species.

One native disturbance or ruderal type, dominated by the native dwarf-shrub *Gutierrezia sarothrae* (snakeweed) was sampled once near GRBA, but not included in the vegetation classification because it were not sampled in the park. *Gutierrezia sarothrae* is often present in dry shrublands, but not strongly dominant. Further sampling may document *Gutierrezia sarothrae* Dwarf-shrubland Alliance (A2528) within in the park.

The complete GRBA vegetation classification is provided in Appendix E within the rUSNVC hierarchical structure representing 18 macrogroups, 35 groups, 77 alliances, and 136 association level units. The classification is displayed within the rUSNVC hierarchical structure using the Division level with hierarchy codes to organize the middle and lower level units (Macrogroup to Association). This is the most current rUSNVC Hierarchy however, placement and names of some classification units may change slightly at Group and Alliance levels as this new hierarchy is finalized. The Alliance level was adapted from the previous USNVC classification and should be considered provisional until peer reviewed and standardized. The GRBA Association level classification is based on data collected at GRBA and concepts should not change. Also included is the number of samples sites (Plots, Observation Points or Rapid Assessments Points) per association within the GRBA project area.

In addition, GRBA NPS_VIP Map Classes have been inserted between the Group and Alliance levels in Appendix E to clarify how the vegetation classification relates to the GRBA map legend. Map classes often vary in scale depending on how distinctive the vegetation being mapped. Because of its hierarchical nature of the rUSNVC can often match the different map class scales with standard classification units. The concepts of the GRBA map classes are clarified in the Appendix H Field Key to the Map Classes of GRBA.

In the past, NPS VIP projects have been provided with both local and global descriptions for all association level units. Changes in the program guidance now recommend only local descriptions be written for NPS VIP projects. Local descriptions are based only on information collected at the park vs. range wide or "global" descriptions. At GRBA because of high number of associations with only one or two plots and limited funding it was decided that local descriptions would be written for the major associations covering large areas of the park that had adequate plot information (at least 3 plots), and selected Alliances and Group level units. Data from associations represented by only 1 or 2 plots were incorporated into alliance and group level descriptions. A total of 53 local descriptions were written (22 associations, 23 alliances and 8 groups) and can be found in Appendix G. Selected global information such as Global Range and Global Summary fields were provided with the local descriptions when available. In Appendix E, described vegetation types were highlighted at the various hierarchy levels to clarify what which types have local descriptions written. The number of plots per association level unit was also provided and is a major criterion for deciding which types got local descriptions written. For associations, alliances and groups without local descriptions written global descriptions may be available through NatureServe Explorer (http://www.natureserve.org/explorer) and http://www.usnvc.org.

Table 6. Summary of the association level of rUSNVC for the GRBA Vegetation Classification. Associations and Park Specials are listed with the number of sites sampled by type within GRBA project area. The total number of plots, which includes nearby field samples outside of project area, is also provided for comparison. Plant communities with "*" have a local description written in Appendix G. Field data from outside the project area was used to augment the local descriptions. Other common vegetation types are described at the alliance or group level of the rUSNVC.

Association	Element code	GRBA Field Samples	Total Field Samples
Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum Forest	CEGL005418	3	3
Abies concolor - Populus tremuloides / Carex scopulorum Forest	CEGL005419	1	1
Abies concolor - Populus tremuloides Avalanche Chute Shrubland	CEGL005420	1	1
Abies concolor - Pseudotsuga menziesii / Carex rossii Forest	CEGL000431	1	1
Abies concolor / Arctostaphylos patula Forest	CEGL000242	7	7
Abies concolor / Cercocarpus ledifolius Woodland	CEGL000885	4	4
**Abies concolor / Symphoricarpos oreophilus* Forest	CEGL000263	7	10
Abies concolor Rock Outcrop Sparse Vegetation [Park Special]	CEPS009594	1	1
Acer glabrum Drainage Bottom Shrubland	CEGL001062	1	1
Achnatherum lettermanii Herbaceous Vegetation	CEGL005354	1	1
Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata) Semi-natural Herbaceous Vegetation	CEGL005266	1	1
**Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland	CEGL002820	3	3
Aquilegia scopulorum - Eriogonum holmgrenii Fell-field Herbaceous Vegetation	CEGL005421	3	3
Arctostaphylos patula / Ceanothus martinii Shrubland	CEGL005422	2	2
Arctostaphylos patula Shrubland	CEGL002696	1	1
**Artemisia arbuscula* ssp. *arbuscula / Pseudoroegneria spicata* Shrub Herbaceous Vegetation	CEGL001412	2	3
Artemisia nova / Achnatherum hymenoides Shrubland	CEGL001422	1	7
Artemisia nova / Poa fendleriana Shrubland	CEGL002698	1	1
Artemisia nova / Pseudoroegneria spicata Shrubland	CEGL001424	1	1
Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Semi-natural Shrubland	CEGL002699	2	7
Artemisia tridentata / Elymus elymoides Shrubland	CEGL001001	1	1
Artemisia tridentata ssp. *tridentata - Peraphyllum ramosissimum - Chamaebatiaria millefolium* Shrubland [Park Special]	CEPS009595	1	1
**Artemisia tridentata* ssp. *tridentata / Agropyron cristatum* Semi-natural Shrubland [Park Special]	CEPS009566	2	4
**Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Shrubland	CEGL001016	3	3
Artemisia tridentata ssp. *tridentata / Pleuraphis jamesii* Shrubland	CEGL001015	1	1
Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus* ssp. *trachycaulus* Shrubland	CEGL001034	5	7
Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland	CEGL001038	7	7
Artemisia tridentata ssp. *vaseyana / Poa (glauca, secunda)* Shrubland	CEGL005423	4	4
Artemisia tridentata ssp. *vaseyana / Poa fendleriana* Shrubland	CEGL002812	4	5

Association	Element code	GRBA Field Samples	Total Field Samples
Astragalus kentrophyta - Eriogonum holmgrenii Fell-field Herbaceous Vegetation [Park Special]	CEPS009597	1	1
Balsamorhiza sagittata Herbaceous Vegetation [Park Special]	CEPS009598	1	1
Betula occidentalis / Cornus sericea Shrubland	CEGL001161	1	1
Betula occidentalis / Mesic Graminoids Shrubland	CEGL002654	1	1
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	CEGL005264	1	1
Bromus tectorum Semi-natural Herbaceous Vegetation	CEGL003019	1	1
Carex elynoides - Geum rossii Herbaceous Vegetation	CEGL001853	2	2
Carex elynoides - Phlox pulvinata - Poa secunda Herbaceous Vegetation	CEGL005424	3	3
Carex nebrascensis Herbaceous Vegetation	CEGL001813	2	2
**Carex scopulorum* Herbaceous Vegetation	CEGL001822	3	3
Carex subnigricans - Geum rossii - Sibbaldia procumbens Snowbed [Provisional]	CEGL005425	1	1
**Cercocarpus intricatus - Glossopetalon spinescens* Shrubland	CEGL005426	4	5
Cercocarpus ledifolius / Arctostaphylos patula Woodland [Provisional]	CEGL005355	5	5
Cercocarpus ledifolius / Artemisia tridentata ssp. *vaseyana* Woodland	CEGL001022	2	2
Cercocarpus ledifolius / Pseudoroegneria spicata Shrubland	CEGL000967	1	1
Cercocarpus ledifolius / Symphoricarpos oreophilus Woodland	CEGL000970	9	9
Cercocarpus ledifolius Rock Outcrop Sparse Vegetation [Park Special]	CEPS009599	1	1
Chrysothamnus viscidiflorus Shrub Herbaceous Vegetation [Provisional]	CEGL002530	1	1
Cymopterus nivalis - Erigeron leiomerus - Poa secunda Herbaceous Vegetation [Park Special]	CEPS009600	1	1
Dasiphora fruticosa ssp. *floribunda / Elymus trachycaulus* Shrub Herbaceous Vegetation [Park Special]	CEPS009601	1	1
**Dodecatheon alpinum* Herbaceous Vegetation [Park Special]	CEPS009590	5	5
Elymus trachycaulis Herbaceous Vegetation	CEGL005427	3	3
Ericameria nauseosa / Bromus tectorum Semi-natural Shrubland	CEGL002937	1	1
Geum rossii - Calamagrostis purpurascens Herbaceous Vegetation [Park Special]	CEPS009602	1	1
Geum rossii - Phlox pulvinata Fell-field Herbaceous Vegetation	CEGL005428	2	2
Geum rossii Herbaceous Vegetation	CEGL001964	1	1
Hulsea algida - Selaginella watsonii Herbaceous Vegetation [Provisional]	CEGL005429	1	1
Juncus balticus Herbaceous Vegetation	CEGL001838	1	1
Juncus nevadensis - Poa secunda Herbaceous Vegetation [Park Special]	CEPS009603	1	1
Leymus cinereus Herbaceous Vegetation	CEGL001479	2	2
Lomatium graveolens var. alpinum Herbaceous Vegetation [Park Special]	CEPS009604	1	1
Peraphyllum ramosissimum - Artemisia tridentata Shrubland	CEGL005430	2	2
Petrophyton caespitosum Sparse Vegetation [Park Special]	CEPS009605	1	1
Phlox pulvinata Herbaceous Vegetation [Provisional]	CEGL002740	1	1
Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis) Krummholz	CEGL005432	4	4
Picea engelmannii - (Pinus flexilis) / Carex rossii Woodland	CEGL005433	16	16
Picea engelmannii - Populus tremuloides / Arctostaphylos patula Forest [Park Special]	CEPS009644	1	1
Picea engelmannii - Populus tremuloides / Mesic Forb Forest [Park Special]	CEPS009587	3	3
Picea engelmannii - Populus tremuloides Avalanche Chute Shrubland	CEGL005431	2	2
Picea engelmannii / Carex scopulorum Woodland	CEGL005446	4	4
Picea engelmannii / Juniperus communis Forest	CEGL005925	9	9
Picea engelmannii / Moss Forest	CEGL000371	2	2

Association	Element code	GRBA Field Samples	Total Field Samples
**Picea engelmannii / Ribes montigenum* Forest	CEGL000374	8	8
Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula Forest	CEGL005434	9	9
Pinus flexilis / Artemisia tridentata ssp. *vaseyana* Woodland [Park Special]	CEPS009588	1	2
Pinus flexilis / Symphoricarpos oreophilus Woodland	CEGL005321	1	1
Pinus flexilis Bedrock Sparse Vegetation [Park Special]	CEPS009606	1	1
Pinus flexilis / Selaginella watsonii Krummholz	CEGL005435	2	2
**Pinus longaeva / (Ericameria discoidea, Ribes montigenum)* Woodland	CEGL005447	11	15
Pinus longaeva / Arctostaphylos patula Woodland [Park Special]	CEPS009591	2	2
Pinus longaeva / Symphoricarpos oreophilus Woodland [Park Special]	CEPS009593	1	1
Pinus monophylla - Juniperus osteosperma / Artemisia arbuscula Woodland	CEGL000830	1	3
**Pinus monophylla - Juniperus osteosperma / Artemisia nova* Woodland	CEGL000831	2	14
**Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* ssp. *vaseyana* - Mixed Shrub Woodland	CEGL005436	5	10
Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. *vaseyana / Pseudoroegneria spicata* Woodland	CEGL000833	2	2
**Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Woodland	CEGL000832	7	15
**Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii* Woodland [Park Special]	CEPS009607	2	2
**Pinus monophylla – (Juniperus osteosperma) / Cercocarpus intricatus* Woodland	CEGL005437	3	6
**Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland	CEGL000828	5	10
Pinus monophylla - Juniperus osteosperma / Glossopetalon spinescens - Artemisia tridentata - Purshia stansburiana Woodland [Provisional]	CEGL005438	2	2
Pinus monophylla - Juniperus osteosperma / Peraphyllum ramosissimum Woodland	CEGL005439	1	3
Pinus monophylla - Juniperus osteosperma / Poa (fendleriana, secunda) Woodland	CEGL005440	2	2
Pinus monophylla - Juniperus osteosperma / Prunus virginiana Woodland	CEGL000836	1	1
Pinus monophylla - Juniperus osteosperma / Purshia tridentata Woodland [Park Special]	CEPS009608	3	3
**Pinus monophylla - Juniperus osteosperma /* Sparse Understory Woodland	CEGL000829	5	8
Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus Woodland [Provisional]	CEGL005441	2	2
**Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland [Provisional]	CEGL005442	4	4
Pinus ponderosa - Abies concolor Riparian Forest [Park Special]	CEPS009609	2	2
Pinus ponderosa / Arctostaphylos patula Woodland	CEGL000842	1	1
Poa fendleriana - Astragalus kentrophyta Herbaceous Vegetation [Park Special]	CEPS009610	1	1
Poa secunda - Arenaria congesta Herbaceous Vegetation [Park Special]	CEPS009611	1	1
Poa secunda - Cirsium eatonii Post-burn Herbaceous Vegetation [Park Special]	CEPS009612	1	1
Polemonium viscosum - Castilleja nana Alpine Rock Sparse Vegetation [Provisional]	CEGL005443	4	4
Polygonum bistortoides Herbaceous Vegetation [Park Special]	CEPS009613	2	2
Populus angustifolia / Artemisia tridentata ssp. *tridentata - Prunus virginiana* Woodland [Park Special]	CEPS009614	1	1
Populus angustifolia / Cornus sericea Woodland	CEGL002664	1	1

Association	Element code	GRBA Field Samples	Total Field Samples
Populus angustifolia / Prunus virginiana Woodland	CEGL000651	2	2
Populus angustifolia / Rosa woodsii Forest	CEGL000653	2	2
**Populus tremuloides - Abies concolor / Arctostaphylos patula* Forest	CEGL000522	8	8
Populus tremuloides - Abies concolor / Mesic Graminoid Forest [Park Special]	CEPS009586	1	1
Populus tremuloides - Abies concolor / Poa pratensis Semi-natural Forest	CEGL002947	1	1
Populus tremuloides - Abies concolor / Symphoricarpos oreophilus Forest	CEGL000523	6	6
**Populus tremuloides - Pinus flexilis* Forest	CEGL000540	6	6
Populus tremuloides / Artemisia tridentata Forest	CEGL000572	1	1
Populus tremuloides / Betula occidentalis Forest	CEGL002650	4	4
Populus tremuloides / Bromus carinatus Forest	CEGL000573	2	2
Populus tremuloides / Invasive Perennial Grasses Forest	CEGL003748	1	1
Populus tremuloides / Juniperus communis Forest	CEGL000587	1	1
Populus tremuloides / Prunus virginiana - Symphoricarpos oreophilus Forest [Park Special]	CEPS009645	1	1
Populus tremuloides / Ribes spp. Woodland [Park Special]	CEPS009589	1	1
Populus tremuloides / Rosa woodsii Forest	CEGL003149	1	1
Populus tremuloides / Symphoricarpos oreophilus Forest	CEGL000610	3	3
Prunus virginiana - Mixed Shrub Talus Shrubland [Provisional]	CEGL005444	2	2
Prunus virginiana - Penstemon rostriflorus Post-burn Shrubland [Park Special]	CEPS009596	1	1
Pseudoroegneria spicata - Hesperostipa comata Herbaceous Vegetation	CEGL001679	1	1
Pseudoroegneria spicata Herbaceous Vegetation	CEGL001660	2	2
Pseudotsuga menziesii / Arctostaphylos patula Woodland	CEGL000423	1	1
Purshia tridentata - Artemisia tridentata ssp. *tridentata* Shrubland	CEGL001054	1	1
Purshia tridentata / Hesperostipa comata Shrub Herbaceous Vegetation	CEGL001498	1	1
**Ribes (cereum, montigenum) - Ericameria discoidea* Shrubland [Provisional]	CEGL005445	4	4
Rosa woodsii Shrubland	CEGL001126	1	1
Salix bebbiana / Mesic Graminoids Shrubland	CEGL001174	2	2
Salix boothii / Mesic Forbs Shrubland	CEGL001180	1	1
Salix boothii / Mesic Graminoids Shrubland	CEGL001181	3	3
Salix exigua / Mesic Graminoids Shrubland	CEGL001203	1	1
**Sarcobatus vermiculatus / Artemisia tridentata* Shrubland	CEGL001359	2	3
Symphoricarpos oreophilus Shrubland	CEGL002951	1	1
Unclassified Plots		3	3
Total (136 total plant communities)		343	410

NatureServe and Natural Heritage Programs have a system of imperilment ranks for species and plant communities. Ideally each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of of known distinct localities or populations. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences. Although many of the rUSNVC associations at GRBA are not ranked (45 GNR) or considered secure (41 G4-G5), there are 19 associations of concern listed in Table 7 (G1= 3, G2 = 5, G2G= 4 and G3 = 7). These global ranks have not been updated based on new in formation from GRBA.

Table 7. List of G1-G3 Global Ranks for Associations at GRBA

Global Rank	Element Code	Association
G1	CEGL000833	*Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* ssp. *vaseyana / Pseudoroegneria spicata* Woodland
G1	CEGL001054	*Purshia tridentata - Artemisia tridentata ssp. tridentata* Shrubland
G1Q	CEGL000836	*Pinus monophylla - Juniperus osteosperma / Prunus virginiana* Woodland
G2	CEGL001016	*Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Shrubland
G2	CEGL000970	*Cercocarpus ledifolius / Symphoricarpos oreophilus* Woodland
G2	CEGL001660	*Pseudoroegneria spicata* Herbaceous Vegetation
G2	CEGL001498	*Purshia tridentata / Hesperostipa comata* Shrub Herbaceous Vegetation
G2?	CEGL000431	*Abies concolor - Pseudotsuga menziesii / Carex rossii* Forest
G2G3	CEGL000653	*Populus angustifolia / Rosa woodsii* Forest
G2G3	CEGL000540	*Populus tremuloides - Pinus flexilis* Forest
G2G3Q	CEGL001479	*Leymus cinereus* Herbaceous Vegetation
G2Q	CEGL000651	*Populus angustifolia / Prunus virginiana* Woodland
G3	CEGL001161	*Betula occidentalis / Cornus sericea* Shrubland
G3	CEGL002654	*Betula occidentalis /* Mesic Graminoids Shrubland
G3	CEGL001022	*Cercocarpus ledifolius / Artemisia tridentata* ssp. *vaseyana* Woodland
G3	CEGL005925	*Picea engelmannii / Juniperus communis* Forest
G3	CEGL002650	*Populus tremuloides / Betula occidentalis* Forest
G3	CEGL001174	*Salix bebbiana /* Mesic Graminoids Shrubland
G3	CEGL001180	*Salix boothii /* Mesic Forbs Shrubland

The Heritage Conservation Status Global Rank which best characterizes the relative rarity or endangerment of the Association worldwide. Values for Global Rank are:

G1 = Critically imperiled globally = Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s)
G2 = Imperiled globally = Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s)
G3 = Rare or uncommon = Generally 21-100 occurrences; either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factor(s)

G4 = Widespread, abundant, and apparently secure, but with cause for long-term concern = Uncommon but not rare (although it may be quite rare in parts of its range, especially at the periphery); apparently not vulnerable in most of its range
G5 = Demonstrably widespread, abundant and secure = Common, widespread, and abundant (although it may be quite rare in parts of its range, especially at the periphery); not vulnerable in most of its range
G#G# = Numeric range rank (range no greater than 2) = Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate; for example, a G1G3 rank indicates the rank could be G1, G2, or G3
GNR = Not yet ranked = Status has not yet been assessed
GNA = Rank not applicable
GH = Historical = Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with potential for restoration (e.g., *Castanea dentata* Forest)
GX = Extirpated = Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species
GU = Unrankable = Status cannot be determined at this time
Qualifiers:
? = Inexact numeric rank = A question mark added to a rank expresses an uncertainty about the rank in the range of 1 in either way on the 1-5 scale; for example, a G2? rank indicates that the rank is thought to be G2, but could be G1 or G3 (Note: G1? and G5? are both valid ranks)
Q = Questionable taxonomy = A "Q" added to a rank denotes questionable taxonomy; it modifies the degree of imperilment and is only used in cases where the type would have a less imperiled rank if it were not recognized as a valid type (i.e., if it were combined with a more common type); a GUQ rank often indicates that the type is unrankable because of daunting taxonomic question.

DISCUSSION

Collecting field samples was an amazing collaborative effort between the MOJN and GRBA staff, contractors and volunteers. Overall, I think we captured most of the vegetation diversity that exists within GRBA, filling in the gaps in the from the 2003 field data during the 2008 and 2009 field seasons. Some over-sampling of certain plant communities is the result of the 2003 legacy data which used a stratified random sampling design to answer questions about the distribution of fuels across the landscape. Although appropriate for 2003 project, field data from a stratified random sampling design can also have issues of representativeness and over/under sampling. Random sites may not be representative of vegetation type, or worse fall in a transition zone (ecotone) between two distinct vegetation types, which can confound analysis. For efficiency, stratified random sampling designs are not ideal for field sampling all the vegetation types, as crews may walk past similar vegetation types or new unsampled vegetation types on route to a random point. In a sense, the 2003 sampling effort assessed the accuracy of the map classes in the Eddleman and Jandl 1994 vegetation map by using the map classes to stratify the random plots. Charlet (2003) summarized the percent of correct predictions from and reported low accuracy (22%) of the Eddleman and Jandl 1994 map. Still the 2003 project provided foundation of valuable field data for the classification and I appreciate the foresight of the decision makers for using and NPS for funding the NPS_VIP field crew training to ensure the data would be compatible with future data collected at the park.

In addition, although only 60% of the plots from 2003 (158 of 266 plots) was used to classify the vegetation of GRBA, all the 2003 data was classified and 67 of the 108 field samples were classified to associations that occurred within the park and could be used to augment local descriptions of selected types.

Consistency in data collection methodology can be an issue when vegetation is sampled by numerous field members. At GRBA, even with having dozens of field personnel collecting data, data collection inconsistencies were minimized by field methodology training sessions at the beginning of the 2003 and 2009 field seasons and using trained staff in 2008. Most of the inconsistencies are minor; however one issue that needed to be addressed was inconsistent identification of big sagebrush to subspecies because it affected vegetation classification. The rUSNVC classifies sagebrush to subspecies because these taxa occur in ecologically different environments. Misidentification or not noting the subspecies is understandable because big sagebrush subspecies can hybridize and are often challenging to identify especially at GRBA. Because of this, an elevation breakof approximately 7500 feet (2300 m), landform type, and total floristic composition were used to separate the montane-subalpine mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) shrubland and shrub steppe from the lower elevation basin big sagebrush shrublands (*A. t.* ssp. *tridentata)* when subspecies was not specified. This method was also used to separate pinyon – juniper woodlands with different subspecies of big sagebrush in the understory. Wyoming big sagebrush *(Artemisia tridentata* ssp. *wyomingensis)* is not reported from within the park boundaries and likely does not occur there (Clifton 2008).

Future Recommendations

This project represents the best efforts put forth by NPS and NS staff and others over a relatively short time period for such a challenging environment with diverse vegetation. In order to create the best possible "long-term" vegetation classification for GRBA this project should not be viewed as final, but park staff should continue to explore the park and observe the vegetation to look for additional types. Present and future NPS staff should be encouraged to scrutinize the classification, to better understand the full range of variation of undersampled types and document unsampled and undersampled types by using the field key and doing additional rapid assessment points.

Research and Management Opportunities

A current vegetation classification presents several research and management opportunities. Research could range from setting up a photo monitoring project to periodically retake plot photographs to document vegetation change over time to mining the PLOTS database for locations of species of concern both for rare plants or invasive species. Several of the rare alpine plants at GRBA such as *Eriogonum holmgrenii* (globally critically imperiled, G1) were sampled in the course of this project.

When the GRBA Vegetation Map is complete the data in the PLOTS database can be related spatially beyond the sample site location to other similarly mapped vegetation.

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APPENDIX A: ECOLOGICAL SYSTEM GAP ANALYSIS AND SAMPLING DESIGN REVIEW

NatureServe May 2009

Introduction and Methods

As part of completing deliverables for Task 2: Review Legacy Data and Sample Design and Task 10: Vegetation Sampling Field Training, a gap analysis using spatial data was completed. The purpose of this "Gap" analysis is identify additional sampling needed to classify, describe and map all vegetation types at GRBA and develop a sampling design to target likely locations under-sampled vegetation types. This was done initially with just the 2003 data for the 2008 field season, and was updated with 2008 data to inform the 2009 sampling.

The steps used were to 1) determine relative abundances of Ecological Systems mapped within the boundaries of GRBA, 2) compare the number of sampled plots labeled to each system, and 3) identify ecological systems that need additional sampling (gaps).

For baseline Ecological Systems abundances (area) we used NatureServe Terrestrial Ecological System and Land Cover for the Coterminous US, version 2.6. This map is a composite of regional and national mapping efforts such as SWReGAP, LandFire EVT that have had systematic ecological review by NS and Heritage Program Ecologists. For baseline plots I used vegetation sampling data from 2003 and 2008 within the park boundaries. Plots were labeled to Ecological Systems by NatureServe and summarized by total number and relative abundance of plots. I also included plot information from plots sampled outside the park boundary (environs) generally at lower elevations that may be useful for vegetation classification, but not mapping.

Results and Discussion

The Gap analysis results are summarized in Table 1. This table shows a total of 24 ecological systems were mapped within GRBA boundaries and 10 other systems that were not mapped. These are sorted with the most abundant types to the least abundant types. Some of these types such as Inter-Mountain Basins Big Sagebrush Shrubland and Inter-Mountain Basins Mixed Salt Desert Scrub mostly occur in basins and are peripheral to GRBA if they occur at all within the park boundaries. Also, two of the mapped types Rocky Mountain Gambel Oak-Mixed Montane Shrubland and Rocky Mountain Bigtooth Maple Ravine Woodland do not occur at GRBA and are small mapping errors inherent in many regional-scale vegetation maps. Total area of each mapped system is recorded with relative percent of that system at GRBA are displayed in the second and third column of Table 1.

The numbers of plots were tallied by ecological systems from within the park boundaries and total # plots (including environs). Results are shown in Column 4-7 in Table 1. Some comments are included in Notes column. Using this table it is easy to compare relative abundances of mapped ecological systems and number of plots classified to each type.

Although some systems may be over- or under- mapped, the relative abundances of the common types are reasonable and it is useful to compare how many plots of each ecological system were sampled. Small patch types such as marshes are difficult to map at regional scales and are often under-mapped. Narrow riparian zones are sometimes included in upland types. At other times they may be over mapped beyond the edge of fluvial processes.

Table 1. Relative abundance and diversity of Ecological Systems mapped a Great Basin NP ordered by area of each type.

Ecological System Name	Area (ha)	Percent Area in GRBA	# plots in GRBA only	Percent of GRBA plots	# plots in GRBA & Evirons	Percent of Total Plots	Notes
Great Basin Pinyon-Juniper Woodland	7272.0	23.329	36	17.8	67	22.1	ok
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	6019.1	19.309	9	4.5	11	3.6	ok
Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	4676.1	15.001	12	5.9	19	6.3	ok
Inter-Mountain Basins Montane Sagebrush Steppe	3332.2	10.690	8	4.0	12	4.0	ok
Rocky Mountain Alpine Bedrock and Scree	1890.5	6.065	4	2.0	4	1.3	ok
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	1836.6	5.892	26	12.9	26	8.6	ok
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	1692.0	5.428	3	1.5	5	0	over mapped, but more plots
Rocky Mountain Aspen Forest and Woodland	1074.4	3.447	5	2.5	5	1.7	ok
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	964.7	3.095	28	13.9	28	9.2	ok
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	860.9	2.762	1	0.5	1	0.3	over mapped, but more plots
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	447.0	1.434	13	6.4	16	6.9	ok
Inter-Mountain Basins Cliff and Canyon	374.0	1.200	1	0.5	1	0.3	more plots
Rocky Mountain Subalpine-Montane Riparian Woodland	205.5	0.659	0	0	0	0	Under-sampled/ over mapped?
Great Basin Xeric Mixed Sagebrush Shrubland	198.2	0.636	1	0.5	14	4.6	under-sampled in park
Rocky Mountain Alpine Turf	135.5	0.435	9	4.5	9	3.0	highly diverse type – more plots
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	109.5	0.351	7	3.5	9	3.0	Highly diverse type – more plots
Southern Rocky Mountain Ponderosa Pine Woodland	25.5	0.082	2	1.0	2	0.7	more plots
North American Arid West Emergent Marsh	21.3	0.068	5	2.5	5	1.7	Possibly confused with ? More plots
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	14.6	0.047	0	0	0	0	Not in Park

Ecological System Name	Area (ha)	Percent Area in GRBA	# plots in GRBA only	Percent of GRBA plots	# plots in GRBA & Evirons	Percent of Total Plots	Notes
Inter-Mountain Basins Semi-Desert Grassland	11.1	0.036	0	0	1	0.3	Possibly confused with montane grassland?
Inter-Mountain Basins Big Sagebrush Shrubland	8.1	0.026	2	1.0	11	3.6	ARTRT in park?
Great Basin Semi-Desert Chaparral	2.2	0.007	3	1.5	3	1.0	ok
Inter-Mountain Basins Mixed Salt Desert Scrub	0.5	0.002	0	0	13	4.3	Not in Park
Rocky Mountain Bigtooth Maple Ravine Woodland	0.5	0.002	0	0	0	0	Not in Park
Ecological systems not mapped within park boundaries							
Rocky Mountain Subalpine-Montane Mesic Meadow	0	0	7	3.5	7	2.3	Possibly confused with semi-arid grassland? More
Rocky Mountain Lower Montane-Foothill Shrubland	0	0	6	3.0	7	2.3	Not Mapped
Rocky Mountain Alpine Fell-Field	0	0	5	2.5	5	1.7	Not Mapped
Southern Rocky Mountain Montane-Subalpine Grassland	0	0	4	2.0	4	1.3	Possibly confused with semi-arid grassland? More
Northern Rocky Mountain Avalanche Chute Shrubland	0	0	3	1.5	3	1.0	Not mapped - small patch
Rocky Mountain Subalpine-Montane Riparian Shrubland	0	0	2	1.0	2	0.7	More plots if available
Inter-Mountain Basins Greasewood Flat	0	0	0	0	9	3.0	Not in Park
Inter-Mountain Basins Alkaline Closed Depression	0	0	0	0	2	0.7	Not in Park
Inter-Mountain Basins Semi-Desert Shrub-Steppe	0	0	0	0	2	0.7	Under mapped - more plots
Invasive Annual Grassland	0	0	0	0	0	0	Not Mapped
Total	31,172	100%	202	100%	303	100%	

Summary and Recommendations

(Systems are listed alphabetically)

Great Basin Pinyon-Juniper Woodland: In general there are plenty of plots in this type. Reviewing association level classification may identify types that need additional samples or a missed association, but this is lower priority.

Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland: These riparian woodlands and shrublands are diverse type. More plots are needed to sample additional associations and to document occurrences at GRBA.

Great Basin Semi-Desert Chaparral: This is a seral / fire-maintained system which is adequate, unless new associations are encountered.

Great Basin Xeric Mixed Sagebrush Shrubland: There are ample *Artemisia nova* (black sagebrush) plots at lower elevation type, but it is not documented from within the park boundaries. Additional *Artemisia arbuscula* (low sagebrush) plots are needed to clarify types.

Inter-Mountain Basins Alkaline Closed Depression: Restricted to lower elevation basins and does not occur in the park.

Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland: It looks like there are plenty of plots in this system.

Inter-Mountain Basins Big Sagebrush Shrubland: Restricted to lower elevation basins and likely does not occur in the park (*Artemisia tridentata* ssp. *tridentata* dominated shrublands).

Inter-Mountain Basins Cliff and Canyon: Only one plot in this common type. More samples are needed in this lower elevation rock (not alpine) system. Sparsely vegetated or non-vascular (lichens) types are highly variable and generally quick to sample.

Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland: In general there are plenty of plots, but most are sampled in the northern half of the park. We may want some samples for the southern portion of the park to document variation from limestone substrates.

Inter-Mountain Basins Greasewood Flat: Restricted to lower elevation basins and does not occur in the park.

Inter-Mountain Basins Mixed Salt Desert Scrub: Generally in lower elevation basins. On certain substrates it may be possible to have saltbush forming communities within the park.

Inter-Mountain Basins Montane Sagebrush Steppe: In general there are plenty of plots in this type, but most are sampled in the northern half of the park. We may want some samples for the southern portion of the park to document variation from limestone substrates. Reviewing association level classification may identify types that need additional samples or a missed association, but this is lower priority.

Inter-Mountain Basins Semi-Desert Grassland: Likely over-mapped in the park or confused with montane grasslands. However, all grasslands should be targeted including semi-arid grasslands and steppes in the foothill - lower montane zone.

Inter-Mountain Basins Semi-Desert Shrub-Steppe: This is a broadly defined ecological system and includes the rabbitbrush steppe/shrublands that occur within the park. More samples of this and other shrub steppe are needed.

Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland: In general there are plenty of plots in this type. Reviewing association level classification may identify types that need additional samples or a missed association, but this is lower priority.

Invasive Annual Grassland: Not sampled in the park, but it likely occurs there. We may want to document some cheatgrass dominated/disturbed sites with an observation points to help mapping.

North American Arid West Emergent Marsh: We have several plots, but this is a diverse system and we should review association level classification to identify types that need additional samples or a missed association that need to be sampled.

Northern Rocky Mountain Avalanche Chute Shrubland: This system was not mapped at GRBA. This is a localized seral – disturbance maintained system. Additional plots would be helpful to characterize the type, but not a high priority.

Rocky Mountain Alpine Bedrock and Scree: In general it appears that there are adequate numbers of plots although classification is not done. Alpine bedrock and scree and other sparsely vegetated or non-vascular (lichens) types are highly variable and generally quick to sample. If you are near a site, and have time additional plots would be helpful.

Rocky Mountain Alpine Fell-Field: This system was not mapped at GRBA. Additional plots are needed to characterize this wind blasted alpine cushion plant sites. Fell-fields are often confused with barren or alpine turf sites by mappers.

Rocky Mountain Alpine Turf: This is a highly diverse ecological system that is not well studied in the Great Basin region. Review association level classification to identify types that are missing or under sampled and need additional plots.

Rocky Mountain Aspen Forest and Woodland: This map class appears adequately sampled at the system and alliance level. Reviewing association level classification may identify types that need additional samples or a missed association, but this is lower priority.

Rocky Mountain Bigtooth Maple Ravine Woodland: Bigtooth maple does not occur at GRBA. Likely mapped other riparian woodlands.

Rocky Mountain Gambel Oak-Mixed Montane Shrubland: Gambel oak does not occur at GRBA. Likely mapping the lower montane-foothill shrubland system that includes shrublands like *Amelanchier utahensis* (serviceberry).

Rocky Mountain Lower Montane-Foothill Shrubland: This system was not mapped at GRBA. We may need additional samples. Reviewing association level classification may identify types that need additional samples or a missed association that need to be sampled.

Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland: Looks like there are ample plots sampled in this system.

Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland: This map class appears over mapped. This system is found on mesic lower slopes with northerly aspects. They have characterized by a mesic understory so are likely uncommon at GRBA. Currently, only one plot has been sampled. Documenting other mesic subalpine forest associations with additional plots or rapid assessment would be good.

Rocky Mountain Subalpine-Montane Mesic Meadow: This system was not mapped at GRBA. Reviewing association level classification may identify types that need additional samples or a missed association that need to be sampled.

Rocky Mountain Subalpine-Montane Riparian Shrubland: This system was not mapped at GRBA. Salix spp. dominated riparian shrubland are uncommon at GRBA. Review association level classification and sample any addition stands/types that are encountered.

Rocky Mountain Subalpine-Montane Riparian Woodland: This type is likely over-mapped as these riparian woodlands are generally narrow. Lower elevation plots sample in this type were likely included in Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland.

Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland: It looks like there are ample plots sampled in this system.

Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland: This map class appears over mapped. This system is found on mesic lower slopes with northerly aspects. They have characterized by a mesic understory so are uncommon at GRBA. Currently only a couple Abies concolor / Symphoricarpos (white fir / snowberry) stands have been sampled. Documenting other mesic montane associations with additional plots or rapid assessment would be good.

Southern Rocky Mountain Montane-Subalpine Grassland: This system was not mapped at GRBA. Reviewing association level classification may identify types that need additional samples or a missed association that need to be sampled.

Southern Rocky Mountain Ponderosa Pine Woodland: This system is restricted to the southern portion of the park. Only a couple plots have been sampled. Reviewing association level classification may identify types that need additional samples or a missed association that need to be sampled

General Recommendations

(Ecological systems that need additional sampling during 2009 field season)

- Target wetlands
- Target Riparian, especially montane-subalpine
- Target Alpine turf and fell-field to help sort out alpine communities in the Great Basin.
- Target Meadow, Grassland and Shrub Steppe associations, especially in montane-subalpine
- Target Sparsely Vegetated types, especially in montane and subalpine
- Target systems that are under-sampled and need additional plots to characterize and map

APPENDIX B: GRBA FIELD DATA FORMS
2003 Plot Forms

NATIONAL PARK VEGETATION MAPPING PROGRAM: GREAT BASIN NP PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code: VMP.GRBA ____________ Alliance Group Code: ____________

Provisional Community Name: ____________

State: NV Park Name: Great Basin NP Park Site Name: ____________

Quad Name: ____________ Quad Code: ____________

Survey Date: ____________ Surveyors: ____________

UTM X: __ __ __ __ __ __ __ (m E) UTM Y: __ __ __ __ __ __ __ __ (m N) UTM Zone: 11

Comments: ____________ GPS Error (+/-) ____________

Directions to Plot:

Plot length(m): ______ Azimuth: ______ Plot width(m): _____ If circle (dia.): ________ Flashcard/Roll #: ________ Frame #: ________

Permanent Plot Marker Code: VMP.GRBA ________ Flashcard/Roll #: ________ Frame #: ________

Plot representativeness (discuss decisions for placement and/or reasons for non-representativeness)

Representativeness of association (if known):

Representativeness of plot in stand:

ENVIRONMENTAL DESCRIPTION

Elevation ____________ Slope ____________ Aspect ____________

Topographic Position (see cheat sheet)

Landform (see cheat sheet)

Surficial Geology (see cheat sheet)

Cowardan System
_ Upland ____ Palustrine
Riverine ____ Lacustrine

Hydrology
___Permanently Flooded ___Seasonally Flooded ___Temporarily Flooded
___Semi-permanently Flooded ___Saturated ___Intermittently Flooded
___Unknown

Environmental Comments (dynamic stage, fire history, insect damage, etc):

% Ground Cover: *(estimate to the nearest percentage. Sum = 100%)*
___ Bare soil ___ Moss ___ Small rocks (0.2-10 cm)
___ Bedrock ___ Water ___ Large rocks (> 10 cm)
___ Litter / duff ___ Cryptogam ___ Sand (0.1-2 mm)
___ Wood (> 1 cm) ___ Lichen ___ Other: ________

Soil Texture:
___ sand ___ loam ___ clay ___ loamy sand
__ ___ silt loam ___ silt ___ clay loam ___ silty clay
___ sandy clay ___ peat ___ muck ___ sandy loam

Soil Drainage
___ Rapidly drained ___ Well drained
___ Moderately well drained ___ Somewhat poorly drained
___ Poorly drained ___ Very poorly drained

GRBA Vegetation Plot Form, Revised 5/2003

2003 Plot Forms (continued)

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Height Scale for Strata	Cover Scale for Strata
Trees and Shrubs __ __Evergreen __ __Cold-deciduous __ __Mixed evergreen-cold-deciduous Herbs ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte	___Forest ___Woodland ___Shrubland ___Dwarf Shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated	<0.5 m 0.5-1m 1-2 m 2-5 m 5-10 m 10-15 m 15-20 m 20-35 m 35 – 50 m 10 >50 m	T 0-1% P >1-5% >5-15% >15-25% >25-35% >35-45% >45-55% >55-65% >65-75% >75-85% >85-95% 10 > 95%

Strata Height Class	Strata CBH Class	Cover Class	Dominant Species (mark Diagnostics with *)
T1 Emergent ______	______	______	
T2 Canopy ______	______	______	
T3 Sub-canopy ______	______	______	
S1 Tall shrub ______	______	______	
S2 Short Shrub ______	______	______	
S3 Dwarf-shrub	______	______	
Ht Herbaceous	______	______	
H1 Graminoids ______	______	______	
H2 Forbs ______	______	______	
H3 Ferns ______	______	______	
H4 Tree seedlings	______	______	
N Non-vascular	______	______	
V Vine/liana ______	______	______	
E Epiphyte ______	______	______	

Animal Use Evidence (including scat, browse, graze, burrows, bedding sites, etc)

Natural and Anthropogenic Disturbance Comments (please see cheat sheet for impact codes, list intensity as High, Med, or Low)

Other Comments (locations of photos and permanent plot marker)

GRBA Vegetation Plot Form, Revised 5/2003

2003 Plot Forms (continued)

Plot Code_VMP GRBA____________

Species/percent cover: Starting with the uppermost stratum, list all species with % cover for each species in the stratum. For each **tree** species estimate seedling, sapling, and mature cover indicating stratum. Put an asterisk next to any species that are known diagnostics for a particular community in the classification.

Also list species outside the plot at the end of the table or designate with a 0 in Cover Class column.

Vegetation Strata: T1 Emergent; T2 Canopy; T3 Subcanopy, S1 Tall Shrub (>2m), S2 Short Shrub (<2m), S3 Dwarf-shrub (<0.5m), Ht Herbaceous total, H1 Graminoids, H2 Forbs, H3 Ferns, H4 Tree seedlings, N non-vascular, V vine, E Epiphyte

Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class

2008 /2009 Plot Forms

NPS VEGETATION MAPPING PROGRAM: GREAT BASIN NATIONAL PARK VEGETATION SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code: GRBA.____________ ☐ Observation Point Survey Date: ____/____/2008 Surveyors: ________________________

Provisional Map Unit Name: ____

Provisional Association Name: ____

UTM Zone: 11 UTM X: __ __ __ __ __ __ (m E) UTM Y: __ __ __ __ __ __ __ (m N) Accuracy ___________m

Location Comments:

Plot length(m):______ Plot width(m):______

Azimuth: ________° Radius(m):________

Camera #: ______ CF Card #: ______Other#________________________

Photo #: N_______ E_______ S_______ W_______ Rep________________

Plot representativeness (discuss decisions for placement and/or reasons for non-representativeness)

a. Representativeness of association (if known):

b. Representativeness of plot in stand:

ENVIRONMENTAL DESCRIPTION

Elevation ________________m Slope __________________° Aspect______________________°

Topographic Position (see cheat sheet)__________________________ Landform (see cheat sheet)__________________________

Surficial Geology (see cheat sheet)____

Cowardan System:	Soil Texture:	Soil Drainage:	% Ground Cover: *(Sum = 100%)*
___ Upland	___ sand	___ Rapidly drained	___ Litter / duff
___ Palustrine	___ loamy sand	___ Well drained	___ Wood (1<3 cm) ___(3<10cm) ___(>10cm)
___ Riverine	___ sandy loam	___ Moderately well drained	___ Bare soil
___ Lacustrine	___ silt loam	___ Somewhat poorly drained	___ Sand (0.1-2 mm)
	___ sandy clay loam	___ Poorly drained	___ Small rocks (0.2-10cm)
Hydrology:	___ clay loam	___ Very poorly drained	___ Large rocks (10-60cm) ___Boulder(>60cm)
___Permanently Flooded	___ silty clay loam		___ Bedrock
___Seasonally Flooded	___ silt		___ Water
___Semi-permanently Flooded	___ sandy clay		___ Moss
___Temporarily Flooded	___ clay		___ Lichen
___Intermittently Flooded	___ silty clay		___ Cryptogam /Biological Crust
___Saturated	___ peat		___ Basal area
___Unknown	___ muck		___ Other: __________
	___ loam		

Environmental Comments (dynamic stage, fire history, insect damage, animal use evidence, natural or anthropogenic disturbance, geology, etc.):

2008 /2009 Plot Forms (continued)

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Height Class Scale	Cover Class Scale
Trees and Shrubs __Evergreen __Cold-deciduous __Mixed evergreen-cold-deciduous Herbs ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte	___Forest ___Woodland ___Shrubland ___Dwarf Shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated	01 <0.5 m 02 0.5-1m 03 1-2 m 04 2-5 m 05 5-10 m 06 10-15 m 07 15-20 m 08 20-35 m 09 35 – 50 m 10 >50 m	T 0-1% P >1-5% 1- >5-10% 1+ >10-15% 2 >15-25% 3 >25-35% 4 >35-45% 5 >45-55% 6 >55-65% 7 >65-75% 8 >75-85% 9 >85-95% 10 > 95%

	Height Class	Cover Class	Dominant Species (mark Diagnostics with *)
T1 Emergent	______	______	______
T2 Canopy	______	______	______
T3 Sub-canopy	______	______	______
S1 Tall shrub	______	______	______
S2 Short Shrub	______	______	______
S3 Dwarf-shrub	______	______	______
Ht Herbaceous	______	______	______
H1 Graminoids	______	______	______
H2 Forbs	______	______	______
H3 Ferns	______	______	______
H4 Seedlings	______	______	______
N Non-vascular	______	______	______
V Vine/liana	______	______	______
E Epiphyte	______	______	______

Vegetation and Other Comments: average DBH cm of canopy trees. Even-aged, mult-aged canopy, early or late seral/old growth stand.

2008 /2009 Plot Forms (continued)

SPECIES LIST

PlotCode GRBA.___________________________________

Cover Class Scale			
T	0-1%	4	>35-45%
P	>1-5%	5	>45-55%
1-	>5-10%	6	>55-65%
1+	>10-15%	7	>65-75%
2	>15-25%	8	>75-85%
3	>25-35%	9	>85-95%
		10	> 95%

Stratum Codes	S1 Tall Shrub	H1 Graminoids	N Non-vascular
T1 Emergent	S2 Short Shrub	H2 Forbs	V Vine/liana
T2 Canopy	S3 Dwarf-shrub	H3 Ferns	E Epiphyte
T3 Sub-canopy		H4 Seedlings	

Stratum	Species Name	CoverClass	Stratum	Species Name	CoverClass
				Species outside plot:	

2009 Rapid Assessment Forms

NPS VEGETATION MAPPING PROGRAM: GREAT BASIN NATIONAL PARK VEGETATION RAPID ASSESSMENT SURVEY FORM

IDENTIFIERS/LOCATORS

Rapid Point Code: GRBA.____________ _ Observation Point Survey Date: ____/____/2009 Surveyors: ______________________

Provisional Map Unit Name: ____

Provisional Association Name: ____

UTM Zone: 11 UTM X: __ __ __ __ __ __ (m E) UTM Y: __ __ __ __ __ __ __ (m N) Accuracy __________m

Location Comments:

Plot length(m):______ Plot width(m):______

Azimuth: ________° Radius(m):________

Camera #: ______ CF Card #: ______Other#______________________________

Photo #: N_______ E_______ S_______ W_______ Rep________________

Plot representativeness (discuss decisions for placement and/or reasons for non-representativeness)

a. Representativeness of association (if known):

b. Representativeness of plot in stand:

ENVIRONMENTAL DESCRIPTION

Elevation _________________m Slope __________________° Aspect______________________°

Topographic Position (see cheat sheet)_________________________ Landform (see cheat sheet)______________________________

Surficial Geology (see cheat sheet)____

Cowardan System:	Soil Texture:	Soil Drainage:	% Ground Cover: *(Sum = 100%)*
___ Upland	___ sand	___ Rapidly drained	___ Litter / duff
___ Palustrine	___ loamy sand	___ Well drained	___ Wood (1<3 cm) ___(3<10cm) ___(>10cm)
___ Riverine	___ sandy loam	___ Moderately well drained	___ Bare soil
___ Lacustrine	___ silt loam	___ Somewhat poorly drained	___ Sand (0.1-2 mm)
	___ sandy clay loam	___ Poorly drained	___ Small rocks (0.2-10cm)
Hydrology:	___ clay loam	___ Very poorly drained	___ Large rocks (10-60cm) ___Boulder(>60cm)
___Permanently Flooded	___ silty clay loam		___ Bedrock
___Seasonally Flooded	___ silt		___ Water
___Semi-permanently Flooded	___ sandy clay		___ Moss
___Temporarily Flooded	___ clay		___ Lichen
___Intermittently Flooded	___ silty clay		___ Cryptogam /Biological Crust
___Saturated	___ peat		___ Basal area
___Unknown	___ muck		___ Other: __________
	___ loam		

Environmental Comments (dynamic stage, fire history, insect damage, animal use evidence, natural or anthropogenic disturbance, geology, etc.):

Vegetation and Other Comments: average DBH cm of canopy trees. Even-aged, mult-aged canopy, early or late seral/old growth stand.

2009 Rapid Assessment Forms (continued)

VEGETATION DESCRIPTION Plot Code: GRBA.____________ Survey Date: ____/____/ 2009

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Height Class Scale	Cover Class Scale
Trees and Shrubs __Evergreen __Cold-deciduous __Mixed evergreen-cold-deciduous Herbs ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte	___Forest ___Woodland ___Shrubland ___Dwarf Shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated	01 <0.5 m 02 0.5-1m 03 1-2 m 04 2-5 m 05 5-10 m 06 10-15 m 07 15-20 m 08 20-35 m 09 35 – 50 m 10 >50 m	T 0-1% P >1-5% 1- >5-10% 1+ >10-15% 2 >15-25% 3 >25-35% 4 >35-45% 5 >45-55% 6 >55-65% 7 >65-75% 8 >75-85% 9 >85-95% 10 > 95%

	Height Class	Cover Class	Dominant Species (mark Diagnostics with *)
T1 Emergent	______	______	________________________________
T2 Canopy	______	______	________________________________
T3 Sub-canopy	______	______	________________________________
S1 Tall shrub	______	______	________________________________
S2 Short Shrub	______	______	________________________________
S3 Dwarf-shrub	______	______	________________________________
Ht Herbaceous	______	______	________________________________
H1 Graminoids	______	______	________________________________
H2 Forbs	______	______	________________________________
H3 Ferns	______	______	________________________________
H4 Seedlings	______	______	________________________________
N Non-vascular	______	______	________________________________
V Vine/liana	______	______	________________________________
E Epiphyte	______	______	________________________________

SPECIES INFORMATION

Stratum	Species Name	CoverClass	Stratum	Species Name	CoverClass

APPENDIX C: GRBA FIELD MANUALS

Field Sampling at Great Basin National Park, 2003
A Basic Guide for Vegetation Field Work

USGS/NPS* Vegetation *Mapping Program

This document is intended to give you general instructions and guidelines for conducting your field work at Great Basin National Park (GRBA). Detailed, field-by-field coding conventions for the primary forms you'll be completing in the field (the Vegetation Plot and Fuels forms) are provided in the 'cheat sheets' at the back, along with an example of a completed form.

Overview
The data that you collect will be used to create a relatively fine-scale delineation of vegetation pattern in GRBA and its environs, as well as allow modeling of the forest fuels and behavior of potential fires. This field manual describes the methods for collecting the vegetation data.

The range of habitats, and the corresponding diversity of vegetation types, found here is complex. The data you collect will be used by the Park for a number of purposes:
- create a fine scale classification of ecologically distinct vegetation types,
- determine forest fuel loads and model fire behavior,
- plan and monitor management activities,
- track long-term changes in vegetation,
- searches for rare species and weeds
- and portray the wealth of natural diversity on Park lands to the public.

There are between 60-100 vegetation associations estimated on the Park. The preliminary classification will be completed as soon as possible and used to tally plots in each type. It is a first approximation of vegetation associations that occur in the project area. You will work to establish 1-5 plots in each of these vegetation types; (3-5 plots in undescribed associations). Fuels data will also be collected in each vegetation plot you sample. While the data and methods for these plots is different, the two plots share a common plot center.

VEGETATION PLOTS
Establishing a field sampling strategy that captures—in only one field season—sufficient data on <u>all the distinct vegetation types</u> in an area as large, diverse, and rugged as GRBA is a challenge. To make the sampling representative and efficient, random points where selected and stratified by 30 alliance groups that occur within a 1-mile buffer of roads and 0.5 mile buffer from trails. A total of 914 points were identified for possible sampling with at 20-150 points per alliance group depending on abundance in the sampling area. The goal of the fuels sampling is to have 10 plots in each alliance group. There are ample points in each group to reject points for plots. Rejection criteria for excluding a point from sampling include:
- point location ecotonal between two or more vegetation types.
- point location too small to sample without edge ecotonal effects.
- point location not representative of a distinct vegetation type that repeats on the landscape.
- point location is of a vegetation type that is already adequately sampled (3-5 plots) or has a been sampled nearby. Do an observation point instead of full plot.
- Access to point dangerous or inaccessible in reasonable time (cliffs, canyon, unstable slope)

Because the goal of the vegetation sampling is to sample all distinct vegetation types that occur in the project area, it is necessary to sample opportunistically on the way to and from sampling points as time permits. This is best done later in the field season after the crews have developed a better understanding of the vegetation of the park and what the sampling design is capturing or missing. As the field season progresses more emphasis is place on sampling the full diversity of vegetation types and environmental conditions, and efficient sampling (relatively easy access) will be a secondary factor in sample site selection. An exception would be to completely sample lower elevation vegetation types before summer heat makes sampling difficult.

As much as possible, photo interpreters will be examining aerial photos of the areas identified by the Alliances and will make an educated guess about what types of vegetation will be found in the Alliance polygons using plot information from the sampled ones. The photo interpreters will supply mylar overlays with polygons delineated and labeled with vegetation types. The vegetation "types" they are choosing to tag their polygons are those included in the preliminary classification of GRBA vegetation created using the U.S. National Vegetation Classification system (Grossman et al. 1998).

During the field season, some photo-interpreted overlays attached to the photo prints may be available to help find vegetation types that need to be sampled. The delineated polygons provide a perspective of accessibility to selected points and indicate the size of homogenous stands so that sampling can be placed to best advantage within the types. The photo interpreters may give selected, delineated polygons labeled with U.S. National Vegetation Classification types to the field crews to visit.

The field crew will evaluate the field data; assign a preliminary vegetation type to use to update the tally of plots sampled in each vegetation type. The field crew leaders will be keeping a running tally of the number of plots that still need to be established and sampled for each type. The goal is to use *your* time as efficiently as possible; we are trying our best to avoid over-sampling of some types and under-sampling of others. Deciding where to sample to capture the full range of diversity over the Park is going to be very much an iterative process as the field season goes along!

Getting There

You will have a Digital Ortho Quarter Quad (DOQQ) with the Alliance Groups you are to visit/sample indicated. You and your partner will navigate towards each selected Alliance Groups using your road and trail maps, the DOQQ, and/or GPS. The DOQQ's will have roads and trails highlighted on them to help you as well.

Before you leave... check that you have all the materials needed to complete your field work (Please see the checklist and "considerations for mission planning" at the end of this document to help you).

Every morning... check your GPS receiver to make sure it is set to **NAD 83**, that the batteries are charged, and the storage memory is sufficient for the day's work. Check the digital camera to ensure the batteries and memory are sufficient for the day's work. If you will be in the backcountry for several nights, be sure to have sufficient batteries and memory with you.

Along the way...look around. Digital data layers are great, but they do ***not*** replace human perception. The goal of this field work is to sample all the different vegetation types that occur in the Park. If, on the way to one vegetation type, you see an assemblage of plants that seems unique and that is not included on the list of vegetation types, please sample if time allows. You will be better able to recognize these undescribed vegetation types as the season progresses and you become more familiar with the vegetation types and how they can look on the ground. Additionally, it is important that you document occurrences of exotic or rare species you encounter in the course of your travels throughout the park. This can only happen if you are being observant.

Once There

Establishing a Plot

1) Figure out where to place your plot. At Great Basin NP this is a somewhat subjective process. After you travel to the selected point, you'll want to place your plots in areas that seem to be both relatively **homogenous** and **representative** of the vegetation type as a whole, but at the same time should not be biased in respect to fuels sampling. In other words, avoid areas where the vegetation appears to be transitioning from one type to another and areas with anomalous or locally heterogeneous structure or species composition, but include some random placement technique to avoid local bias. Take some time to do this carefully, the plots you establish may be relocated and resampled over time to determine natural changes and responses to management. Look at *all* the vegetation strata to determine if the area is structurally and floristically uniform and generally try to place your plots at least 30 m from what you see as the 'boundary' between this vegetation type and any neighboring, distinctly different types. During the training period this step will be emphasized and discussed in detail. However, the rule-of-thumb is to conduct reconnaissance of the stand as time and topography allows.
Note: In cases where a polygon is very heterogeneous, more than one plot may be needed. Again, look around; use your human ability of perception.

2) Permanently mark the plot location with a plot marker. Plot markers typically consist of a small copper tag inscribed with the project acronym, plot code, and date (e.g. VMP GRBA312 2003/06/17) attached to a coated nail buried at the plot center point. If it is not possible to bury the marker at the plot center, select an alternate location as near to the plot center as possible and note the distance and azimuth to the plot center. The plot marker should be buried in the mineral soil just under the bottom of the duff layer, taking care to disturb as small of an area as possible. It should be buried shallow enough to be easily located with a metal detector, yet deep enough to remain concealed over time and to be relatively protected from fire. Remember, if you are unable to place the marker at the plot center you must clearly describe on the form where the plot center is in relation (e.g., plot center located 13.5 m @200 degrees) from the marker. At GRBA, it was decided not to permanently mark plots, except those requested by Neal Darby, park wildlife biologist.

3) Determine and record the plot location. Using your GPS receiver, determine the UTM coordinates at the center of the plot and record them under the **UTM X** and **UTM Y** blanks on the vegetation survey field form and the forest fuels form. Also record the GPS error. Remember that this is about to become a permanent plot, so being able to *find* it again will be key: use the GPS rather than estimating and be careful in recording the coordinates. Also mark and label the location of the plot on a USGS 7.5 min. topographic map. If you cannot get a GPS reading, estimate UTMs from the USGS topographic map and note on the form that you had to resort to this method. This is important because the datum for the GPS and DOQQ is NAD 83, but USGS topographic map are usually in NAD 27. When you cannot get a GPS reading it is also helpful to note a landmark(s) with distance and azimuth to plot center to help relocate the plot.

Plots may be circular, rectangle or square. Note shape and dimensions on the field form. If the plot is rectangle or square, record the azimuth of the long side (any side if square) to help relocate the plot. It may make more sense to establish rectangular plots in linear vegetation types (e.g. riparian or ridgeline types).

Standard plot sizes should be as follows:

If you're in a ...	**You should usually make your plot...**	**Giving you a plot area of...**
Forest (i.e., trees have their crowns overlapping, usually forming 60-100% cover)	11.3 m radius OR 20 m x 20 m	400 m^2 400 m^2
Woodland (i.e., open stands of trees with crowns usually not touching. Canopy tree cover is 25-60% Or exceeds shrub, dwarf-shrub, herb, and nonvascular cover).	11.3 m radius OR 20 m x 20 m	400 m^2 400 m^2
Shrubland (i.e., shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover)	11.3 m radius OR 20 m x 20 m	400 m^2 400 m^2
Dwarf-shrubland (heath) (i.e., Shrubs less than 0.5 m tall are dominant4, usually forming more than 25% cover OR exceeding tree, shrub, herb, and nonvascular cover).	5.65 m radius OR 10 m x 10 m	100 m^2 100 m^2
Herbaceous (i.e., Herbs dominant, usually forming more than 25 percent cover OR exceeding tree, shrub, dwarf-shrub, and nonvascular cover).	5.65 m radius OR 10 m x 10 m	100 m^2 100 m^2
Sparse vegetation (i.e., Less than 10% vegetation cover; larger plots [200 or 400 m^2] may be needed, to be representative if vegetation heterogeneously distributed.)	5.65 m radius OR 10 m x 10 m	100 m^2 100 m^2
Nonvascular (i.e., nonvascular cover dominant, usually forming more than 25% cover).	2.82 m radius OR 5 m x 5 m	25 m^2 25 m^2

Note: You can deviate from the standard plot *shapes* where that makes sense, but the total plot *area* encompassed by the boundaries should be as listed above for each major class of vegetation. For example, forested riparian vegetation, may be sampled in a more linear 10 x 40 m (400 m^2) plot; herbaceous riparian or ridgeline vegetation in a 2 x 50 m (100 m^2) plot. You may also increase the size of the plot to the next standard size if necessary to accurately sample the heterogeneity of the vegetation. Forests, woodlands and shrublands can be increased to 1000 m^2. Please make a note on the vegetation survey form when this is the case.

4) Complete the **Identifiers/Locators** portion of your Vegetation Survey Form and take the vegetation plot photos.

Identifiers/Locators
Complete the information for any fields that are not already completed.
The permanent plot code is a combination of the project name acronym (VMP), the serial plot number (GRBA###, and the date (2002/06/17). At GRBA, it was decided not to permanently mark plots, except those requested by Neal Darby, park wildlife biologist..

Taking vegetation photographs

One or two digital photos will be taken of the vegetation at each plot. The purpose of these photos is to get a good representation of the vegetation of the plot, <u>not</u> individual species or fuel loads. A laminated piece of colored paper (white has such strong contrast as to be unreadable in the photo) with the plot number and azimuth written on it should be placed in the plot so that these are visible in the photo. Use dry-erase markers for making the plot placard.

Take the photograph looking across the contour if plot is steep. Flag or mark the plot center for the photo to aid relocation. Record flashcard/roll #, frame # and azimuth on the vegetation survey form. Crew leaders are responsible for taking and organizing photos.

Data Collection

Environmental Description

See the coding instructions at the end of this document for guidance on the specific fields.

Vegetation Description

For guidance on the specific fields on the second page of the form, see the coding instructions.

As you begin to collect the species, DBH, and cover information, keep these rules in mind—they will speed your data collection considerably:

1) Except in very diverse plots, don't spend more than **20 minutes** looking for new and different species to record. Remember that these plot data are to be used to classify the overall vegetation of the Park, not to make a complete species list for it. If you had to spend much more than 20 minutes to *find* a species, it isn't important to characterizing the vegetation type. For diverse plots with over 25 taxa you may take up to 30 minutes on the listing process.

2) If you can't identify a plant to species, record it on your form as "unknown species 1," "unknown species 2," "unknown Carex sp. 1," etc. Record associated cover class and other data for the unknown as you would for any other species. Then do one of two things:

If you need the species identified right away because it appears to be dominant or diagnostic (you're seeing it all over the place or you're seeing much more in this particular vegetation type than in others), take a sample of the species with as much of the plant as possible, especially intact sexual parts, if present. Place the sample in a baggie, and label the baggie (or specimen) with the plot code and the name you gave it on the data form.

If you don't need the plant keyed right away, press it. Mark the pressed specimen with the plot code and the name you gave it on the data form.

Store specimens in a cool, dry place. Bagged specimens will keep fresh longer in the refrigerator or ice chest until pressed or identified. You can, of course, key some of these out yourself if you want to, but don't let plant keying get in the way of your primary responsibility: *field data collection*. No one expects you to identify every plant but you should make an effort to learn at least the common species that keep recurring in plots. A quick prioritization of what to key and what to press may be made based on the recurrence of the species in samples and on the cover-class estimate of the species in a particular plot. If the species has a high cover value (>1%) it is more of a priority to identify. Field crews should mark the specimen tag with its cover class estimate and any notes helpful in identification such as "tall shrub" or "wetland plant", as well as its unique identifying number for the vegetation sample. If pressed specimens begin to build up, let your supervisor or the NatureServe folks know. They can take steps to have some of them identified.

Observation Point Form

Occasionally, you may need to collect some plot-free data. This will happen when:

1) The photo interpreters can't tell what kind of vegetation is in a particular polygon [as noted on the mylar] *or*
2) The photo interpreters were wrong about what kind of vegetation is in a polygon *and* sufficient plot data has already been collected for the kind of vegetation that is actually there.

In these two cases, there is no need to establish a plot. However, you will help the photo interpreters identify this type in the future if you collect some data. You will navigate to the polygon as usual, scout

out the polygon briefly to get a feel for what it is like, and record some general data to characterize it on an Observation Point form. This is an abbreviated version of the Plot Survey form, and the same cheat sheet can be used to help with filling it out. GPS points may be taken at any part of the polygon as long as it is >30 m from its edge, to verify its location.

A sample completed Observation Assessment Point form is provided at the end of this document.

We hope you find your field season at Great Basin National Park enjoyable and rewarding. Best of luck!

Literature Cited

Anderson, H.E. 1982. Aids to determining fuel models for estimating fire behavior. USDA Forest Service, General Technical Report INT-GTR-122.

Burgan, R.E. and R.C. Rothermel. 1984. BEHAVE: Fire behavior prediction and fuel modeling system – FUEL subsystem. USDA Forest Service, General Technical Report INT-GTR-167.

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: development, status, and applications. The Nature Conservancy, Arlington, Virginia.

The Nature Conservancy [TNC]. 1998. An environmentally-driven approach to vegetation sampling and mapping at Yosemite National Park. Report prepared for the U.S. Department of the Interior, National Biological Survey and National Park Service. The Nature Conservancy, Arlington, Virginia.

Instructions for filling out Fields in the PLOT SURVEY FORM (GRBA version, 5/2002)

Plot Survey Form

Plot Code
Code indicating the specific plot within the vegetation polygon. For Great Basin National Park, the codes will be "VMP.GRBA.###". Each crew will be assigned a range of plot numbers. Begin with VMP.GRBA.001 and increment up from there. Be certain you are not using the same range as another team or numbers you have already used. If someone switches to another team, it is important they know what plot numbers the team will use to identify the data they gather. Before you leave be sure you know what number range the crew will use and that these are not being used by another team!

Alliance Group Code
The alliance group code will be taken from the map. This should be filled in based on Alliance Group you are surveying and should be shown on the map you are using to get to the site.

Provisional Community Name
Using the provisional classification you were provided for the Park, assign the name of the vegetation type that most closely resembles the type you are surveying. Enter the finest level of the classification possible. In fact, *none* of the names may be a good fit; you may have found a new type, although this should be the exception and not the rule. If you have a new type, create a provisional name with the dominant and diagnostic species. The 'provisional community name' that is assigned will be used to update the tally of plots needed for each vegetation type.

State NV

Park Name Great Basin NP

Park Site Name
This is a provisional name you assign to describe where the data were collected. It should represent a nearby and identifiable feature on the topographic map.

Quad Name
Appropriate name/scale from survey map used; this will typically be a 7.5-minute quadrangle.

Quad Code
Code of quadrangle map. This code is shown on the lower right hand corner of the map.

UTM X
Use GPS if at all possible. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

UTM Y
Use GPS if at all possible. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

GPS Error
Note the error in the GPS reading off the PLGR.

Survey Date
Date the survey was taken; year, month, day.

Surveyors
Names of surveyors, with crew leader listed first.

Directions to Plot
Precise directions to the site using a landmark (e.g., a named point on the topo map, a major highway, using park naming conventions for roads) readily locatable on a 7.5 minute topo map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances as closely as possible to the 0.1 mile and use compass directions. Give additional directions to the plot within the site. Do not take more than a couple of minutes to fill this out.

Plot Length and Plot Width
Enter diameter for circular plots and width and length dimensions for square or rectangular plots. Choose the appropriate plot size based on the following:

Vegetation Class	**Standard Plot Dimensions**	**PLOT AREA**
Forest	11.3 m radius or 20 m x 20 m	**400 m^2**
Woodland	11.3 m radius or 20 m x 20 m	**400 m^2**
Shrubland	11.3 m radius or 20 m x 20 m	**400 m^2**
Dwarf-shrubland	5.65 m radius or 10 m x 10 m	**100 m^2**
Herbaceous	5.65 m radius or 10 m x 10 m	**100 m^2**
Sparse Vegetation	5.65 m radius or 10 m x 10 m or larger if needed to capture species diversity.	**100 $m^{2,}$ 200 m^2 or 400 m^2**
Nonvascular	2.82 m radius or 5 m x 5 m	**25 m^2**

Roll Number/Frame Numbers
We are taking 1-2 representative pictures of the plots. Note the roll number and frame number of each photo.

Permanent Plot Marker Code
Indicate the exact code written onto the plot tag buried at the plot. This should include the project acronym, plot code, and the date (e.g. VMP.GRBA.312 2002/06/17). . At GRBA, it was decided not to permanently mark plots, except those requested by Neal Darby, park wildlife biologist.

Plot Representativeness
Does this plot represent the full variability of the polygon/stand? If not, were additional plots taken? Note additional species not seen in the plot in the space provided below. Note: we distinguish in this section the plot's ability to represent the stand or polygon you are sampling as one component and the ability of this sample to represent the range of variability of the association in the entire mapping area. The former comment may be ascertained by reconnaissance of the stand. The latter comment comes only after some familiarity with the vegetation type throughout the mapping area and may be left blank if you have no opinion at this time.

ENVIRONMENTAL DESCRIPTION

Elevation
Elevation of the plot. Specify whether in feet or meters (this will depend on the units used on the GPS or on the topographic map being used). In general, we have determined that the reading you get from a topo map, provided you are certain where you are, is more accurate than the average reading from the GPS unit. Thus, please attempt to estimate your elevation with the topo map.

Slope
Measure the slope in degrees using a clinometer.

Aspect
Measure the slope aspect using a compass (be sure to correct for the magnetic declination). Note: all compasses should be pre-set to an average declination for the park and thus, readings from the compasses carried by the field crews may be directly noted.

Topographic Position
Topographic position of the plot. Choose one:

INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.

HIGH SLOPE (shoulder slope, upper slope, convex creep slope). Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

HIGH LEVEL (mesa). Level top of a plateau.

MIDSLOPE (transportational midslope, middle slope). Intermediate slope position.

BACKSLOPE (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments (fall faces).

STEP IN SLOPE (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.

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

TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

LOW LEVEL (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL WALL (bank). Sloping side of a channel.

CHANNEL BED (narrow valley bottom, gully, arroyo, wash). Bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

Landform

Enter the landform that describes the site where the plot was taken. Note on the code sheet the landform choices are listed at different scales. Thus, one can select more than one for plot if appropriate (e.g., mountain could be macro and ridge could be meso scale). You can add to the list for Great Basin NP. Just be consistent so we can analyze by landform (Consult with Park staff for final list).

LANDFORM	levee
Bench	meander belt
Bottomland	meander scar
Canyon	moraine (undifferentiated)
Channel	mound
cirque floor	mountain valley
cirque headwall	mountain (s)
cliff	mountain-valley fan
col	mud flat
colluvial slope	patterned ground (undifferentiated)
dome	periglacial boulderfield
drainage channel (undifferentiated)	pinnacle
draw	plateau
earth flow	ravine
eroded bench	ridge
eroding stream channel system	ridge & valley
erosional stream terrace	ridgetop bedrock outcrop
escarpment	rim
flood plain	riverbed
fluvial	rock fall avalanche
glaciated uplands	saddle
gorge	scour
ground moraine	seep
hanging valley	upper 1/3 of slope
hills	middle 1/3 of slope
hillslope bedrock outcrop	lower 1/3 of slope
island	slump pond
knob	soil creep slope
knoll	stream terrace (undifferentiated)
lake/pond	streambed
lake bed	swale
lake plain	talus
lake terrace	tarn
lateral moraine	toe slope
lava flow (undifferentiated)	valley floor
ledge	

Surficial Geology

Note the geologic substrate influencing the plant community (bedrock or surficial materials). Accurately recording the geology at the plot is especially important if the plot is on an inclusion in the type on the geology map. Included below is general geology substrate list to use to characterize the geology of the plot (others can be added if necessary).

General bedrock or surficial geology - use more specific park geology legend if available.

IGNEOUS ROCKS Granitic (Granite, Schyolite, Syenite, Trachyte) Ioritic (Diorite, Dacite, Andesite) Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite) SEDIMENTARY ROCKS Conglomerates and Breccias Sandstone Siltstone Shale Limestone and Dolomite Marble Gypsum METAMORPHIC ROCKS Gneiss Schist Slate and Phyllite Marble Serpentine	GLACIAL DEPOSITS Undifferentiated glacial deposit Till Moraine Bedrock and till Glacio-fluvial deposits (outwash plains, ice contacted GF deposits, eskers, kames, proglacial deltas, crevasse filling, etc.) Deltaic deposits (alluvial cones, deltaic complexes) Lacustrine and fluvial deposits (glacio-fluvial, fluvio-lacustrine, freshwater sandy beaches, stony/gravelly shoreline) ORGANIC DEPOSITS Peat (with clear fibric structure) Muck Marsh, regularly flooded by lake or river (high mineral content) SLOPE AND MODIFIED DEPOSITS talus and scree slopes colluvial solifluction, landslide

Cowardin System / Hydrology

If the system is a wetland, check off the name of the USFWS system which best describes its hydrology and landform. Indicate “upland” if the system is not a wetland.

Next, assess the hydrologic regime of the plot using the descriptions below (adapted from Cowardin et al. 1979).

SEMIPERMANENTLY FLOODED - Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's Intermittently Exposed and Semipermanently Flooded modifiers.

SEASONALLY FLOODED - Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

SATURATED - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's Saturated modifier.

TEMPORARILY FLOODED - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands. Equivalent to Cowardin's Temporary modifier.

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

PERMANENTLY FLOODED - Water covers the land surface at all times of the year in all years. Equivalent to Cowardin's "permanently flooded."

UNKNOWN - The water regime of the area is not known. The unit is simply described as a non-tidal wetland.

Environmental Comments

Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors.

Ground Cover

Estimate ground cover to the nearest percentage by each category, including woody stem basal area where significant in "other" category. Cover estimates should sum to 100%. In cases where moss, lichen, sand or litter covers thinly covers rock, ignore the less significant cover and record the total cover of rock. This non-vascular cover can be included in the total cover moss and lichen and recorded in the non-vascular strata. Moss or Lichen cover can be estimated separately on the species cover form.

Soil Texture
Using the key below, assess average soil texture. If substrate is organic muck or peat, record that on form instead of soil texture

Simplified Key to Soil Texture (Brewer and McCann 1982)

A1 Soil does not remain in a ball when squeezed..sand

A2 Soil remains in a ball when squeezed..B

B1 Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you push up over your finger.
Soil makes no ribbon..……………………………loamy sand

B2 Soil makes a ribbon; may be very short...C

C1 Ribbon extends less than 1 inch before breaking..D

C2 Ribbon extends 1 inch or more before breaking...E

D1 Add excess water to small amount of soil
Soil feels at least slightly gritty………………………………………..loam or sandy loam

D2 Soil feels smooth..silt loam

E1 Soil makes a ribbon that breaks when 1-2 inches long;
cracks if bent into a ring...F

E2 Soil makes a ribbon 2+ inches long; does not crack when bent into a ring…………….…G

F1 Add excess water to small amount of soil;
soil feels at least slightly gritty......………………...................sandy clay loam or clay loam

F2 Soil feels smooth...silty clay loam or silt

G1 Add excess water to a small amount of soil;
soil feels at least slightly gritty...............……………………………sandy clay or clay

G2 Soil feels smooth...silty clay

Soil Drainage

The soil drainage classes are defined in terms of (1) actual moisture content (in excess of field moisture capacity) and (2) the extent of the period during which excess water is present in the plant-root zone. It is recognized that permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. It is further recognized that soil profile morphology, for example mottling, normally, but not always, reflects soil moisture status. Although soil morphology may be a valuable field indication of moisture status, it should not be the overriding criterion. Soil drainage classes cannot be based solely on the presence or absence of mottling. Topographic position and vegetation as well as soil morphology are useful field criteria for assessing soil moisture status.

RAPIDLY DRAINED - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water addition. Soils are free from any evidence of gleying throughout the profile. Rapidly drained soils are commonly coarse textured or soils on steep slopes.

WELL DRAINED - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 3 feet, but may be mottled below this depth. B horizons, if present, are reddish, brownish, or yellowish.

MODERATELY WELL DRAINED - The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are commonly mottled (chroma < 2) in the lower B and C horizons or below a depth of 2 feet. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the solum. In grassland soils the B and C horizons may be only faintly mottled and the A horizon may be relatively thick and dark.

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

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

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

VEGETATION DESCRIPTION

Leaf Phenology

Select the value which best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

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

COLD DECIDUOUS – More than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

MIXED EVERGREEN - COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and cold-deciduous species admixed.

PERENNIAL - Herbaceous vegetation composed of more than 50% perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50% annual species.

Leaf Type

Select one value which best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

MICROPHYLLOUS - Woody cover primarily microphyllous.

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF-HERBACEOUS) - Herbaceous vegetation composed of more than 50% broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves.

Physiognomic Class
Choose one:

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

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

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

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

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

Nonvascular: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively.

Sparse Vegetation: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 10% and greater than 0%).

Strata/Lifeform, Height, Cover, Diagnostic Species
Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. Height and Cover classes are also listed below. Do not over stratify community. Rule of thumb is to have at least 10% vegetation cover per strata e.g., if short shrub layer (0.5-2 m tall) is 30% cover and dwarf shrub cover (<0.5 m tall) is <10 % cover then combine into one, especially if the dominated by same species.

Trees are defined as single- or few-stemmed woody plants, generally greater than 5 m in height and 10 cm DBH at maturity and under optimal growing conditions. Individuals can be determined relatively easily. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions, and determining individuals can sometimes be difficult.

Herbaceous layers are Ht = total, H1 = Graminoids (grass, sedge, rush), H2 = Forbs (Dicot herbaceous), H3 = Ferns and Fern allies, and H4 tree seedlings. List the dominant species in each stratum. If species known to be diagnostic of a particular vegetation type are present, list these as well, marking them with an asterisk.

Cover Scale for Strata		Height Scale for Strata	
T	0-1%	01	<0.5 m
P	>1-5%	02	0.5-1m
1	>5-15%	03	1-2 m
2	>15-25%	04	2-5 m
3	>25-35%	05	5-10 m
4	>35-45%	06	10-15 m
5	>45-55%	07	15-20 m
6	>55-65%	08	20-35 m
7	>65-75%	09	35 - 50 m
8	>75-85%	10	>50 m
9	>85-95%		
10	>95-		

Animal Use Evidence
Comment on any evidence of use of the plot/polygon by non-domestic animals (i.e., tracks, scat, gopher or prairie dog mounds, etc.). Notes on domestic animals should be made in the field below.

Natural and Anthropogenic Disturbance
Comment on any evidence of natural or anthropogenic disturbance and specify the source.

Other Comments
Any other comments.

Species/Percent Cover and DBH Tables (see Species Cover and DBH forms)
Starting with the uppermost stratum, list all the species present and cover class (using the 12 point scale) and percent cover of each species in that particular stratum. Indicate strata in the left-hand columns. If in the tree layer (single-stemmed woody plants, generally 5 m in height or greater at maturity), note in the "T" column if T1 (emergent tree), T2 (tree canopy), or T3 (tree sub-canopy). If in the shrub layer, note in the "S" column if S1 (tall shrub, > 2m), S2 (short shrub, < 2m), or S3 (dwarf shrub. < 0.5m). If in the ground layer, note in the "G" column if H1 (herbaceous - graminoid), H2 (Herbaceous Forb), H3 (Herbaceous Fern), H4 (Tree Seedlings), N (nonvascular other than ferns), V (vine/liana) or E (epiphyte).

*For plots with trees, estimate cover of seedlings, saplings, mature (all others), and total cover for each tree species. Use a separate line for each and assign the most appropriate strata class (by height). Seedlings are generally less than 1.5 m, but that may vary by species.

Record species and DBH in cm increments for all trees over 2 meters in height on plot and greater than 10 cm DBH. Tally trees with 5-10 cm DBH. See Great Basin National Park Diameter Form form for recording details. If trees numerous, > 100 individuals, then subsample one quarter of the plot. Record which quadrant, be consistent to avoid bias unless quadrant not representative of plot.

CONSIDERATIONS FOR MISSION PLANNING:
FIELD SAMPLING FOR VEGETATION MAPPING PROJECT

Planning for the day: (ecologist/team leader)

1. Safety and sustenance issues (plenty of food, water, proper clothing, first-aid kit - bring water filter if long steep hike where water can be obtained)
2. Field communications:
   a. Develop plan with other team(s), if necessary for radio check-in time re: plot types and contingencies for duplication problems
   b. Do you have radio and are batteries charged?
3. Check on GPS (batteries, memory available, waypoints for priority samples logged using spreadsheet?)
4. Check on camera (film, batteries)
5. Check list for all other field equipment
   a. clipboard
   b. pens, pencils
   c. compass-clinometer
   d. two tape measures
   e. plastic bags for plants
   f. masking tape and sharpies for labeling specimens
   g. if longer mission, small plant press with adequate blotters and newspaper
   h. sufficient field forms for all possible samples
   i. all ancillary information? (cheat sheet, species list, key, sampling priority list for zone, fuels protocol, main sampling protocol)
6. Plan day's mission before departure for day using one copy per team of a) USGS quad, b) hardcopy DOQQ with flagged points, and c) aerial photo with coded overlay
7. Considerations for mission planning:
   a. considerations based on topography, existing access routes, density and complexity of vegetation (more time for forest and woodland plots, less for herbaceous and scrub),
   b. considerations based on priority needs, and
   c. considerations based on possible redundancy of other team (adequate alternative samples)

Planning for the Week:

1. With which 7.5' quads will you be working? Do you have all appropriate maps, photos and DOQQ's?
2. Develop an estimate of reasonable expectations of plots to choose for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week capture all essential associations in work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information for weekly planning? a) DOQQ's for the zone, b) adequate field copies of air photos (1 per team if both will be working same photo), and c) blank field forms.
6. Communication with management team (Neal Darby) and field crews.
   a. update matrix of sampled plots by type, (enter plot number and provisional community name in plots database.
   b. all uncertainties dealt with (new types seen should we sample?, problems with interpreting PI information, personnel issues, problems in interpreting classification/key, park-related logistics.).

7. Organization of field crews:
    a. gather Q.C.'ed field forms (allow time for your Q.C. and resolving your questions about the forms)
    b. collect all plants not identified (allow time for plant I.D.)
    c. what were your questions about the points visited during the week?
    d. what was accomplished, what was not accomplished?
    e. Pass on the developments and questions to the management team on a regular basis. Don't let them build up too long.

Materials checklist

Gradsect DOQQ maps
road / trail maps
DBH tape
2 tape measure(s)
DBH tape or plastic DBH measurement device
compass
plot markers – large nails (1 per plot, plus extra)
PLGR GPS receiver (checked daily to ensure that it is set to NAD 83)
clinometer
camera, film & batteries/memory card (allow at least 3 exposures per plot)
baggies
plant press & paper
pens / permanent markers
Plot Survey forms
Fuel inventory forms
Observation Point forms
marker board
dry-erase markers (for marker board)
most recent version of provisional classification of the Park, and with number of plots needed per type (updated weekly)

GRBA CODE LIST – Draft cheatsheet

LANDFORM (from Glacier)
Bench
bottomland
canyon
channel
cirque floor
cirque headwall
cliff
col
colluvial slope
dome
drainage channel (undifferentiated)
draw
earth flow
eroded bench
eroding stream channel system
erosional stream terrace
escarpment
flood plain
fluvial
glaciated uplands
gorge
ground moraine
hanging valley
hills
hillslope bedrock outcrop
island
knob
knoll
lake/pond
lake bed
lake plain
lake terrace
lateral moraine
lava flow (undifferentiated)
ledge
levee
meander belt
meander scar
moraine (undifferentiated)
mound
mountain valley
mountain (s)
mountain-valley fan
mud flat
patterned ground (undifferentiated)
periglacial boulderfield
pinnacle
plateau
ravine
ridge
ridge & valley
ridgetop bedrock outcrop
rim
riverbed
rock fall avalanche
saddle
scour
seep
upper 1/3 of slope
middle 1/3 of slope
lower 1/3 of slope
slump pond
soil creep slope
stream terrace (undifferentiated)
streambed
swale
talus
tarn
toe slope
valley floor

TOPOGRAPHIC POSITION

Designation	Synonym(s)
Interfluve	crest, summit, ridge
High slope slope	shoulder slope, upper slope, convex creep
High level	mesa
Midslope	transportational midslope, middle slope
Backslope	dipslope
Step in slope	ledge, terracette
Lowslope	lower slope, foot slope, colluvial footslope
Toeslope	alluvial toeslope
Low level	terrace
Channel wall	bank
Channel bed	narrow valley bottom, gully arroyo
Basin floor	depression

SURFICIAL GEOLOGY

IGNEOUS ROCKS
- Granitic (Granite, Schyolite, Syenite, Trachyte)
- Ioritic (Diorite, Dacite, Andesite)
- Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite)

SEDIMENTARY ROCKS
- Conglomerates and Breccias
- Sandstone
- Siltstone
- Shale
- Limestone and Dolomite
- Marble
- Gypsum

METAMORPHIC ROCKS
- Gneiss
- Schist
- Slate and Phyllite
- Marble
- Serpentine

GLACIAL DEPOSITS
- Undifferentiated glacial deposit
- Till
- Moraine
- Bedrock and till
- Glacio-fluvial deposits (outwash plains, ice contacted GF deposits, eskers, kames, proglacial deltas, crevasse filling, etc.)
- : deposits (alluvial cones, deltaic complexes)
- Lacustrine and fluvial deposits (glacio-fluvial, fluvio-lacustrine, freshwater sandy beaches, stony/gravelly shoreline)

ORGANIC DEPOSITS
- Peat (with clear fibric structure)
- Muck
- Marsh, regularly flooded by lake or river (high mineral content)

SLOPE AND MODIFIED DEPOSITS
- talus and scree slopes
- colluvial
- solifluction, landslide

ASPECT
Flat (n/a)
Variable

N	338-22
NE	23-67
E	68-112
SE	113-157
S	158-202
SW	203-247
W	248-292
NW	293-337

SOIL TEXTURE
Sand
Loamy sand
Sandy loam
Loam
Silt loam
Clay loam
Silt
Clay
Sandy Clay
Silty Clay
Peat
Muck

DRAINAGE
Rapidly drained
Well drained
Moderately well drained
Somewhat poorly drained
Poorly drained
Very poorly drained

IMPACTS
Recent Fire Suppression Activity (e.g. fire lines)
Mountain Pine Beetle Damage
Blister Rust (specify tree species and mortality)
Mistletoe (specify tree species)
Trespass Grazing Evidence
Development
Recreation (campsites, etc.)
Significant Weed Invasion
Wildlife impacts –
- Elk wallow
- Small mammal burrows
- etc.

Field Sampling at Great Basin National Park, Nevada

2008-2009

A Basic Guide for Vegetation Field Work

USGS/NPS Vegetation Mapping Program

This document is intended to give you general instructions and guidelines for conducting your NPS Vegetation Mapping Program field work at Great Basin National Park (GRBA). Detailed, field-by-field coding conventions for the primary forms you'll be completing in the field (the Vegetation Plot forms) are provided in the 'cheat sheets' at the back, along with an example of a completed form.

Overview

The data that you collect will be used to create a relatively fine-scale delineation of vegetation pattern in GRBA and its environs. This field manual describes the methods for collecting the vegetation data.

The range of habitats, and the corresponding diversity of vegetation types, found here is complex. The data you collect will be used by the Park for a number of purposes:

- create a fine scale classification of ecologically distinct vegetation types,
- determine forest fuel loads and model fire behavior,
- plan and monitor management activities,
- track long-term changes in vegetation,
- searches for rare species and weeds
- and portray the wealth of natural diversity on Park lands to the public.

SAMPLING DESIGN

Sampling for this project began in 2003 when 266 plots were sampled in park and environs using a stratified random design using 30 alliance groups within a 1-mile buffer of roads and 0.5 mile buffer from trails. The stratified random sampling design was needed to make statistical inferences for this fuels mapping effort, which is not necessary for vegetation mapping. (See 2003 field methods manual for details).

We completed an initial classification of the 2003 plots to preliminary association, alliance and ecological system to inform sampling design. Plots were separated by what was sampled within (202 plots, 165 in 2003, 37in 2008) and outside Park boundaries (101 plots) to help target known associations that needed additional sampling during 2008 sampling effort. The 2003 sampling design resulted in high numbers of common vegetation types and few or no samples of uncommon types like riparian, wetland, grassland and alpine tundra. Also of concern is the low number of plots in the less roaded and less trailed southern portion of GRBA so sampling efforts need to be focused on these poorly sampled areas as well.

There are between 110-125 vegetation associations estimated on the Park based on the sampling in 2003 and supplemental sampling in 2008. The draft classification and a list of types and areas that needed additional plots will be included in sampling material so crews target and tally plots in each type. It is a first approximation of vegetation associations that occur in the project area. For associations new to the rUSNVC, 3-5 plots are needed to become a standard association. For existing rUSNVC associations, only one plot is required, but 2-3 plots help to better describe the variation of the type at GRBA.

VEGETATION PLOTS

Establishing a field sampling strategy that captures sufficient data on all the distinct vegetation types in an area as large, diverse, and rugged as GRBA is a challenge. To make the sampling representative and efficient, you will be targeting unsampled and undersample vegetation communities at GRBA.

Getting There

You will have a Digital Ortho Quarter Quad (DOQQ) with the Alliance Groups you are to visit/sample indicated. You and your partner will navigate towards each selected Alliance Groups using your road and trail maps, the DOQQ, and/or GPS. The DOQQ's will have roads and trails highlighted on them to help you as well.

Before you leave... check that you have all the materials needed to complete your field work (Please see the checklist and "considerations for mission planning" at the end of this document to help you).

Every morning... check your GPS receiver to make sure it is set to **NAD 83**, that the batteries are charged, and the storage memory is sufficient for the day's work. Check the digital camera to ensure the batteries and memory are sufficient for the day's work. If you will be in the backcountry for several nights, be sure to have sufficient batteries and memory with you.

Along the way...look around. Digital data layers are great, but they do ***not*** replace human perception. The goal of this field work is to sample all the different vegetation types that occur in the Park. If, on the way to one vegetation type, you see an assemblage of plants that seems unique and that is not included on the list of vegetation types, please sample if time allows. You will be better able to recognize these undescribed vegetation types as the season progresses and you become more familiar with the vegetation types and how they can look on the ground. Additionally, it is important that you document occurrences of exotic or rare species you encounter in the course of your travels throughout the park. This can only happen if you are being observant.

Once There

Establishing a Plot

1) Figure out where to place your plot. At Great Basin NP this is a somewhat subjective process. After you travel to the selected point, you'll want to place your plots in areas that seem to be both relatively **homogenous** and **representative** of the vegetation type as a whole, but at the same time should not be biased in respect to fuels sampling. In other words, avoid areas where the vegetation appears to be transitioning from one type to another and areas with anomalous or locally heterogeneous structure or species composition, but include some random placement technique to avoid local bias. Take some time to do this carefully, the plots you establish may be relocated and resampled over time to determine natural changes and responses to management. Look at *all* the vegetation strata to determine if the area is structurally and floristically uniform and generally try to place your plots at least 30 m from what you see as the 'boundary' between this vegetation type and any neighboring, distinctly different types. During the training period this step will be emphasized and discussed in detail. However, the rule-of-thumb is to conduct reconnaissance of the stand as time and topography allows.
Note: In cases where a polygon is very heterogeneous, more than one plot may be needed. Again, look around; use your human ability of perception.

2) Permanently mark the plot location with a plot marker. Plot markers typically consist of a small copper tag inscribed with the project acronym, plot code, and date (e.g. VMP GRBA.412 2009/06/17) attached to a coated nail buried at the plot center point. If it is not possible to bury the marker at the plot center, select an alternate location as near to the plot center as possible and note the distance and azimuth to the plot center. The plot marker should be buried in the mineral soil just under the bottom of the duff

layer, taking care to disturb as small of an area as possible. It should be buried shallow enough to be easily located with a metal detector, yet deep enough to remain concealed over time and to be relatively protected from fire. Remember, if you are unable to place the marker at the plot center you must clearly describe on the form where the plot center is in relation (e.g., plot center located 13.5 m @200 degrees) from the marker. At GRBA, it was decided not to permanently mark plots, except those requested by Tod Williams, Chief Resource Manager for park.

3) Determine and record the plot location. Using your GPS receiver, determine the UTM coordinates at the center of the plot and record them under the **UTM X** and **UTM Y** blanks on the vegetation survey field form. Also record the GPS error. Remember that this is about to become a permanent plot, so being able to *find* it again will be key: use the GPS rather than estimating and be careful in recording the coordinates. Also mark and label the location of the plot on a USGS 7.5 min. topographic map. If you cannot get a GPS reading, estimate UTMs from the USGS topographic map and note on the form that you had to resort to this method. This is important because the datum for the GPS and DOQQ is NAD 83, but USGS topographic map are usually in NAD 27. When you cannot get a GPS reading it is also helpful to note a landmark(s) with distance and azimuth to plot center to help relocate the plot.

Plots may be circular, rectangle or square. Note shape and dimensions on the field form. If the plot is rectangle or square, record the azimuth of the long side (any side if square) to help relocate the plot. It may make more sense to establish rectangular plots in linear vegetation types (e.g. riparian or ridgeline types).
Standard plot sizes should be as follows:

If you're in a ...	**You should usually make your plot...**	**Giving you a plot area of...**
Forest (i.e., trees have their crowns overlapping, usually forming 60-100% cover)	11.3 m radius or 20 m x 20 m	400 m^2
Woodland (i.e., open stands of trees with crowns usually not touching. Canopy tree cover is 25-60% Or exceeds shrub, dwarf-shrub, herb, and nonvascular cover).	11.3 m radius or 20 m x 20 m	400 m^2
Shrubland (i.e., shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover)	11.3 m radius or 20 m x 20 m	400 m^2
Dwarf-shrubland (heath) (i.e., Shrubs less than 0.5 m tall are dominant4, usually forming more than 25% cover OR exceeding tree, shrub, herb, and nonvascular cover).	5.65 m radius or 10 m x 10 m Or 11.3 m radius or 20 m x 20 m	100 m^2 Or 400 m^2
Herbaceous (i.e., Herbs dominant, usually forming more than 25 percent cover OR exceeding tree, shrub, dwarf-shrub, and nonvascular cover).	5.65 m radius or 10 m x 10 m Or 11.3 m radius or 20 m x 20 m	100 m^2 Or 400 m^2
Sparse vegetation (i.e., Less than 10% vegetation cover; larger plots [1000 m^2] may be needed, to be representative if vegetation heterogeneously distributed.)	11.3 m radius or 20 m x 20 m Or 17.84 m radius or 33.6 m x 33.6 m	400 m^2 Or 1000 m^2
Nonvascular (i.e., nonvascular cover dominant, usually forming more than 25% cover). Larger plots [100 m^2] may be needed, to be representative if vegetation heterogeneously distributed.)	2.82 m radius or 5 m x 5 m Or 5.65 m radius or 10 m x 10 m	25 m^2 Or 100 m^2

Note: You can deviate from the standard plot *shapes* and sizes where that makes sense, but the total plot *area* encompassed by the boundaries should be as listed above for each major class of vegetation. For example, forested riparian vegetation, may be sampled in a more linear 10 x 40 m (400 m^2) plot; herbaceous riparian or ridgeline vegetation in a 2 x 50 m (100 m^2) plot. You may also increase the size of the plot to the next standard size if necessary to accurately sample the heterogeneity of the vegetation.

Forests, woodlands and shrublands can be increased to 1000 m^2. Please make a note on the vegetation survey form when this is the case. A standard (400 m^2) plot works well for most types balancing representativeness of vegetation structure and species composition of type with moderate effort.

4) Complete the **Identifiers/Locators** portion of your Vegetation Survey Form and take the vegetation plot photos.

Identifiers/Locators
Complete the information for any fields that are not already completed.
The permanent plot code is a combination of the project name acronym (VMP), the serial plot number (GRBA.401 and the date (2009/06/17). At GRBA, it was decided not to permanently mark plots, except those requested by Tod Williams, park Director of Natural Resources.

Taking vegetation photographs

Take the photograph looking across the contour if plot is steep. Flag or mark the plot center for the photo to aid relocation. Record flashcard/roll #, frame # and azimuth on the vegetation survey form. Crew leaders are responsible for taking and organizing photos. See the coding instructions at the end of this document for guidance on the specific fields.

Data Collection

Environmental Description

See the coding instructions at the end of this document for guidance on the specific fields.

Vegetation Description
For guidance on the specific fields on the second page of the form, see the coding instructions.

As you begin to collect the species, DBH, and cover information, keep these rules in mind—they will speed your data collection considerably:

1) Except in very diverse plots, don’t spend more than **20 minutes** looking for new and different species to record. Remember that these plot data are to be used to classify the overall vegetation of the Park, not to make a complete species list for it. If you had to spend much more than 20 minutes to *find* a species, it isn’t important to characterizing the vegetation type. For diverse plots with over 25 taxa you may take up to 30 minutes on the listing process.

2) If you can’t identify a plant to species, record it on your form as “unknown species 1,” “unknown species 2,” “unknown Carex sp. 1,” etc. Record associated cover class and other data for the unknown as you would for any other species. Then do one of two things:

If you need the species identified right away because it appears to be dominant or diagnostic (you’re seeing it all over the place or you’re seeing much more in this particular vegetation type than in others), take a sample of the species with as much of the plant as possible, especially intact sexual parts, if present. Place the sample in a baggie, and label the baggie (or specimen) with the plot code and the name you gave it on the data form.

If you don’t need the plant keyed right away, press it. Mark the pressed specimen with the plot code and the name you gave it on the data form.

Store specimens in a cool, dry place. Bagged specimens will keep fresh longer in the refrigerator or ice chest until pressed or identified. You can, of course, key some of these out yourself if you want to, but don't let plant keying get in the way of your primary responsibility: *field data collection*. No one expects you to identify every plant but you should make an effort to learn at least the common species that keep recurring in plots. A quick prioritization of what to key and what to press may be made based on the recurrence of the species in samples and on the cover-class estimate of the species in a particular plot. If the species has a high cover value (>1%) it is more of a priority to identify. Field crews should mark the specimen tag with its cover class estimate and any notes helpful in identification such as "tall shrub" or "wetland plant", as well as its unique identifying number for the vegetation sample. If pressed specimens begin to build up, let your supervisor or the NatureServe folks know. They can take steps to have some of them identified. After an unknown specimen is identified, please update plot form.

Observation Point Form

Occasionally, you may need to collect some plot-free data. Observation Points take less time than full plots, because soils data and full species data are not collected. This will happen when:

1) You have an ample number of full plots of a type, but are in a significantly different location in the park and want to document that a given association occurs there. Vegetation mappers need lots of reference points to accurately map vegetation over large parks such as GRBA.
2) You want to quick document variation within a stand you just sampled or you are not sure it is a valid vegetation type (ecotonal, disturbed or unique and may not repeat in similar environments on landscape).
3) You do not have time to do a full plot but want to capture some data on a vegetation type.

In these cases, there is no need to establish a plot. However, you will help the photo interpreters identify this type in the future if you collect some data. You will navigate to the polygon as usual, scout out the polygon briefly to get a feel for what it is like, and record some general data to characterize it on an Observation Point form. Use Plot Survey form, and the same cheat sheet can be used to help with filling it out. GPS points may be taken at any part of the polygon as long as it is >30 m from its edge, to verify its location.

Use the standard plot form, but omit soil type texturing and full species list / cover data sheet and checking Observation Point box. Record dominant and diagnostic species names and cover classes on strata form. Important vegetation classification information can be captured in Vegetation Comments. *We hope you find your field season at Great Basin National Park enjoyable and rewarding. Best of luck!*

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The Nature Conservancy [TNC]. 1998. An environmentally-driven approach to vegetation sampling and mapping at Yosemite National Park. Report prepared for the U.S. Department of the Interior, National Biological Survey and National Park Service. The Nature Conservancy, Arlington, Virginia.

Instructions for filling out Fields in the PLOT SURVEY FORM (GRBA version, 2008-09)

Plot Code
Code indicating the specific plot within the vegetation polygon. For Great Basin National Park, the codes will be "GRBA.###". Each crew will be assigned a range of plot numbers. Begin with GRBA.501 and increment up from there for 2009 sampling. Be certain you are not using the same range as another team or numbers you have already used. If someone switches to another team, it is important they know what plot numbers the team will use to identify the data they gather. Before you leave be sure you know what number range the crew will use and that these are not being used by another team!

Observation box
Check box if plot is an Observation Point. Otherwise it is assumed a full plot was completed.

Provisional Map Class Name
Using the list of provisional map class name, enter the map class that best fits the sampled vegetation. Leave blank or enter appropriate Ecological System if provisional map class or ecological system list is not available.

Provisional Community Name
Using the provisional classification you were provided for the Park, assign the name of the vegetation type that most closely resembles the type you are surveying. Enter the finest level of the classification possible. In fact, none of the names may be a good fit; you may have found a new type, although this should be the exception and not the rule. If you have a new type, create a provisional name with the dominant and diagnostic species. The 'provisional community name' that is assigned will be used to update the tally of plots needed for each vegetation type. This is often done after the plot is sampled.

State NV

Park Name Great Basin NP

Location Comments
This is a site name you assign to describe where the data were collected. It should represent a nearby and identifiable feature on the topographic map. Include brief directions to help relocate plot or avoid hazards if UTM location alone is not adequate e.g., Long meadow north of Strawberry Creek near end of road or 500 m East of Wheeler Peak Campground.

UTM X
Use GPS if at all possible. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

UTM Y
Use GPS if at all possible. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

GPS Error
It is occasionally difficult to acquire UTM coordinates as your GPS receiver may only see one or two satellites. Ideally, your receiver should see at least four or more satellites. If you are unable to acquire UTM coordinates in the plot, or if the PDOP is greater than 8 (or EPE is greater than 50 m), first try to acquire a signal from a higher point outside (but still close to) the plot. If that fails, you will need to estimate the UTM coordinates from the USGS topo quad map or GIS field map, and manually enter these numbers into the data logger or plot form. Verify the map being used has the project standard datum of

NAD83. Sometimes, a satellite is just below the horizon and will move into position by the time you are finished collecting data on the plot. Additionally, if you can get an accurate GPS reading on a nearby knoll or canopy gap, you can record the compass bearing and distance (m) to an accurate GPS location. You must record any deviation from the standard method in GPS comments.

Survey Date
Date the survey was taken; year, month, day.

Surveyors
Names of surveyors, with crew leader listed first.

Plot Dimensions Circular, Square or Rectangle Shape
Choose the appropriate plot size based on the following vegetation types. Default to standard 400 m2 plots unless there is a reason to change. A 400 m2 plot is generally a good balance between representativeness and effort. You may need to increase size for sparsely vegetation communities to adequately sample the full diversity of species. For some herbaceous or non-vascular communities you may decrease size if species diversity is extreme and a larger plot would take too much time.
It is important to enter size and shape of diameter for circular plots and width and length dimensions for square or rectangular plots. For rectangular plots record azimuth of a long side.

Vegetation Class	**Circular or Square Plot, Homogenous Vegetation**	**Rectangular Plot Riparian or other linear vegetation**
Forest Woodland Shrubland	400 m^2 11.28 m radius 20 m x 20 m	400 m^2 10 m x 40 m 5 m x 80 m.
Dwarf-shrubland Herbaceous	100 m^2 or 400 m^2 5.62 m radius or 11.28 m radius 10 m x 10 m or 20 m x 20 m	100 m^2 or 400 m^2 5 m x 20 m or 10 m x 40 m 2 m x 50 m or 5 m x 80 m
Sparse Vegetation	400 m^2 or 1000 m^2 11.28 m radius or 17.84 m radius 20 m x 20 m or 33.6 m x 33.6 m	400 m^2 or 1000 m^2 5 m x 20 m or 10 m x 100 m 20 m x 50 m or 20 m x 50 m
Nonvascular	25 m^2 or 100 m^2 2.82 m radius or 5.62 m radius 5 m x 5 m or 10 m x 10 m	25 m^2 or 100 m^2 1 m x 25 m or 5 m x 20 m

Plot Photos
We are taking 5-6 pictures of each plot. Photos 1-4 are taken using cardinal directions starting in with N, then going clock-wise E, S, and W. If possible, take photo with plot center in bottom and horizon on top. This gives a view of the center point for relocation and landscape context for the photo. A couple pin flags are helpful it indicate plot center. Next take 1 or 2 representative photos from outside plots looking in. Record camera or memory card # being used, photo # and bearing or azimuth of all photos. If you will be using a photolink program, take a picture of the gps unit to time stamp photos.

A small dry erase or chalk board with plot #, (GRBA.401), azimuth (N, E, S, W) and date is useful for identifying plot photos in future. The board can be held by a co-worker or propped up in bottom of photo. Be sure board does not block a large portion of photo. A separate photo log can also be used if needed to manage photos so they can be tied to plot number in future.

Permanent Plot Marker Code
Indicate the exact code written onto the plot tag buried at the plot. This should include the project acronym, plot code, and the date (e.g. VMP.GRBA.312 2002/06/17). At GRBA, it was decided not to permanently mark plots, except those requested by Tod Williams, Chief Resource Manager.

Plot Representativeness
Does this plot represent the full variability of the polygon/stand? If not, were additional plots taken? Note additional species not seen in the plot in the space provided below. Note: we distinguish in this section the plot's ability to represent the stand or polygon you are sampling as one component and the ability of this sample to represent the range of variability of the association in the entire mapping area. Comment A, comes only after some familiarity with the vegetation type throughout the mapping area and may be left blank if you have no opinion at this time. Comment B, representativeness of plot in stand is ascertained by reconnaissance of the stand.

ENVIRONMENTAL DESCRIPTION

Elevation
Elevation of the plot. **Specify whether in feet or meters** (this will depend on the units used on the GPS or on the topographic map being used). In general, we have determined that the reading you get from a topo map, provided you are certain where you are, is more accurate than the average reading from the GPS unit. Thus, please attempt to estimate your elevation with the topo map.

Slope
Measure the slope in degrees using a clinometer.

Aspect
Measure the slope aspect using a compass (be sure to correct for the magnetic declination). Note: all compasses should be pre-set to an average declination for the park and thus, readings from the compasses carried by the field crews may be directly noted.

Topographic Position
Topographic position of the plot. Choose one:

INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.

HIGH SLOPE (shoulder slope, upper slope, convex creep slope). Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

HIGH LEVEL (mesa). Level top of a plateau.

MIDSLOPE (transportational midslope, middle slope). Intermediate slope position.

BACKSLOPE (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments (fall faces).

STEP IN SLOPE (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.

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

TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

LOW LEVEL (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL WALL (bank). Sloping side of a channel.

CHANNEL BED (narrow valley bottom, gully, arroyo, wash). Bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

Landform

Enter the landform that describes the site where the plot was taken. Note on the code sheet the landform choices are listed at different scales. Thus, one can select more than one for plot if appropriate (e.g., mountain could be macro and ridge could be meso scale). You can add to the list for Great Basin NP. Just be consistent so we can analyze by landform (Consult with Park staff for final list). Peterson (1981) Landforms of the Great Basin and Range Province is a useful reference for understanding landforms and has standard names.

LANDFORM	levee
Bench	meander belt
Bottomland	meander scar
Canyon	moraine (undifferentiated)
Channel	mound
cirque floor	mountain valley
cirque headwall	mountain (s)
cliff	mountain-valley fan
col	mud flat
colluvial slope	patterned ground (undifferentiated)
dome	periglacial boulderfield
drainage channel (undifferentiated)	pinnacle
draw	plateau
earth flow	ravine
eroded bench	ridge
eroding stream channel system	ridge & valley
erosional stream terrace	ridgetop bedrock outcrop
escarpment	rim
flood plain	riverbed
fluvial	rock fall avalanche
glaciated uplands	saddle
gorge	scour
ground moraine	seep
hanging valley	upper 1/3 of slope
hills	middle 1/3 of slope
hillslope bedrock outcrop	lower 1/3 of slope
island	slump pond
knob	soil creep slope
knoll	stream terrace (undifferentiated)
lake/pond	streambed
lake bed	swale
lake plain	talus
lake terrace	tarn
lateral moraine	toe slope
lava flow (undifferentiated)	valley floor
ledge	

Surficial Geology
Note the geologic substrate influencing the plant community (bedrock or surficial materials). Accurately recording the geology at the plot is especially important if the plot is on an inclusion in the type on the geology map. Included below is general geology substrate list to use to characterize the geology of the plot (others can be added if necessary).

General bedrock or surficial geology - use more specific park geology legend if available.

IGNEOUS ROCKS Granitic (Granite, Schyolite, Syenite, Trachyte) Ioritic (Diorite, Dacite, Andesite) Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite) SEDIMENTARY ROCKS Conglomerates and Breccias Sandstone Siltstone Shale Limestone and Dolomite Marble Gypsum METAMORPHIC ROCKS Gneiss Schist Slate and Phyllite Marble Serpentine	GLACIAL DEPOSITS Undifferentiated glacial deposit Till Moraine Bedrock and till Glacio-fluvial deposits (outwash plains, ice contacted GF deposits, eskers, kames, proglacial deltas, crevasse filling, etc.) Deltaic deposits (alluvial cones, deltaic complexes) Lacustrine and fluvial deposits (glacio-fluvial, fluvio-lacustrine, freshwater sandy beaches, stony/gravelly shoreline) ORGANIC DEPOSITS Peat (with clear fibric structure) Muck Marsh, regularly flooded by lake or river (high mineral content) SLOPE AND MODIFIED DEPOSITS talus and scree slopes colluvial solifluction, landslide

Cowardin System / Hydrology
If the system is a wetland, check off the name of the USFWS system which best describes its hydrology and landform. Indicate "upland" if the system is not a wetland.

Next, assess the hydrologic regime of the plot using the descriptions below (adapted from Cowardin et al. 1979).

SEMIPERMANENTLY FLOODED - Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's Intermittently Exposed and Semipermanently Flooded modifiers.

SEASONALLY FLOODED - Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

SATURATED - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's Saturated modifier.

TEMPORARILY FLOODED - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands. Equivalent to Cowardin's Temporary modifier.

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

PERMANENTLY FLOODED - Water covers the land surface at all times of the year in all years. Equivalent to Cowardin's "permanently flooded."

UNKNOWN - The water regime of the area is not known. The unit is simply described as a non-tidal wetland.

Environmental Comments
Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors. Include any comments on any evidence of natural or anthropogenic disturbance and specify the source.

Also include any comments on any evidence of use of the plot/polygon by non-domestic animals (i.e., tracks, scat, gopher or prairie dog mounds, etc.). Notes on domestic animals should be made in the field below.

Ground Cover
Estimate ground cover to the nearest percentage by each category, including woody stem basal area where significant in "other" category. Cover estimates should sum to 100%. In cases where moss, lichen, sand or litter covers thinly covers rock, ignore the less significant cover and record the total cover of rock. This non-vascular cover can be included in the total cover moss and lichen and recorded in the non-vascular strata. Moss or Lichen cover can be estimated separately on the species cover form.

Soil Texture
Using the key below, assess average soil texture. If substrate is organic muck or peat, record that on form instead of soil texture.

Simplified Key to Soil Texture (Brewer and McCann 1982)

A1 Soil does not remain in a ball when squeezed .... **sand**

A2 Soil remains in a ball when squeezed .... B

B1 Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you push up over your finger.
Soil makes no ribbon ....**loamy sand**

B2 Soil makes a ribbon; may be very short C

C1 Ribbon extends less than 1 inch before breaking... D

C2 Ribbon extends 1 inch or more before breaking ....E

D1 Add excess water to small amount of soil
Soil feels at least slightly gritty..**loam or sandy loam**

D2 Soil feels smooth...**silt loam**

E1 Soil makes a ribbon that breaks when 1-2 inches long;
cracks if bent into a ring..F

E2 Soil makes a ribbon 2+ inches long; does not crack when bent into a ring .... G

F1 Add excess water to small amount of soil;
soil feels at least slightly gritty ....**sandy clay loam or clay loam**

F2 Soil feels smooth...**silty clay loam or silt**

G1 Add excess water to a small amount of soil;
soil feels at least slightly gritty ....**sandy clay or clay**

G2 Soil feels smooth.. **silty clay**

Soil Drainage
The soil drainage classes are defined in terms of (1) actual moisture content (in excess of field moisture capacity) and (2) the extent of the period during which excess water is present in the plant-root zone. It is recognized that permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. It is further recognized that soil profile morphology, for example mottling, normally, but not always, reflects soil moisture status. Although soil morphology may be a valuable field indication of moisture status, it should not be the overriding criterion. Soil drainage classes cannot be based solely on the presence or absence of mottling. Topographic position and vegetation as well as soil morphology are useful field criteria for assessing soil moisture status.

RAPIDLY DRAINED - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water addition. Soils are free from any evidence of gleying throughout the profile. Rapidly drained soils are commonly coarse textured or soils on steep slopes.

WELL DRAINED - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 3 feet, but may be mottled below this depth. B horizons, if present, are reddish, brownish, or yellowish.

MODERATELY WELL DRAINED - The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are commonly mottled (chroma < 2) in the lower B and C horizons or below a depth of 2 feet. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the solum. In grassland soils the B and C horizons may be only faintly mottled and the A horizon may be relatively thick and dark.

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

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

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

VEGETATION DESCRIPTION

Leaf Phenology
Select the value which best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

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

COLD DECIDUOUS – More than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

MIXED EVERGREEN - COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and cold-deciduous species admixed.

PERENNIAL - Herbaceous vegetation composed of more than 50% perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50% annual species.

Leaf Type
Select one value which best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

MICROPHYLLOUS - Woody cover primarily microphyllous.

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF-HERBACEOUS) - Herbaceous vegetation composed of more than 50% broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves.

Physiognomic Class
Choose one:

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

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

Shrubland: Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less

	than 25% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation dominated by woody vines is generally treated in this class.
Dwarf-Shrubland:	Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively
Herbaceous:	Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.
Nonvascular:	Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively.
Sparse Vegetation:	Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 10% and greater than 0%).

Strata/Lifeform, Height, Cover, Diagnostic Species
Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. List dominant species and indicate with * the diagnostic species. Height and Cover classes are also listed below. Do not over stratify community. Rule of thumb is to have at least 10% vegetation cover per strata e.g., if short shrub layer (0.5-2 m tall) is 30% cover and dwarf shrub cover (<0.5 m tall) is <10 % cover then combine into one, especially if the dominated by same species.

Trees are defined as single- or few-stemmed woody plants, generally greater than 5 m in height and 10 cm DBH at maturity and under optimal growing conditions. Individuals can be determined relatively easily. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions, and determining individuals can sometimes be difficult.

Herbaceous layers are Ht = total, H1 = Graminoids (grass, sedge, rush), H2 = Forbs (Dicot herbaceous), H3 = Ferns and Fern allies, and H4 tree seedlings. List the dominant species in each stratum. If species known to be diagnostic of a particular vegetation type are present, list these as well, marking them with an asterisk.

Note: When using this form for Observation Points, next to dominant and diagnostic species listed by strata add individual species cover classes in parentheses. Use vegetation comments is more room is needed. This information is very useful in classifying observation point.

Cover Scale for Strata		Height Scale for Strata	
T	0-1%	01	<0.5 m
P	>1-5%	02	0.5-1m
1-	>5-10%	03	1-2 m
1+	>10-15%	04	2-5 m
2	>15-25%	05	5-10 m
3	>25-35%	06	10-15 m
4	>35-45%	07	15-20 m
5	>45-55%	08	20-35 m
6	>55-65%	09	35 - 50 m
7	>65-75%	10	>50 m
8	>75-85%		
9	>85-95%		
10	>95-		

Vegetation and Other Comments

Include notes on atypical variation of this plots including unusual species or structure. E.g., mesic species are restricted to depression in SE corner of plot. Describe stand structure: even-aged, mult-aged canopy, early/late seral/old growth stand or note average DBH in cm of canopy trees or height of emergent tree.

Species List / Percent Cover Table (Full Plots only)

Starting with the uppermost stratum, list all the species present and cover class (using the 12 point scale) and percent cover of each species in that particular stratum. Indicate strata in the left-hand columns. If in the tree layer (single-stemmed woody plants, generally 5 m in height or greater at maturity), note in the "T" column if T1 (emergent tree), T2 (tree canopy), or T3 (tree sub-canopy). If in the shrub layer, note in the "S" column if S1 (tall shrub, > 2m), S2 (short shrub, < 2m), or S3 (dwarf shrub. < 0.5m). If in the ground layer, note in the "G" column if H1 (herbaceous - graminoid), H2 (Herbaceous Forb), H3 (Herbaceous Fern), H4 (Tree Seedlings), N (nonvascular other than ferns), V (vine/liana) or E (epiphyte).

For plots with trees, estimate cover of seedlings, saplings, mature (all others), and total cover for each tree species. Use a separate line for each and assign the most appropriate strata class (by height). Seedlings are generally less than 1.5 m, but that may vary by species.

CONSIDERATIONS FOR MISSION PLANNING:
FIELD SAMPLING FOR VEGETATION MAPPING PROJECT

Planning for the day: (ecologist/team leader)
1. Safety and sustenance issues (plenty of food, water, proper clothing, first-aid kit - bring water filter if long steep hike where water can be obtained)
2. Field communications:
   a. Develop plan with other team(s), if necessary for radio check-in time re: plot types and contingencies for duplication problems
   b. Do you have radio and are batteries charged?
3. Check on GPS (batteries, memory available, waypoints for priority samples logged using spreadsheet?)
4. Check on camera (film, batteries)
5. Check list for all other field equipment
   a. clipboard
   b. pens, pencils
   c. compass-clinometer
   d. two tape measures
   e. plastic bags for plants
   f. masking tape and sharpies for labeling specimens
   g. if longer mission, small plant press with adequate blotters and newspaper
   h. sufficient field forms for all possible samples
   i. all ancillary information? (cheat sheet, species list, key, sampling priority list for zone, fuels protocol, main sampling protocol)
6. Plan day's mission before departure for day using one copy per team of a) USGS quad, b) hardcopy DOQQ with flagged points, and c) aerial photo with coded overlay
7. Considerations for mission planning:
   a. considerations based on topography, existing access routes, density and complexity of vegetation (more time for forest and woodland plots, less for herbaceous and scrub),
   b. considerations based on priority needs, and
   c. considerations based on possible redundancy of other team (adequate alternative samples)

Planning for the Week:
1. With which 7.5' quads will you be working? Do you have all appropriate maps, photos and DOQQ's?
2. Develop an estimate of reasonable expectations of plots to choose for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week capture all essential associations in work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information for weekly planning? a) DOQQ's for the zone, b) adequate field copies of air photos (1 per team if both will be working same photo), and c) blank field forms.
6. Communication with management team (Neal Darby) and field crews.
   a. update matrix of sampled plots by type, (enter plot number and provisional community name in plots database.
   b. all uncertainties dealt with (new types seen should we sample?, problems with interpreting PI information, personnel issues, problems in interpreting classification/key, park-related logistics.).

7. Organization of field crews:

a. gather Q.C.'ed field forms (allow time for your Q.C. and resolving your questions about the forms)
b. collect all plants not identified (allow time for plant I.D.)
c. what were your questions about the points visited during the week?
d. what was accomplished, what was not accomplished?
e. Pass on the developments and questions to the management team on a regular basis. Don't let them build up too long.

Materials checklist

Gradsect DOQQ maps
road / trail maps
DBH tape
2 tape measure(s)
DBH tape or plastic DBH measurement device
compass
plot markers – large nails (1 per plot, plus extra)
PLGR GPS receiver (checked daily to ensure that it is set to NAD 83)
clinometer
camera, film & batteries/memory card (allow at least 3 exposures per plot)
baggies
plant press & paper
pens / permanent markers
Plot Survey forms
Fuel inventory forms
Observation Point forms
marker board
dry-erase markers (for marker board)
most recent version of provisional classification of the Park, and with number of plots needed per type (updated weekly)

APPENDIX D: GRBA FIELD PLOT CROSSWALK TO REVISED US NATIONAL VEGETATION CLASSIFICATION ASSOCIATIONS

A total of 343 field samples (full plots, rapid assessment points, observation points and three accuracy assessment points) from the project area were classified to association level of the revised US National Vegetation Classification (rUSNVC). Element codes are used by NatureServe and state Natural Heritage Programs to track nomenclature and status of rare plants, rare animals, and communities (“elements”). Plant species taxonomic nomenclature used by the NatureServe and revised USNVC follows Kartesz (1999).

Association	Element Code	No. of Samples	Field Samples
Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum Forest	CEGL005418	3	GRBA.609, GRBA.620, GRBA.621
Abies concolor - *Populus tremuloides / Carex scopulorum* Forest	CEGL005419	1	GRBA.610
Abies concolor - *Populus tremuloides* Avalanche Chute Shrubland	CEGL005420	1	GRBA.314
Abies concolor - *Pseudotsuga menziesii / Carex rossii* Forest	CEGL000431	1	GRBA.105
Abies concolor / Arctostaphylos patula Forest	CEGL000242	7	GRBA.107, GRBA.125, GRBA.149, GRBA.153, GRBA.158, GRBA.163, GRBA.715
Abies concolor / Cercocarpus ledifolius Woodland	CEGL000885	4	GRBA.049, GRBA.174, GRBA.451, GRBA.810
Abies concolor / Symphoricarpos oreophilus Forest	CEGL000263	7	GRBA.106, GRBA.108, GRBA.109, GRBA.256, GRBA.257, GRBA.333, GRBA.707
Abies concolor Rock Outcrop Sparse Vegetation [Park Special]	CEPS009594	1	GRBA.507
Acer glabrum Drainage Bottom Shrubland	CEGL001062	1	GRBA.330
Achnatherum lettermanii Herbaceous Vegetation	CEGL005354	1	GRBA.301
Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata) Semi-natural Herbaceous Vegetation	CEGL005266	1	GRBA.442
Amelanchier utahensis - *Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland	CEGL002820	3	GRBA.044, GRBA.313, GRBA.703
Aquilegia scopulorum - *Eriogonum holmgrenii* Fell-field Herbaceous Vegetation	CEGL005421	3	GRBA.196, GRBA.197, GRBA.198
Arctostaphylos patula / Ceanothus martinii Shrubland	CEGL005422	2	GRBA.310, GRBA.318
Arctostaphylos patula Shrubland	CEGL002696	1	GRBA.320
Artemisia arbuscula ssp. *arbuscula / Pseudoroegneria spicata* Shrub Herbaceous Vegetation	CEGL001412	2	GRBA.038, GRBA.612
Artemisia nova / Achnatherum hymenoides Shrubland	CEGL001422	1	GRBA.804
Artemisia nova / Poa fendleriana Shrubland	CEGL002698	1	GRBA_AA_0318
Artemisia nova / Pseudoroegneria spicata Shrubland	CEGL001424	1	GRBA.721

Association	Element Code	No. of Samples	Field Samples
Bromus tectorum Semi-natural Shrubland	CEGL003019	1	GRBA_AA_0199
Artemisia tridentata / Elymus elymoides Shrubland	CEGL001001	1	GRBA.801
Artemisia tridentata ssp. *tridentata - Peraphyllum ramosissimum - Chamaebatiaria millefolium* Shrubland [Park Special]	CEPS009595	1	GRBA.404
Artemisia tridentata ssp. *tridentata / Agropyron cristatum* Semi-natural Shrubland [Park Special]	CEPS009566	2	GRBA.430, GRBA.440
Artemisia tridentata ssp. *tridentata / Leymus cinereus* Shrubland	CEGL001016	3	GRBA.403, GRBA.731, GRBA.811
Artemisia tridentata ssp. *tridentata / Pleuraphis jamesii* Shrubland	CEGL001015	1	GRBA.261
Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus* ssp. *trachycaulus* Shrubland	CEGL001034	5	GRBA.247, GRBA.248, GRBA.716, GRBA.726, GRBA.749
Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland	CEGL001038	7	GRBA.051, GRBA.099, GRBA.127, GRBA.420, GRBA.510, GRBA.515, GRBA.516
Artemisia tridentata ssp. *vaseyana / Poa (glauca, secunda)* Shrubland	CEGL005423	4	GRBA.725, GRBA.727, GRBA.728, GRBA.737
Artemisia tridentata ssp. *vaseyana / Poa fendleriana* Shrubland	CEGL002812	4	GRBA.050, GRBA.098, GRBA.706, GRBA.718
Astragalus kentrophyta - Eriogonum holmgrenii Fell-field Herbaceous Vegetation [Park Special]	CEPS009597	1	GRBA.817
Balsamorhiza sagittata Herbaceous Vegetation [Park Special]	CEPS009598	1	GRBA.508
Betula occidentalis / Cornus sericea Shrubland	CEGL001161	1	GRBA.032
Betula occidentalis / Mesic Graminoids Shrubland	CEGL002654	1	GRBA.094
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	CEGL005264	1	GRBA.614
Carex elynoides - Geum rossii Herbaceous Vegetation	CEGL001853	2	GRBA.307, GRBA.903
Carex elynoides - Phlox pulvinata - Poa secunda Herbaceous Vegetation	CEGL005424	3	GRBA.323, GRBA.326, GRBA.327
Carex nebrascensis Herbaceous Vegetation	CEGL001813	2	GRBA.302, GRBA.334
Carex scopulorum Herbaceous Vegetation	CEGL001822	3	GRBA.309, GRBA.735, GRBA.742
Carex subnigricans - Geum rossii - Sibbaldia procumbens Snowbed [Provisional]	CEGL005425	1	GRBA.426
Cercocarpus intricatus - Glossopetalon spinescens Shrubland	CEGL005426	4	GRBA.234, GRBA.235, GRBA.236, GRBA.702
Cercocarpus ledifolius / Arctostaphylos patula Woodland [Provisional]	CEGL005355	5	GRBA.136, GRBA.137, GRBA.142, GRBA.151, GRBA.514
Cercocarpus ledifolius / Artemisia tridentata ssp. *vaseyana* Woodland	CEGL001022	2	GRBA.052, GRBA.187
Cercocarpus ledifolius / Pseudoroegneria spicata Shrubland	CEGL000967	1	GRBA.509
Cercocarpus ledifolius / Symphoricarpos oreophilus Woodland	CEGL000970	9	GRBA.004, GRBA.103, GRBA.150, GRBA.188, GRBA.704, GRBA.708, GRBA.720, GRBA.729, GRBA.805

Association	Element Code	No. of Samples	Field Samples
Cercocarpus ledifolius Rock Outcrop Sparse Vegetation [Park Special]	CEPS009599	1	GRBA.319
Chrysothamnus viscidiflorus Shrub Herbaceous Vegetation [Provisional]	CEGL002530	1	GRBA.316
Cymopterus nivalis - Erigeron leiomerus - Poa secunda Herbaceous Vegetation [Park Special]	CEPS009600	1	GRBA.324
Dasiphora fruticosa ssp. *floribunda / Elymus trachycaulus* Shrub Herbaceous Vegetation [Park Special]	CEPS009601	1	GRBA.740
Dodecatheon alpinum Herbaceous Vegetation [Park Special]	CEPS009590	5	GRBA.110, GRBA.733, GRBA.745, GRBA.746, GRBA.748
Elymus trachycaulis Herbaceous Vegetation	CEGL005427	3	GRBA.128, GRBA.734, GRBA.736
Ericameria nauseosa / Bromus tectorum Semi-natural Shrubland	CEGL002937	1	GRBA.431
Geum rossii - Calamagrostis purpurascens Herbaceous Vegetation [Park Special]	CEPS009602	1	GRBA.424
Geum rossii - Phlox pulvinata Fell-field Herbaceous Vegetation	CEGL005428	2	GRBA.306, GRBA.422
Geum rossii Herbaceous Vegetation	CEGL001964	1	GRBA.428
Hulsea algida - Selaginella watsonii Herbaceous Vegetation [Provisional]	CEGL005429	1	GRBA.232
Juncus balticus Herbaceous Vegetation	CEGL001838	1	GRBA_AA_1107
Juncus nevadensis - Poa secunda Herbaceous Vegetation [Park Special]	CEPS009603	1	GRBA.112
Leymus cinereus Herbaceous Vegetation	CEGL001479	2	GRBA.332, GRBA.336
Lomatium graveolens var. alpinum Herbaceous Vegetation [Park Special]	CEPS009604	1	GRBA.322
Peraphyllum ramosissimum - Artemisia tridentata Shrubland	CEGL005430	2	GRBA.407, GRBA.409
Petrophyton caespitosum Sparse Vegetation [Park Special]	CEPS009605	1	GRBA.506
Phlox pulvinata Herbaceous Vegetation [Provisional]	CEGL002740	1	GRBA.901
Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis) Krummholz	CEGL005432	4	GRBA.145, GRBA.328, GRBA.423, GRBA.425
Picea engelmannii - (Pinus flexilis) / Carex rossii Woodland	CEGL005433	16	GRBA.146, GRBA.160, GRBA.162, GRBA.165, GRBA.202, GRBA.203, GRBA.204, GRBA.205, GRBA.211, GRBA.214, GRBA.217, GRBA.218, GRBA.226, GRBA.258, GRBA.259, GRBA.421
Picea engelmannii - Populus tremuloides / Arctostaphylos patula Forest [Park Special]	CEPS009644	1	GRBA.184
Picea engelmannii - Populus tremuloides / Mesic Forb Forest [Park Special]	CEPS009587	3	GRBA.155, GRBA.709, GRBA.750
Picea engelmannii - Populus tremuloides Avalanche Chute Shrubland	CEGL005431	2	GRBA.168, GRBA.321
Picea engelmannii / Carex scopulorum Woodland	CEGL005446	4	GRBA.135, GRBA.605, GRBA.606, GRBA.607

Association	Element Code	No. of Samples	Field Samples
Picea engelmannii / Juniperus communis Forest	CEGL005925	9	GRBA.193, GRBA.206, GRBA.207, GRBA.209, GRBA.213, GRBA.223, GRBA.224, GRBA.225, GRBA.812
Picea engelmannii / Moss Forest	CEGL000371	2	GRBA.502, GRBA.739
Picea engelmannii / Ribes montigenum Forest	CEGL000374	8	GRBA.169, GRBA.189, GRBA.194, GRBA.219, GRBA.220, GRBA.221, GRBA.222, GRBA.712
Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula Forest	CEGL005434	10	GRBA.144, GRBA.159, GRBA.161, GRBA.166, GRBA.167, GRBA.176, GRBA.177, GRBA.178, GRBA.743
Pinus flexilis / Artemisia tridentata ssp. *vaseyana* Woodland [Park Special]	CEPS009588	1	GRBA.255
Pinus flexilis / Symphoricarpos oreophilus Woodland	CEGL005321	1	GRBA.511
Pinus flexilis Bedrock Sparse Vegetation [Park Special]	CEPS009606	1	GRBA.513
Pinus flexilis / Selaginella watsonii Krummholz	CEGL005435	2	GRBA.904, GRBA.905
Pinus longaeva / (Ericameria discoidea, Ribes montigenum) Woodland	CEGL005447	11	GRBA.227, GRBA.233, GRBA.262, GRBA.263, GRBA.427, GRBA.500, GRBA.501, GRBA.504, GRBA.505, GRBA.813, GRBA.816
Pinus longaeva / Arctostaphylos patula Woodland [Park Special]	CEPS009591	2	GRBA.195, GRBA.517
Pinus longaeva / Symphoricarpos oreophilus Woodland [Park Special]	CEPS009593	1	GRBA.711
Pinus monophylla - Juniperus osteosperma / Artemisia arbuscula Woodland	CEGL000830	2	GRBA.037, GRBA.090
Pinus monophylla - Juniperus osteosperma / Artemisia nova Woodland	CEGL000831	2	GRBA.041, GRBA.173
Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. *vaseyana* - Mixed Shrub Woodland	CEGL005436	5	GRBA.031, GRBA.053, GRBA.084, GRBA.086, GRBA.242
Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. *vaseyana / Pseudoroegneria spicata* Woodland	CEGL000833	2	GRBA.115, GRBA.803
Pinus monophylla - Juniperus osteosperma / Artemisia tridentata Woodland	CEGL000832	7	GRBA.029, GRBA.030, GRBA.035, GRBA.036, GRBA.097, GRBA.260, GRBA.411
Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii Woodland [Park Special]	CEPS009607	2	GRBA.056, GRBA.095
Pinus monophylla – (Juniperus osteosperma) / Cercocarpus intricatus Woodland	CEGL005437	3	GRBA.055, GRBA.170, GRBA.171
Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius Woodland	CEGL000828	5	GRBA.082, GRBA.241, GRBA.705, GRBA.714, GRBA.717
Pinus monophylla - Juniperus osteosperma /	CEGL005438	2	GRBA.410, GRBA.412

Association	Element Code	No. of Samples	Field Samples
Glossopetalon spinescens - Artemisia tridentata - Purshia stansburiana Woodland [Provisional]			
Pinus monophylla - Juniperus osteosperma / Peraphyllum ramosissimum Woodland	CEGL005439	1	GRBA.700
Pinus monophylla - Juniperus osteosperma / Poa (fendleriana, secunda) Woodland	CEGL005440	2	GRBA.003, GRBA.054
Pinus monophylla - Juniperus osteosperma / Prunus virginiana Woodland	CEGL000836	1	GRBA.085
Pinus monophylla - Juniperus osteosperma / Purshia tridentata Woodland [Park Special]	CEPS009608	3	GRBA.433, GRBA.434, GRBA.724
Pinus monophylla - Juniperus osteosperma / Sparse Understory Woodland	CEGL000829	5	GRBA.083, GRBA.102, GRBA.172, GRBA.732, GRBA.808
Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus Woodland [Provisional]	CEGL005441	2	GRBA.701, GRBA.818
Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus Woodland [Provisional]	CEGL005442	4	GRBA.311, GRBA.312, GRBA.450, GRBA.452
Pinus ponderosa - Abies concolor Riparian Forest [Park Special]	CEPS009609	2	GRBA.337, GRBA.611
Pinus ponderosa / Arctostaphylos patula Woodland	CEGL000842	1	GRBA.741
Poa fendleriana - Astragalus kentrophyta Herbaceous Vegetation [Park Special]	CEPS009610	1	GRBA.329
Poa secunda - Arenaria congesta Herbaceous Vegetation [Park Special]	CEPS009611	1	GRBA.308
Poa secunda - Cirsium eatonii Post-burn Herbaceous Vegetation [Park Special]	CEPS009612	1	GRBA.814
Polemonium viscosum - Castilleja nana Alpine Rock Sparse Vegetation [Provisional]	CEGL005443	4	GRBA.228, GRBA.229, GRBA.230, GRBA.902
Polygonum bistortoides Herbaceous Vegetation [Park Special]	CEPS009613	2	GRBA.111, GRBA.113
Populus angustifolia / Artemisia tridentata ssp. *tridentata - Prunus virginiana* Woodland [Park Special]	CEPS009614	1	GRBA.406
Populus angustifolia / Cornus sericea Woodland	CEGL002664	1	GRBA.140
Populus angustifolia / Prunus virginiana Woodland	CEGL000651	2	GRBA.414, GRBA.416
Populus angustifolia / Rosa woodsii Forest	CEGL000653	2	GRBA.139, GRBA.747
Populus tremuloides - Abies concolor / Arctostaphylos patula Forest	CEGL000522	8	GRBA.124, GRBA.126, GRBA.148, GRBA.157, GRBA.164, GRBA.179, GRBA.185, GRBA.744
Populus tremuloides - Abies concolor / Mesic Graminoid Forest [Park Special]	CEPS009586	1	GRBA.613
Populus tremuloides - Abies concolor / Poa pratensis Semi-natural Forest	CEGL002947	1	GRBA.138
Populus tremuloides - Abies concolor / Symphoricarpos oreophilus Forest	CEGL000523	6	GRBA.104, GRBA.147, GRBA.152, GRBA.156, GRBA.186, GRBA.710
Populus tremuloides - Pinus flexilis Forest	CEGL000540	6	GRBA.190, GRBA.192, GRBA.210, GRBA.212, GRBA.215, GRBA.216
Populus tremuloides / Artemisia tridentata Forest	CEGL000572	1	GRBA.141
Populus tremuloides / Betula occidentalis Forest	CEGL002650	4	GRBA.101, GRBA.600, GRBA.602, GRBA.615

Association	Element Code	No. of Samples	Field Samples
Populus tremuloides / Bromus carinatus Forest	CEGL000573	2	GRBA.719, GRBA.738
Populus tremuloides / Invasive Perennial Grasses Forest	CEGL003748	1	GRBA.154
Populus tremuloides / Juniperus communis Forest	CEGL000587	1	GRBA.191
Populus tremuloides / Prunus virginiana Forest - *Symphoricarpos oreophilus* [Park Special]	CEPS009645	1	GRBA.402
Populus tremuloides / Ribes spp. Woodland [Park Special]	CEPS009589	1	GRBA.730
Populus tremuloides / Rosa woodsii Forest	CEGL003149	1	GRBA.601
Populus tremuloides / Symphoricarpos oreophilus Forest	CEGL000610	3	GRBA.143, GRBA.512, GRBA.713
Prunus virginiana - Mixed Shrub Talus Shrubland [Provisional]	CEGL005444	1	GRBA.405, GRBA.408
Prunus virginiana - Penstemon rostriflorus Post-burn Shrubland [Park Special]	CEPS009596	1	GRBA.815
Pseudoroegneria spicata - Hesperostipa comata Herbaceous Vegetation	CEGL001679	1	GRBA.806
Pseudoroegneria spicata Herbaceous Vegetation	CEGL001660	2	GRBA.303, GRBA.317
Pseudotsuga menziesii / Arctostaphylos patula Forest	CEGL000423	1	GRBA.175
Purshia tridentata - Artemisia tridentata ssp. *tridentata* Shrubland	CEGL001054	1	GRBA.722
Purshia tridentata / Hesperostipa comata Shrub Herbaceous Vegetation	CEGL001498	1	GRBA.723
Ribes (cereum, montigenum) - Ericameria discoidea Shrubland [Provisional]	CEGL005445	4	GRBA.208, GRBA.231, GRBA.325, GRBA.503
Rosa woodsii Shrubland	CEGL001126	1	GRBA.335
Salix bebbiana / Mesic Graminoids Shrubland	CEGL001174	2	GRBA.305, GRBA.603
Salix boothii / Mesic Forbs Shrubland	CEGL001180	1	GRBA.608
Salix boothii / Mesic Graminoids Shrubland	CEGL001181	3	GRBA.304, GRBA.331, GRBA.604
Salix exigua / Mesic Graminoids Shrubland	CEGL001203	1	GRBA.432
Sarcobatus vermiculatus / Artemisia tridentata Shrubland	CEGL001359	2	GRBA.441, GRBA.443
Symphoricarpos oreophilus Shrubland	CEGL002951	1	GRBA.315
Unclassified	NA	3	GRBA.401, GRBA.807, GRBA.809

APPENDIX E: GRBA VEGETATION CLASSIFICATION IN THE REVISED US NATIONAL VEGETATION CLASSIFICATION HIERARCHY

This table displays the GRBA Vegetation Classification within the revised US National Vegetation Classification (rUSNVC) Hierarchy using the Division level with hierarchy codes to organize the middle and lower level units (Macrogroup to Association). GRBA NPS_VIP Map Classes have been inserted between the Group and Alliance levels to clarify how the vegetation classification relates to the GRBA map legend (a few associations have multiple map classes). Also included is the number of samples sites (Plots, Observation Points or Rapid Assessments Points) per association within the GRBA project area). The highlighted vegetation classification units indicate which Associations, Alliances and Groups had descriptions written in Appendix G. As you can see the # of plots per type was a major criterion for deciding which types got local descriptions written.

This is the most current rUSNVC Hierarchy however, placement and names of some classification units may change slightly at Group and Alliance levels as this new hierarchy is finalized. The Alliance level was adapted from the previous USNVC classification and should be considered provisional until peer reviewed and standardized. The GRBA association classification is based on data collected at GRBA and is final.

<table>
<tr><th>MacroGroup</th><th>Group</th><th>Map Class</th><th>Map Code</th><th>Alliance</th><th>Association_</th><th>Element Code</th><th># Site</th></tr>
<tr><td colspan="8">1.B.2.Nb Western North American Cool Temperate Forest</td></tr>
<tr><td rowspan="5">Rocky Mountain Subalpine & High Montane Conifer Forest</td><td rowspan="5">Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland</td><td rowspan="3">Great Basin Pinus flexilis Woodland Alliance</td><td rowspan="3">W_PIFL</td><td rowspan="3">Great Basin Pinus flexilis Woodland Alliance</td><td>Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula Forest</td><td>CEGL005434</td><td>9</td></tr>
<tr><td>Pinus flexilis / Artemisia tridentata ssp. vaseyana Woodland [Park Special]</td><td>CEPS009588</td><td>1</td></tr>
<tr><td>Pinus flexilis / Symphoricarpos oreophilus Woodland</td><td>CEGL005321</td><td>1</td></tr>
<tr><td rowspan="2">Pinus longaeva Montane Woodland</td><td rowspan="2">W_PILO2</td><td rowspan="2">Pinus longaeva Woodland Alliance</td><td>Pinus longaeva / Arctostaphylos patula Woodland [Park Special]</td><td>CEPS009591</td><td>2</td></tr>
<tr><td>Pinus longaeva / Symphoricarpos oreophilus Woodland [Park Special]</td><td>CEPS009593</td><td>1</td></tr>
</table>

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Pinus longaeva Subalpine Woodland	W_PILO1		*Pinus longaeva / (Ericameria discoidea, Ribes montigenum)* Woodland	CEGL005447	11
	Rocky Mountain Subalpine & Montane Aspen Forest & Woodland	Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance	F_POTR1	Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance	*Populus tremuloides / Artemisia tridentata* Forest	CEGL000572	1
					Populus tremuloides / Bromus carinatus Forest	CEGL000573	2
					Populus tremuloides / Invasive Perennial Grasses Forest	CEGL003748	1
					Populus tremuloides / Juniperus communis Forest	CEGL000587	1
					Populus tremuloides / Ribes spp. Woodland [Park Special]	CEPS009589	1
					Populus tremuloides / Symphoricarpos oreophilus Forest	CEGL000610	3
	Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland	*Picea engelmannii - Populus tremuloides* Forest	F_PIEN3	*Picea engelmannii - Populus tremuloides* Dry-Mesic Forest Alliance	*Picea engelmannii - Populus tremuloides / Arctostaphylos patula* Forest [Park Special]	CEPS009644	1
		Picea engelmannii - (Pinus flexilis) Great Basin Krummholz Alliance	S_PIEN	*Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz Alliance	*Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis)* Krummholz	CEGL005432	4
					Pinus flexilis / Selaginella watsonii Krummholz	CEGL005435	2
		Picea engelmannii Forest Complex	F_PIEN1	*Picea engelmannii* Dry-Mesic Forest Alliance	*Picea engelmannii - (Pinus flexilis) / Carex rossii* Woodland	CEGL005433	16

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
					Picea engelmannii / Juniperus communis Forest	CEGL005925	9
					Picea engelmannii / Moss Forest	CEGL000371	2
	Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland	*Picea engelmannii* Forest Complex	F_PIEN1	*Picea engelmannii* Mesic-Wet Forest Alliance	*Picea engelmannii / Ribes montigenum* Forest	CEGL000374	8
		Southern Rocky Mountain Avalanche Chute Shrubland Complex	S_AVAL	*Populus tremuloides - (Picea engelmanii - Abies spp. - Pseudotsuga menziesii)* Avalanche Chute Shrubland Alliance	*Abies concolor - Populus tremuloides* Avalanche Chute Shrubland	CEGL005420	1
					Picea engelmannii - Populus tremuloides Avalanche Chute Shrubland	CEGL005431	2
	Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland	*Populus tremuloides - Pinus flexilis* Forest	F_PIPT	*Pinus flexilis - Populus tremuloides* Forest Alliance	*Populus tremuloides - Pinus flexilis* Forest	CEGL000540	6
Southern Rocky Mountain Lower Montane Forest	Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest	*Abies concolor - Populus tremuloides* Forest Complex	F_ABPO	*Abies concolor - Populus tremuloides* Mesic Forest Alliance	*Populus tremuloides - Abies concolor / Poa pratensis* Semi-natural Forest	CEGL002947	1
		Abies concolor - Populus tremuloides Forest Complex	F_ABPO		*Populus tremuloides - Abies concolor / Symphoricarpos oreophilus* Forest	CEGL000523	6
		Abies concolor Riparian Forest & Woodland Alliance	W_ACRIP				

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Abies concolor - Pseudotsuga menziesii Forest & Woodland Complex	W_ACPM	*Abies concolor - Pseudotsuga menziesii* Mesic Forest Alliance	*Abies concolor / Symphoricarpos oreophilus* Forest	CEGL000263	7
	Southern Rocky Mountain Ponderosa Pine Forest & Woodland	*Pinus ponderosa (Pseudotsuga menziesii)* Woodland Complex	W_PPPM1	*Pinus ponderosa /* Interior Chaparral Woodland Alliance	*Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus* Woodland [Provisional]	CEGL005441	2
					Pinus ponderosa / Arctostaphylos patula Woodland	CEGL000842	1
				Pinus ponderosa / Mixed Shrub Woodland Alliance	*Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland [Provisional]	CEGL005442	4
	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest	*Abies concolor - Populus tremuloides* Forest Complex	F_ABPO	*Abies concolor - Populus tremuloides* Dry Forest Alliance	*Populus tremuloides - Abies concolor / Arctostaphylos patula* Forest	CEGL000522	8
		Abies concolor - Pseudotsuga menziesii Forest & Woodland Complex	W_ACPM	*Abies concolor - Pseudotsuga menziesii* Dry Forest & Woodland Alliance	*Abies concolor - Pseudotsuga menziesii / Carex rossii* Forest	CEGL000431	1
					Abies concolor / Arctostaphylos patula Forest	CEGL000242	7
					Abies concolor / Cercocarpus ledifolius Woodland	CEGL000885	4
				Pseudotsuga menziesii Forest Alliance	*Pseudotsuga menziesii / Arctostaphylos patula* Woodland	CEGL000423	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
1.B.2.Nc Western North American Cool Temperate Woodland & Scrub							
Intermountain Singleleaf Pinyon - Western Juniper Woodland	Great Basin Pinyon - Juniper Woodland	*Pinus monophylla - (Juniperus osteosperma) / Artemisia* spp. Woodland Complex	W_PJSG	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance	*Pinus monophylla - Juniperus osteosperma / Artemisia arbuscula* Woodland	CEGL000830	1
					Pinus monophylla - Juniperus osteosperma / Artemisia nova Woodland	CEGL000831	2
					Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. *vaseyana* - Mixed Shrub Woodland	CEGL005436	5
					Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. *vaseyana / Pseudoroegneria spicata* Woodland	CEGL000833	2
					Pinus monophylla - Juniperus osteosperma / Artemisia tridentata Woodland	CEGL000832	7
					Pinus monophylla - Juniperus osteosperma / Purshia tridentata Woodland [Park Special]	CEPS009608	3
		Pinus monophylla - (Juniperus osteosperma) / Grass & Sparse Understory Woodland	W_PJSP	*Pinus monophylla - (Juniperus osteosperma) /* Herbaceous Understory Woodland Alliance	*Pinus monophylla - Juniperus osteosperma / Poa (fendleriana, secunda)* Woodland	CEGL005440	2

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Complex		*Pinus monophylla - (Juniperus osteosperma) /* Sparse Understory Woodland Alliance	*Pinus monophylla - Juniperus osteosperma /* Sparse Understory Woodland	CEGL000829	5
		Pinus monophylla - (Juniperus osteosperma) / Mixed Shrub Woodland Complex	W_PJMX	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance	*Pinus monophylla - (Juniperus osteosperma) / Cercocarpus intricatus* Woodland	CEGL005437	3
					Pinus monophylla - Juniperus osteosperma / Glossopetalon spinescens - Artemisia tridentata - Purshia stansburiana Woodland [Provisional]	CEGL005438	2
					Pinus monophylla - Juniperus osteosperma / Peraphyllum ramosissimum Woodland	CEGL005439	1
					Pinus monophylla - Juniperus osteosperma / Prunus virginiana Woodland	CEGL000836	1
		Pinus monophylla - Juniperus osteosperma / Mixed Riparian Shrub Woodland Complex	W_PJRP	*Pinus monophylla - (Juniperus osteosperma)* Riparian Woodland Alliance	*Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii* Woodland [Park Special]	CEPS009607	2

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius Woodland	W_PJCL	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance	*Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland	CEGL000828	5
	Intermountain Basins Curl-leaf Mountain-mahogany Scrub & Woodland	*Cercocarpus ledifolius* Shrubland & Woodland Complex	W_CELE	*Cercocarpus ledifolius* Woodland Alliance	*Cercocarpus ledifolius / Arctostaphylos patula* Woodland [Provisional]	CEGL005355	5
					Cercocarpus ledifolius / Artemisia tridentata ssp. *vaseyana* Woodland	CEGL001022	2
					Cercocarpus ledifolius / Symphoricarpos oreophilus Woodland	CEGL000970	9
					Cercocarpus ledifolius / Pseudoroegneria spicata Scrub	CEGL000967	1
1.B.3.Nc Western North American Flooded & Swamp Forest							
Rocky Mountain & Great Basin Flooded & Swamp Forest	Rocky Mountain & Great Basin Lowland & Foothill Riparian Forest	*Pinus ponderosa (Pseudotsuga menziesii* Riparian Forest Alliance	W_PPPM2	*Pinus ponderosa (Pseudotsuga menziesii* Riparian Forest Alliance	*Pinus ponderosa - Abies concolor* Riparian Forest [Park Special]	CEPS009609	2
	Rocky Mountain & Great Basin Montane Riparian Forest	*Abies concolor* Riparian Forest & Woodland Alliance	W_ACRIP	*Abies concolor* Riparian Forest & Woodland Alliance	*Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum* Forest	CEGL005418	3
					Abies concolor - Populus tremuloides / Carex scopulorum Forest	CEGL005419	1
		Abies concolor Riparian Forest & Woodland	W_ACRIP		*Populus tremuloides - Abies concolor /* Mesic *Graminoid* Forest [Park	CEPS009586	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Alliance			Special]		
		Abies concolor - Populus tremuloides Forest Complex	F_ABPO				
		Picea engelmannii Riparian Forest & Woodland Alliance	F_PIEN2	*Picea engelmannii* Riparian Forest & Woodland Alliance	*Picea engelmannii - Populus tremuloides /* Mesic Forb Forest [Park Special]	CEPS009587	3
					Picea engelmannii / Carex scopulorum Woodland	CEGL005446	4
		Populus angustifolia Riparian Forest & Woodland Alliance	F_POAN	*Populus angustifolia* Riparian Forest & Woodland Alliance	*Populus angustifolia / Artemisia tridentata* ssp. *tridentata - Prunus virginiana* Woodland [Park Special]	CEPS009614	1
					Populus angustifolia / Cornus sericea Woodland	CEGL002664	1
					Populus angustifolia / Prunus virginiana Woodland	CEGL000651	2
					Populus angustifolia / Rosa woodsii Forest	CEGL000653	2
		Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance	F_POTR2	Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance	*Populus tremuloides / Betula occidentalis* Forest	CEGL002650	4
					Populus tremuloides / Prunus virginiana - Symphoricarpos oreophilus Forest [Park Special]	CEPS009645	1
					Populus tremuloides / Rosa woodsii Forest	CEGL003149	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
2.B.2.Na Western North American Grassland & Shrubland							
Northern Rocky Mountain Montane & Foothill Grassland & Shrubland	Northern Rocky Mountain Lower Montane, Foothill & Valley Grassland	Rocky Mountain Montane-Subalpine Grassland Complex	H_RMGC	Northern Rocky Mountain *Pseudoroegneria spicata* Herbaceous Alliance	*Pseudoroegneria spicata - Hesperostipa comata* Herbaceous Vegetation	CEGL001679	1
	Northern Rocky Mountain Montane-Foothill Mesic Deciduous Shrubland	Montane Riparian Shrubland Complex	S_RIP	*Rosa woodsii* Temporarily Flooded Shrubland Alliance	*Rosa woodsii* Shrubland	CEGL001126	1
Southern Rocky Mountain Montane Grassland & Shrubland	Southern Rocky Mountain Cercocarpus-Mixed [Dry] Foothill Shrubland	*Cercocarpus intricatus – (Peraphyllum ramosissimum)* Shrubland Complex	S_CIPR	*Cercocarpus intricatus* Shrubland Alliance	*Cercocarpus intricatus - Glossopetalon spinescens* Shrubland	CEGL005426	4
	Southern Rocky Mountain Gambel Oak-Mixed [Mesic] Montane Shrubland	Montane Talus & Rock Outcrop Shrubland Complex	S_MOTA	*Prunus virginiana* Shrubland Alliance	*Prunus virginiana* - Mixed Shrub Talus Shrubland [Provisional]	CEGL005444	2
		Post-fire Shrubland Complex	S_FIRE	*Prunus virginiana* Shrubland Alliance	*Prunus virginiana - Penstemon rostriflorus* Post-burn Shrubland [Park Special]	CEPS009596	1
		Southern Rocky Mountain Avalanche Chute Shrubland Complex	S_AVAL	*Symphoricarpos oreophilus* Shrubland Alliance	*Symphoricarpos oreophilus* Shrubland	CEGL002951	1
		Post-fire Shrubland Complex	S_FIRE				

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
	Northern Rocky Mountain Montane-Subalpine Grassland	Rocky Mountain Montane-Subalpine Grassland Complex	H_RMGC	Southern Rocky Mountain *Pseudoroegneria spicata* Herbaceous Alliance	*Pseudoroegneria spicata* Herbaceous Vegetation	CEGL001660	2
	Southern Rocky Mountain Montane-Subalpine Grassland			*Achnatherum lettermanii* Herbaceous Alliance	*Achnatherum lettermanii* Herbaceous Vegetation	CEGL005354	1
				Poa fendleriana Herbaceous Alliance	*Poa fendleriana - Astragalus kentrophyta* Herbaceous Vegetation [Park Special]	CEPS009610	1
				Poa secunda - Arenaria congesta - Cirsium eatonii Herbaceous Alliance [Provisional]	*Poa secunda - Arenaria congesta* Herbaceous Vegetation [Park Special]	CEPS009611	1
		Rocky Mountain Montane-Subalpine Grassland Complex	H_RMGC		*Poa secunda - Cirsium eatonii* Post-burn Herbaceous Vegetation [Park Special]	CEPS009612	1
		Post-fire Shrubland Complex	S_FIRE				
		Southern Rocky Mountain Avalanche Chute Shrubland Complex	S_AVAL				
		Rocky Mountain Montane-Subalpine Grassland	H_RMGC	Post-fire Ruderal Herbaceous Vegetation Alliance [Provisional]	*Balsamorhiza sagittata* Herbaceous Vegetation [Park Special]	CEPS009598	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Complex					
Rocky Mountain-Vancouverian Subalpine & High Montane Mesic Grass & Forb Meadow	Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow	Montane Mesic Meadow Complex	H_MESC	*Dasiphora fruticosa* ssp. *floribunda* Shrub Herbaceous Alliance	*Dasiphora fruticosa* ssp. *floribunda / Elymus trachycaulus* Shrub Herbaceous Vegetation [Park Special]	CEPS009601	1
				Elymus trachycaulis Herbaceous Alliance	*Elymus trachycaulis* Herbaceous Vegetation	CEGL005427	3
Western North American Ruderal Grassland & Shrubland	Western North American Ruderal Grassland & Shrubland	Perennial Invasive Grassland Complex	H_PINV	Western Ruderal Perennial Herbaceous Alliance	*Bromus inermis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation	CEGL005264	1
2.B.2.Nd Western North American Interior Sclerophyllous Chaparral Shrubland							
Cool Interior Chaparral	Western North American Montane Sclerophyll Scrub [Provisional]	*Arctostaphylos patula* Shrubland Alliance	S_ARPA	*Arctostaphylos patula* Shrubland Alliance	*Arctostaphylos patula / Ceanothus martinii* Shrubland	CEGL005422	2
					Arctostaphylos patula Shrubland	CEGL002696	1
2.B.6.Nb Western North American Freshwater Shrubland, Wet **Meadow & Marsh**							
Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland	Montane Riparian Shrubland Complex	S_RIP	*Salix exigua* Shrubland Alliance [Provisional]	*Salix exigua* / Mesic Graminoids Shrubland	CEGL001203	1
Western North American Montane Wet Shrubland &	Rocky Mountain & Great Basin Montane Alder & Birch Riparian	Montane Riparian Shrubland Complex	S_RIP	*Acer glabrum* Mesic-Wet Shrubland Alliance	*Acer glabrum Drainage Bottom* Shrubland	CEGL001062	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
Wet Meadow	Shrubland			*Betula occidentalis* Riparian/Seep Shrubland Alliance	*Betula occidentalis / Cornus sericea* Shrubland	CEGL001161	1
					Betula occidentalis / Mesic Graminoids Shrubland	CEGL002654	1
	Rocky Mountain & Great Basin Montane Riparian & Seep Shrubland	Montane Riparian Shrubland Complex	S_RIP	*Salix bebbiana* Temporarily Flooded Shrubland Alliance	*Salix bebbiana /* Mesic Graminoids Shrubland	CEGL001174	2
				Salix boothii Temporarily Flooded Shrubland Alliance	*Salix boothii /* Mesic Forbs Shrubland	CEGL001180	1
					Salix boothii / Mesic Graminoids Shrubland	CEGL001181	3
	Vancouverian & Rocky Mountain Montane Wet Meadow	Montane Wet Meadow Complex	H_WET	*Carex nebrascensis* Seasonally Flooded Herbaceous Alliance	*Carex nebrascensis* Herbaceous Vegetation	CEGL001813	2
				Carex scopulorum Seasonally Flooded Herbaceous Alliance	*Carex scopulorum* Herbaceous Vegetation	CEGL001822	3
				Dodecatheon - Mimulus - Veronica Wet Meadow Alliance [Provisional]	*Dodecatheon alpinum* Herbaceous Vegetation [Park Special]	CEPS009590	5
				Juncus balticus Seasonally Flooded	*Juncus balticus* Herbaceous Vegetation	CEGL001838	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
				Herbaceous Alliance			
				Juncus nevadensis Herbaceous Alliance [Provisional]	*Juncus nevadensis - Poa secunda* Herbaceous Vegetation [Park Special]	CEPS009603	1
		Montane Wet Meadow Complex	H_WET	*Leymus cinereus* Herbaceous Alliance	*Leymus cinereus* Herbaceous Vegetation	CEGL001479	2
		Montane Mesic Meadow Complex	H_MESC				
		Montane Wet Meadow Complex	H_WET	*Polygonum bistortoides* Herbaceous Alliance [Provisional]	*Polygonum bistortoides* Herbaceous Vegetation [Park Special]	CEPS009613	2
2.B.7.Nd North American Western Interior Brackish Marsh							
Cool Semi-Desert Alkali-Saline Wetland	Intermountain Basins Alkaline-Saline Shrub Wetland	*Sarcobatus vermiculatus* Shrubland Alliance	S_SAVE	*Sarcobatus vermiculatus* Shrubland Alliance	*Sarcobatus vermiculatus / Artemisia tridentata* Shrubland	CEGL001359	2
3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland							
Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe	Intermountain Dry Tall Sagebrush Shrubland	*Artemisia tridentata* ssp. *tridentata* Shrubland Complex	S_ARTR	*Artemisia tridentata* / Ruderal Understory Shrubland Alliance	*Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum* Semi-natural Shrubland	CEGL002699	2
		Artemisia tridentata ssp. *vaseyana* Shrubland Alliance	S_ARTRV				

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
		Artemisia tridentata ssp. *tridentata* Shrubland Complex	S_ARTR		*Artemisia tridentata* ssp. *tridentata / Agropyron cristatum* Semi-natural Shrubland [Park Special]	CEPS009566	2
				Artemisia tridentata Dry Shrubland Alliance [Provisional]	*Artemisia tridentata / Elymus elymoides* Shrubland	CEGL001001	1
					Artemisia tridentata ssp. *tridentata / Pleuraphis jamesii* Shrubland	CEGL001015	1
				Purshia tridentata Shrub Herbaceous Alliance	*Purshia tridentata / Hesperostipa comata* Shrub Herbaceous Vegetation	CEGL001498	1
				Purshia tridentata Shrubland Alliance	*Purshia tridentata - Artemisia tridentata* ssp. *tridentata* Shrubland	CEGL001054	1
		Cercocarpus intricatus – (Peraphyllum ramosissimum) Shrubland Complex	S_CIPR	*Artemisia tridentata* Dry Shrubland Alliance [Provisional]	*Peraphyllum ramosissimum - Artemisia tridentata* Shrubland	CEGL005430	2
	Intermountain Mesic Tall Sagebrush Shrubland & Steppe	*Artemisia tridentata* ssp. *tridentata* Shrubland Complex	S_ARTR	*Artemisia tridentata* ssp. *tridentata* Mesic Shrubland Alliance	*Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Shrubland	CEGL001016	3
				Artemisia tridentata ssp. *tridentata* Mesic Shrubland Alliance	*Artemisia tridentata* ssp. *tridentata - Peraphyllum ramosissimum - Chamaebatiaria millefolium* Shrubland [Park Special]	CEPS009595	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
	Intermountain Mountain Big Sagebrush Shrubland & Steppe	*Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland	S_AMART V	*Artemisia tridentata* ssp. *vaseyana* - Mixed Shrubland Alliance	*Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland	CEGL002820	3
		Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus* Shrubland Alliance	S_ARTSY	*Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance	*Artemisia tridentata* ssp. *vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus* ssp. *trachycaulus* Shrubland	CEGL001034	5
					Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland	CEGL001038	7
		Artemisia tridentata ssp. *vaseyana /* Grass Understory Shrubland Complex	S_ARTRV		*Artemisia tridentata* ssp. *vaseyana / Poa (glauca, secunda)* Shrubland	CEGL005423	4
					Artemisia tridentata ssp. *vaseyana / Poa fendleriana* Shrubland	CEGL002812	4
Great Basin & Intermountain Dwarf Sage Shrubland & Steppe	Intermountain Low & Black Sagebrush Shrubland & Steppe	*Artemisia arbuscula* ssp. *arbuscula* Shrub Herbaceous Alliance	S_ARAR	*Artemisia arbuscula* ssp. *arbuscula* Shrub Herbaceous Alliance	*Artemisia arbuscula* ssp. *arbuscula / Pseudoroegneria spicata* Shrub Herbaceous Vegetation	CEGL001412	2
		Artemisia nova Shrubland Alliance	S_ARNO	*Artemisia nova* Shrubland Alliance	*Artemisia nova / Achnatherum hymenoides* Shrubland	CEGL001422	1
					Artemisia nova / Poa fendleriana Shrubland	CEGL002698	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
					Artemisia nova / Pseudoroegneria spicata Shrubland	CEGL001424	1
Great Basin & Intermountain Dry Shrubland & Grassland	Great Basin & Intermountain Ruderal Dry Shrubland & Grassland	Perennial Invasive Grassland	H_PINV	Great Basin & Intermountain Ruderal Perennial Herbaceous Alliance	*Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata)* Semi-natural Herbaceous Vegetation	CEGL005266	1
		Annual Invasive Complex	H_AINV	Great Basin & Intermountain Ruderal Annual Herbaceous Alliance	*Bromus tectorum* Semi-natural Herbaceous Vegetation	CEGL003019	1
	Intermountain Semi-Desert Shrubland & Steppe	Post-fire Shrubland Complex	S_FIRE	*Chrysothamnus viscidiflorus* Shrub Herbaceous Alliance	*Chrysothamnus viscidiflorus* Shrub Herbaceous Vegetation [Provisional]	CEGL002530	1
		Southern Rocky Mountain Avalanche Chute Shrubland Complex	S_AVAL				
		Rocky Mountain Montane-Subalpine Grassland Complex	H_RMGC				
		Ericameria nauseosa Shrubland Alliance	S_ERNA	*Ericameria nauseosa* Ruderal Shrubland Alliance	*Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland	CEGL002937	1
4.B.1.Nb Western North American Alpine Scrub, Forb Meadow & Grassland							
Rocky Mountain Alpine Scrub,	Rocky Mountain Alpine Dwarf-Shrubland	*Ribes montigenum – (Juniperus*	S_RMJC	*Ribes montigenum* Shrubland Alliance	*Ribes (cereum, montigenum) - Ericameria discoidea*	CEGL005445	4

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
Forb Meadow & Grassland		*communis)* Shrubland Complex			Shrubland [Provisional]		
	Rocky Mountain Alpine Turf & Fell-Field	Alpine Cushion Plant Fell-field Complex	SV_FELL	*Aquilegia scopulorum - Eriogonum holmgrenii - Geum rossii* Alpine Fell-field Herbaceous Alliance	*Aquilegia scopulorum - Eriogonum holmgrenii* Fell-field Herbaceous Vegetation	CEGL005421	3
					Astragalus kentrophyta - Eriogonum holmgrenii Fell-field Herbaceous Vegetation [Park Special]	CEPS009597	1
					Cymopterus nivalis - Erigeron leiomerus - Poa secunda Herbaceous Vegetation [Park Special]	CEPS009600	1
					Geum rossii - Phlox pulvinata Fell-field Herbaceous Vegetation	CEGL005428	2
				Phlox pulvinata Herbaceous Alliance	*Phlox pulvinata* Herbaceous Vegetation [Provisional]	CEGL002740	1
		Alpine Turf Complex	H_TURF	*Carex elynoides* Herbaceous Alliance	*Carex elynoides - Geum rossii* Herbaceous Vegetation	CEGL001853	2
					Carex elynoides - Phlox pulvinata - Poa secunda Herbaceous Vegetation	CEGL005424	3
				Carex subnigricans - Sibbaldia procumbens Snowbed Alliance	*Carex subnigricans - Geum rossii - Sibbaldia procumbens* Snowbed [Provisional]	CEGL005425	1
				Geum rossii Herbaceous Alliance	*Geum rossii - Calamagrostis purpurascens* Herbaceous Vegetation [Park Special]	CEPS009602	1

MacroGroup	Group	Map Class	Map Code	Alliance	Association_	Element Code	# Site
					Geum rossii Herbaceous Vegetation	CEGL001964	1
		Southern Rocky Mountain Avalanche Chute Herbaceous Vegetation Complex	H_AVAL	*Lomatium graveolens var. alpinum* Herbaceous Alliance *[Placeholder]*	*Lomatium graveolens var. alpinum* Herbaceous Vegetation [Park Special]	CEPS009604	1
6.B.2.Nb Western North American Temperate Cliff, Scree & Rock Vegetation							
Rocky Mountain Alpine Cliff, Scree & Rock Vegetation	Rocky Mountain Cliff, Scree & Rock Vegetation	Mixed Rock & Talus Shrubland Complex	S_RT	*Hulsea algida* Herbaceous Alliance	*Hulsea algida - Selaginella watsonii* Herbaceous Vegetation [Provisional]	CEGL005429	1
				Polemonium - Castilleja - Ribes - Trisetum Alpine Rock Sparse Vegetation Alliance [Provisional]	*Petrophyton caespitosum* Sparse Vegetation [Park Special]	CEPS009605	1
					Polemonium viscosum - Castilleja nana Alpine Rock Sparse Vegetation [Provisional]	CEGL005443	4
6.C.2.Na North American Cool Semi-Desert Cliff, Scree & Rock Vegetation							
Intermountain Basin Cliff, Scree & Badland Sparse Vegetation	Intermountain Basins Cliff, Scree & Badland Sparse Vegetation	Mixed Rock & Talus Shrubland Complex	S_RT	Sparse Wooded Vegetation Alliance	*Abies concolor* Rock Outcrop Sparse Vegetation [Park Special]	CEPS009594	1
					Cercocarpus ledifolius Rock Outcrop Sparse Vegetation [Park Special]	CEPS009599	1
					Pinus flexilis Bedrock Sparse Vegetation [Park Special]	CEPS009606	1
					Unclassified		3
Grand Total							343

APPENDIX F: FIELD KEY TO THE VEGETATION OF GREAT BASIN NATIONAL PARK, NEVADA

The Great Basin National Park (GRBA) Vegetation Classification was completed as part of the National Park Service's National Vegetation Inventory Program. A diverse assemblage of plant associations and other vegetation types were classified using field data collected in 2003 by Charlet and field crews, and during 2008, 2009, and 2010 by NatureServe and National Park Service staff. Some types identified from plots sampled outside the park boundaries are in included in this key as it is possible that they also occur within the park boundaries, but have not yet been sampled within the park. This key is structured to facilitate identification of plant associations with one or more dominant or characteristic species, and in some cases, the key also relates associations to their primary habitats and range within the Park. Because of natural variation within plant associations, it is possible that a community can be keyed using more than one of the physiognomic keys. For sites within ecotones (areas where dominant species intermix between plant associations), it may be difficult to determine a definitive association name

How to use the key

The key is designed to assist users in identifying vegetation associations in the field. The key has two levels; the first level is defined by the physiognomy of the vegetation, i.e., Forest/ Woodland, Shrubland/Shrub Steppe (shrub herbaceous), Herbaceous (graminoid or forb dominated) and Sparse vegetation. The second level focuses on the dominant and diagnostic species' canopy cover and to a lesser extent, habitat or elevation zone. The association field key was constructed from data collected during the classification phase of the mapping project. Because the key is based on a sample of the vegetation, it may not account for all associations occurring within GRBA, nor explain the full range of variation of all associations as they appear on the ground. When new associations are encountered during accuracy assessment, propose a community name and if time, do a rapid assessment to collect more data for classification.

When using this key, you may have difficulty arriving at an association that precisely describes your community. There are several possible reasons for this problem and each has a solution:

1. You are observing vegetation that you think is an herbaceous or shrubland community, but it has some tree cover. In this case, try keying the vegetation through the woodland key as well as the herbaceous or shrubland key. In general with any layer, if it does not cover at least 8% (tree layer) or 5% (shrub or herbaceous layers), it is ignored. The exception is in very sparse communities (see #4 below). Commonly confused types will be included in multiple places in the key.

2. The diagnostic layer consists of woody plants that may appear in either a shrub or a tree form, depending on site conditions and age. These species include *Pinus monophylla, Juniperus osteosperma,* and *Cercocarpus ledifolius*. In this key, these species are considered to be evergreen trees, regardless of their height or growth form, and the rest are considered shrubs, regardless of their height or growth form.

3. Big sagebrush *Artemisia tridentata* was inconsistently identified to subspecies for a variety of reasons at GRBA. In general big sagebrush is confusing with putative hybrids or possibly additional subspecies such as *A. t.* ssp. *spiciformis*. Therefore only montane and subalpine stands of big sagebrush were treated as *A. t.* ssp. *vaseyana*.

4. You can follow a key to a certain point, but you clearly have something not described in the key. This is to be expected occasionally – very likely you have an association that was not found during the sampling phase of the project. As an example in this instance, simply record "Unclassified pinyon-juniper (or whatever type of vegetation you have) association". Be sure to note the dominant species and cover in each layer (stratum) as you fill out the Vegetation Description portion of the accuracy assessment (AA) form, as well as writing careful, complete notes on the environmental setting. For AA, be sure to key to map class as well.

5. Sparsely vegetated communities are defined as having total vascular plant cover of 2-10% (sometimes a little more given the range of natural variation) and are often a mix of woody and herbaceous plants with nothing dominant or diagnostic. In some stands cover of non-vascular organisms such as lichen and moss may actually dominate these communities. Sparsely vegetated areas are typically heterogeneous and borderline "sparsely" vegetated stands should always be run through multiple keys because even though they may not fall cleanly into a woodland, shrubland or herbaceous categories, they may actually be non-sparse communities given that the natural variation of some of the non-sparse GRBA vegetation types approaches 10% total vascular plant cover and may range below. This is especially true for shrubland and dwarf-shrubland associations that occur in harsh habitats. Go by dominance rather than absolute cover measurements.

6. Focus on the perennial species in the community unless the community or layer consists almost entirely of annuals or ephemerals or is highly disturbed or degraded.

7. When in doubt, record detailed field notes on your accuracy assessment field forms. These notes and the Vegetation Description information will be entered into the PLOTS database and analyzed to determine the map accuracy by comparing the map class identified by the photo-interpreter to the map class and association identified in the field by the AA field crew.

Special instructions for AA Crews

1. There are a number of closely related plant associations at Great Basin National Park that may be confusing in the field, although the key makes them appear easily distinguishable:

   For example, mixed mountain shrublands have been separated out into a number of associations, but a mix of shrubs not identified in the association name is generally present. The thing to keep in mind is that there is a classic "profile" for these associations, but a considerable amount of variation may occur. For example:

   a. ***Amelanchier utahensis* - *Artemisia tridentata (vaseyana, wyomingensis)* Shrubland** nearly always has *Symphoricarpos oreophilus* present and occasionally co-dominant. *Amelanchier utahensis* ranges from strongly dominant to codominant with *Artemisia tridentata*.

   b. ***Cercocarpus ledifolius / Pseudoroegneria spicata* Shrubland** nearly always has *Artemisia tridentata* present and sometimes co-dominant, and in heavily grazed examples, *Pseudoroegneria* may be very sparse to absent. *Amelanchier utahensis* is often present, but only with very low cover (<5%).

   c. Other ***Artemisia tridentata*** ssp. ***vaseyana*** **Shrublands** often have *Symphoricarpos oreophilus* present and often co-dominant in the northwestern portion of the park. *Amelanchier utahensis* may also be present with low cover.

2. *Pinus monophylla - Juniperus osteosperma* / Sparse Understory Woodland is a broadly defined association that includes both 1) mature pinyon – juniper stands that have a relatively dense tree canopy (35-90% cover) and a sparse understory as result of shading, and 2) sparse to open canopy stands (5-35% tree cover) occurring on rocky or shaley sites that limit understory growth to a few scattered plants.

3. Associations with "forest" in the name usually have 60+% canopy cover, but also includes stands with < 60% canopy cover. Likewise, examples of associations with "woodland" in the name may occasionally have more than 60% cover.

4. Mixed evergreen – deciduous (aspen) forests and woodlands generally have 25-75% relative tree canopy cover of both conifers and aspen. Aspen stands generally have <25% relative tree canopy cover of conifer trees and conifer stands have <25% relative tree canopy cover of aspen. Be sure to consider the full Minimum Mapping Unit (MMU) observation area in case the point lands near a small patch inclusion.

5. For mixed canopy stands such as a *Picea engelmannii* and *Pinus flexilis* codominated forest stand, key vegetation in both species group keys for best fit.

6. If vegetation does not key to association, record alliance name and collect additional understory information or do a Rapid Assessment Point.

7. When in doubt, record detailed field notes. These notes and the Vegetation Description information are very important and will be entered into a database to be evaluated in detail during the Accuracy Assessment meeting that will be held to determine the map accuracy by comparing the interpreted map unit to the association identified in the field.

8. Another helpful tool is for you to understand that the revised United States National Vegetation Classification (rUSNVC) does not weight all species as contributing equally to a classification. Species vary in their degree of habitat specialization. To a point, the more specialized and persistent a species (in the larger world, not just at GRBA), the more it is likely to be a "diagnostic" species that controls the assignment of a community to an association. Generalist species such as *Ephedra viridis, Ericameria nauseosa, Gutierrezia sarothrae, Poa secunda, Opuntia* spp. are only considered diagnostic if they are overwhelmingly dominant. For example, if you are in a pinyon - juniper woodland with about equal cover of *Cercocarpus ledifolius* and *Artemisia tridentata,* it will be classified as *Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland, not *Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Woodland. Weak indicator species generally are not used to classify unless strongly dominant.

   So-called "diagnostic" species are not all equal either. There is a hierarchy, and it varies depending on the habitat and life form. Some examples are:

   Rocky Slope: *Cercocarpus ledifolius > Cercocarpus intricatus > Peraphyllum ramosissimum, Glossopetalon spinescens > Artemisia tridentata >Ephedra viridis*

   Uplands: *Artemisia arbuscula, Artemisia nova > Artemisia tridentata* ssp. *vaseyana > A. t.* ssp. *tridentata > Amelanchier utahensis > Purshia tridentata > Symphoricarpos oreophilus*

   Alluvial fans, alluvial flats and terraces: *Sarcobatus vermiculatus > Artemisia tridentata* ssp. *tridentata > A. t.* ssp. *wyomingensis > Ericameria nauseosa*

   Grasses: Strong indicators: *Leymus cinereus, Elymus trachycaulus, Pseudoroegneria spicata, Achnatherum lettermanii, Hesperostipa comata,* **Medium***: Pleuraphis jamesii, Achnatherum hymenoides, Poa fendleriana.* **Weak***: Poa secunda, Elymus elymoides, Aristida* spp.*, Sporobolus cryptandrus, Bromus inermis, Poa pratensis, B. tectorum*.

   Subalpine trees: *Pinus longaeva > Picea engelmannii > Pinus flexilis > Populus tremuloides*

   Montane trees: *Pinus ponderosa > Abies concolor > Pseudotsuga menziesii > Populus tremuloides*, although this will differ among seral stands versus persistent stands.

Table of Contents

KEY I: THE MAJOR PHYSIOGNOMIC GROUPS OF GREAT BASIN NATIONAL PARK

1a) Site vegetated with > 10% total vascular vegetation cover. **(2)**

1b) Site sparsely vegetated generally with < 10% total vascular vegetation cover. Non-vascular (lichen and mosses) may exceed 10% cover.
Go to: **Key V (p 34)**

2a) Vegetation woody or appearing woody; the tallest layer (usually with at least 5% cover) dominated by trees, shrubs, or dwarf-shrubs; total vegetation cover may range from sparse to dense. **(3)**

2b) Vegetation non-woody; the tallest layer (usually with at least 5% cover) dominated by grasses, grass-like herbs (graminoids), and broad-leaf herbs (forbs), which may be tall and coarse; total vegetation cover may range from sparse to dense; comprised primarily of graminoid species; wetland to upland habitats; characteristic genera include *Achnatherum*, *Agropyron, Aquilegia*, *Astragalus, Balsamorhiza, Bromus*, *Calamagrostis, Carex*, *Distichlis, Dodecatheon*, *Eleocharis*, *Eriogonum, Elymus, Geum, Hesperostipa*, *Leymus*, *Mimulus*, *Muhlenbergia*, *Phlox, Phragmites*, *Pleuraphis*, *Poa, Polemonium, Polygonum, Pseudoroegneria, Sporobolus*, and *Typha* .
Go to: **Key IV (p 30)**

3a) Tree-dominated forests (interlocking tree canopies) or woodlands (open tree layer, non-interlocking tree canopies), or tree species dominated shrublands (avalanche chute, krummholz). Characteristic genera include *Abies, Cercocarpus, Juniperus*, *Picea*, *Pinus*, *Populus*, and *Pseudotsuga.* Generally the tree canopy layer has 10% or more cover, but may be as low 5% cover when trees characterize the otherwise borderline sparse vegetation stand when trees form a layer or are the dominant species in the stand. *Cercocarpus ledifolius* occurs as both a tree and shrub at GRBA and is treated in Key II (Forest and Woodland)
Go to: **Key II (p 7)**

3b) Shrub-dominated vegetation, including shrub-like herbs; canopies may interlock, but are more commonly less dense. Characteristic genera include *Acer, Amelanchier*, *Arctostaphylos*, *Artemisia*, *Atriplex*, *Betula*, *Cercocarpus*, *Chrysothamnus*, *Dasiphora*, *Ephedra*, *Ericameria*, *Eriogonum*, *Gutierrezia*, *Krascheninnikovia*, *Peraphyllum, Picrothamnus*, *Purshia*, *Rhus*, *Ribes, Rosa*, *Salix*, *Sarcobatus,* and *Symphoricarpos.* Scattered taller trees may be absent to present in shrublands especially in transitional standst. *Cercocarpus ledifolius* occurs as both a tree and shrub at GRBA. It is treated in Key II Forest and Woodland (p 5).
Go to: **Key III (p 22)**

KEY II: THE FOREST AND WOODLAND ASSOCIATIONS OF GREAT BASIN NATIONAL PARK

1a) Deciduous forests or woodlands that occupy a variety of habitats from riparian areas to high elevation slopes. Conifer trees are often present, but with <25% relative cover of tree canopy). There may be small patches (below MMU) of conifer dominated tree canopy within the deciduous forest. **(2)**

1b) Evergreen and mixed evergreen – deciduous (aspen) forests and woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) occupying a variety of habitats, typically upland or high elevation sites, but includes riparian sites. Includes both needle-leaved and sclerophyllous evergreen tree species. **(3)**

2a) Forests or woodlands characterized by *Populus angustifolia* occurring within drainage bottoms or on mesic alluvial deposits. Other trees such as *Abies concolor, Juniperus scopulorum* or *Pinus monophylla* are often present and may codominate, however *Populus angustifolia* is diagnostic.

Go to **Narrowleaf Cottonwood Forests and Woodlands (pg 14)**

2b) Forests or woodlands characterized by *Populus tremuloides* typically occupying stream banks, mesic areas, or on higher elevation slopes. Non-deciduous trees such as *Abies concolor, Juniperus scopulorum* or *Pinus flexilis* may be present, but total less than a quarter of total tree canopy.

Go to **Aspen Forests and Woodlands (pg 8)**

3a) Forests or woodlands dominated by sclerophyllous evergreen tree/tall shrub *Cercocarpus ledifolius*. Other trees such as *Abies concolor, Juniperus scopulorum* or *Pinus monophylla* may be present to codominant especially in transitional stands, however *Cercocarpus ledifolius* is diagnostic.

Go to **Mountain Mahogany Woodlands (pg 13)**

3b) Forests or woodlands with *Cercocarpus ledifolius* absent or with low cover in tree canopy, but may form an understory layer. **(4)**

4a) Forests or woodlands dominated or codominated by *Pinus ponderosa* occurring along drainages on mesic alluvial deposits or upland sites. Other trees such as *Abies concolor, Juniperus scopulorum* or *Pinus monophylla* are often present and may codominate, however large, visually dominant (often emergent) *Pinus ponderosa* in tree canopy is diagnostic even if not the most abundant tree.

Go to **Ponderosa Pine Forests and Woodlands (pg 18)**

4b) Forests or woodlands not characterized by *Pinus ponderosa* trees. *Pinus ponderosa* is absent or with low (accidental) cover. **(5)**

5a) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma*. Tree canopy ranges from moderately dense (35-80% canopy cover) to open (10-35% canopy cover) and may include stands with as low as 5% tree cover if these tree species dominate the total vegetation.

Go to **Pinyon Pine and Juniper Woodlands (pg 15)**

5b) Forests or woodlands not dominated by *Pinus monophylla* and *Juniperus osteosperma* trees. *Pinus monophylla* and *Juniperus osteosperma* trees may be present to codominant, but stand is dominated by other, usually taller tree species such as *Abies concolor, Picea engelmannii*, *Pinus flexilis, Pinus longaeva* and/or *Pseudotsuga menziesii*. **(6)**

6a) Woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) dominated or codominated by *Pinus longaeva* and/or *Pinus flexilis*. Other trees such as *Abies concolor,* and *Pseudotsuga menziesii*, may be present especially in transition with montane forests and *Populus tremuloides* may codominate; however the presence of *Pinus longaeva* with 5% or more absolute cover and/or dominance of *Pinus flexilis* trees are diagnostic. If *Picea engelmannii* and *Pinus flexilis* are codominant in tree canopy than *Pinus flexilis* generally has greater cover.

Go to **Bristlecone and Limber Pine Forests and Woodlands (pg 10)**

6b) Forests or woodlands not characterized by *Pinus longaeva* and/or *Pinus flexilis* trees. *Pinus longaeva* trees are absent or with low cover in atypical sites (accidental). If *Picea engelmannii* and *Pinus flexilis* are codominant in tree canopy than *Picea engelmannii* has equal or greater cover. **(7)**

7a) Subalpine forests and woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) dominated or codominated by *Picea engelmannii*. Other trees include *Abies concolor, Pseudotsuga menziesii, Pinus flexilis* and *Populus tremuloides,* which may be present to codominant especially in transition with montane forests; however *Picea engelmannii* is diagnostic when over 20% or more tree absolute canopy cover.

Go to **Engelmann Spruce Forests and Woodlands (pg 12)**

7b) Montane forests and woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) dominated or codominated by *Abies concolor* and *Pseudotsuga menziesii* and mixed conifer-deciduous forests and woodland codominated by *Populus tremuloides*. Other trees such as may be present especially in transition with foothill (*Pinus monophylla*) and subalpine forests *Pinus flexilis, Picea engelmannii)*, however *Abies concolor* and/or *Pseudotsuga menziesii* is diagnostic when over 20% tree canopy.

Go to **White Fir and Douglas-fir Mixed Montane Forests and Woodlands (pg 19)**

Forest and Woodland Groups
(Alphabetized by Common Name of Dominant Species)

<u>Aspen Forests and Woodlands</u>

1a) *Populus tremuloides* forests or woodlands with shrub layer in understory that has 10% or more cover or exceeds herbaceous layer if less than 10% cover. Dominant shrubs include species of *Arctostaphylos, Artemisia, Juniperus, Prunus, Ribes, Rosa,* and *Symphoricarpos*. **(2)**
1b) *Populus tremuloides* forests or woodlands with shrubs absent or low cover (<5% cover) and higher cover of herbaceous species, especially from the *Poa, Bromus,* and *Equisetum* genera. **(9)**

2a) Shrub layer in understory is dominated by *Artemisia tridentata.*
***Populus tremuloides / Artemisia tridentata* Forest**
2b) Shrub layer is dominated by other shrub species. **(3)**

3a) Shrub layer in understory is dominated by *Betula occidentalis.* Other riparian species maybe present such as *Salix boothii* and *S. exigua* - ***Populus tremuloides / Betula occidentalis* Forest**
3b) Shrub layer is dominated by other shrub species. **(4)**

4a) Shrub layer in understory is dominated by *Rosa woodsii.* Riparian species such as *Betula occidentalis, Salix boothii* and *S. exigua* are often present.
***Populus tremuloides / Rosa woodsii* Forest**
4b) Shrub layer is dominated by other shrub species. **(5)**

5a) Shrub layer in understory is dominated by *Prunus virginiana.*
***Populus tremuloides / Prunus virginiana - Symphoricarpos oreophilus* Forest [Park Special]**
5b) Shrub layer is dominated by other shrub species. **(6)**

6a) Shrub layer in understory is dominated by *Ribes* species such as *R. cereum.*
***Populus tremuloides / Ribes* spp. Woodland [Park Special]**
6b) Shrub layer is dominated by other shrub species. **(7)**

7a) Shrub layer in understory is dominated by *Juniperus communis.*
***Populus tremuloides / Juniperus communis* Forest**
7b) Shrub layer is dominated by other shrub species. **(8)**

8a) Shrub layer in understory is dominated by *Symphoricarpos oreophilus*
***Populus tremuloides / Symphoricarpos oreophilus* Forest**
8b) Shrub layer is dominated by other shrub species.
Unclassified *Populus tremuloides* Woodland

9a) Herbaceous layer in understory is dominated by *Bromus carinatus (=B. marginatus), Elymus glaucus,* or *Elymus trachycaulus.* Other abundant graminoids include *Juncus balticus, Poa secunda,* or *Poa wheeleri.* Mesic forbs are present and occasionally abundant such as *Achillea millefolium, Lathyrus* spp. or *Vicia americana* are abundant
***Populus tremuloides / Bromus carinatus* Forest**

9b) Herbaceous layer is dominated by other herbaceous species. **(10)**

10a) Herbaceous layer in understory is strongly dominated by *Poa pratensis.*
***Populus tremuloides* / Invasive Perennial Grasses Forest**

10b) Herbaceous layer is dominated by other herbaceous species.
Unclassified *Populus tremuloides* Woodland

Bristlecone and Limber Pine Forests and Woodlands

1a) Stand is a forest or woodland dominated or codominated by *Pinus longaeva* and/or *Pinus flexilis* trees 5-35 m tall. **(2)**

1b) Stand is krummholz scrub dominated by wind-stunted *Pinus flexilis* < 5 m tall occurring near upper tree line.
***Pinus flexilis / Selaginella watsonii* Krummholz**

2a) Open to moderately dense woodlands dominated or codominated by *Pinus longaeva*. *Pinus flexilis* is often present to codominant. Canopy ranges from 5-45%. Other trees such as *Abies concolor, Picea engelmannii*, and *Pseudotsuga menziesii* may be present and *Populus tremuloides* may codominate, however the presence of *Pinus longaeva* trees is diagnostic **(3)**

2b) Woodlands or shrublands dominated or codominated by *Pinus flexilis*. *Pinus longaeva* is typically absent or very low cover (accidental). Other trees such as *Abies concolor* and *Pseudotsuga menziesii* may be present and *Populus tremuloides* and *Picea engelmannii* may codominate, however the dominance of *Pinus flexilis* trees and the absence of *Pinus longaeva* trees is diagnostic **(7)**

3a) Shrubs in understory includes *Ericameria discoidea* and/or *Ribes montigenum*, although *Juniperus communis* may dominate. Subalpine and alpine herbaceous species are typically present as this is a high elevation type.
***Pinus longaeva / (Ericameria discoidea, Ribes montigenum)* Woodland**

3b) Shrub layer is dominated by other shrub species. **(4)**

4a) Shrubs in understory are dominated or codominated by *Cercocarpus intricatus*, although *Glossopetalon spinescens, Peraphyllum ramosissimum* and *Arctostaphylos patula* are often present. This type is typically dominated or codominated by *Pinus ponderosa* trees. *Pinus monophylla* trees may also be present. This type is a low elevation community found only in the Big Wash area on limestone derived substrates.
***Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus* Woodland [Provisional]**

4b) Shrub layer is dominated by other shrub species. **(5)**

5a) Shrubs in understory are dominated by *Arctostaphylos patula* although on rocky sites cover of shrubs may be low. This type is a mid-elevation community.
***Pinus longaeva / Arctostaphylos patula* Woodland**
5b) Shrub layer is dominated by other shrub species. **(6)**

6a) Shrubs in understory are dominated by *Symphoricarpos oreophilus*. If other shrubs are present then they have low cover. This type is a mid-elevation community.
***Pinus longaeva* / *Symphoricarpos oreophilus* Woodland [Park Special]**
6b) Understory is dominated by other shrub or herbaceous species.
Unclassified *Pinus longaeva* Woodland

7a) Tree canopy is codominated by *Populus tremuloides* and *Pinus flexilis*. *Picea engelmannii* may be present to codominate. **(8)**
7b) Tree canopy is dominated by evergreen trees. *Populus tremuloides* may be present but not codominant. **(9)**

8a) Tree canopy is dominated by *Pinus flexilis* with *Populus tremuloides* present to codominant. *Picea engelmannii* may be present to codominate, but its cover is less than the cover of *Pinus flexilis*. This shrubby understory is dominated by *Arctostaphylos patula*.
***Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula* Forest**
8b) Tree canopy is codominated by *Populus tremuloides* and *Pinus flexilis*. *Picea engelmannii* may be present to codominate, but its cover is less than the cover of *Pinus flexilis*. This association is broadly defined and includes stands with understories dominated by shrubs and/or herbaceous species.
***Populus tremuloides - Pinus flexilis* Forest**

9a) Woodlands dominated or codominated by *Pinus flexilis* with herbaceous dominated understory **(10)**
9b) Woodlands dominated or codominated by *Pinus flexilis* with shrub dominated understory **(11)**

10a) Woodland is codominated by *Pinus flexilis* and *Picea engelmannii*. The understory is dominated by *Carex rossii* or other dry upland sedges. Other common graminoids include *Poa fendleriana* and *Poa secunda.* Sometimes herbaceous cover is low, but still dominates.
***Picea engelmannii - (Pinus flexilis) / Carex rossii* Woodland**
10b) Understory is dominated by other herbaceous species or is sparse.
Unclassified *Pinus flexilis* Woodland with herbaceous or sparse understory

11a) Shrubs in understory are dominated or codominated by *Arctostaphylos patula*.
***Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula* Forest**
11b) Shrub layer is dominated by other shrub species. **(12)**

12a) Shrubs in understory are dominated or codominated by *Artemisia tridentata* ssp. *vaseyana*. Other shrubs may be present to codominant. This type is a mid-elevation community and has not been sampled within GRBA boundaries.

***Pinus flexilis / Artemisia tridentata* ssp. *vaseyana* Woodland [Park Special]**

12b) Shrub layer is dominated by other shrub species. **(13)**

13a) Shrubs in understory are dominated by *Symphoricarpos oreophilus*. If other shrubs are present then they have low cover. This type is a mid-elevation community.

***Pinus flexilis* / Symphoricarpos oreophilus Woodland [Park Special]**

13b) Understory is dominated by other shrub species.

Unclassified *Pinus flexilis* Woodland with a shrub layer

Engelmann Spruce Forests and Woodlands

1a) Stand is a forest or woodland dominated or codominated by *Picea engelmannii* trees 5-35 m tall. **(3)**

1b) Stand is shrubland dominated or codominated by *Picea engelmannii* trees < 5 m tall. **(2)**

2a) Stand is composed of short and broken *Picea engelmannii* and *Populus tremuloides* damaged by reoccurring avalanche.

***Picea engelmannii - Populus tremuloides* Avalanche Chute Shrubland**

2b) Stand is a krummholz shrubland dominated by wind-stunted *Picea engelmannii* occurring near upper tree line.

***Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis)* Krummholz**

3a) Mesic to wet lowland subalpine forests and woodlands dominated or codominated by *Picea engelmannii* that occur near streams and below seeps. **(4)**

3b) Upland subalpine forests and woodlands dominated or codominated by *Picea engelmannii*. **(5)**

4a) Understory is characterized by an herbaceous layer dominated or codominated by *Carex scopulorum*. Other graminoids may be present to codominant. This type is a riparian or seep community.

***Picea engelmannii / Carex scopulorum* Woodland**

4b) Understory is characterized by an herbaceous layer dominated or codominated by mesic and wet forbs such as *Aconitum columbianum, Aquilegia formosa, Angelica kingii, Ligusticum porteri, Mertensia ciliata, Mimulus guttatus, Osmorhiza depauperata, O. occidentalis, Ranunculus* spp., and *Saxifraga odontoloma.* Mesic graminoids such as *Carex microptera, Elymus trachycaulus,* and *Juncus balticus* may be present to codominant. *Populus tremuloides* is typically present to codominant.

***Picea engelmannii - Populus tremuloides* / Mesic Forb Forest [Park Special]**

5a) Mixed conifer – aspen subalpine forests and woodlands. *Populus tremuloides* cover has 25-75% relative tree canopy cover. If conifer canopy is mixed than cover of *Picea engelmannii* is equal or greater then *Pinus flexilis* tree cover**.**

***Picea engelmannii - Populus tremuloides* Forest Alliance**

If *Arctostaphylos patula* often dominates understory then stand is:

***Picea engelmannii - Populus tremuloides / Arctostaphylos patula* Forest [Park Special]**

5b) Subalpine forests and woodlands dominated or codominated by *Picea engelmannii* with *Pinus flexilis* absent to codominant. If present, *Populus tremuloides* has <25% relative tree canopy cover. **(6)**

6a) Subalpine forests and woodlands dominated or codominated by *Picea engelmannii* with a shrub dominated understory. Other trees such as *Abies concolor, Pseudotsuga menziesii,* and *Pinus flexilis* may be present to codominant. An herbaceous layer may be present or absent. **(9)**

6b) Subalpine forests and woodlands dominated or codominated by *Picea engelmannii* with herbaceous or non-vascular/moss dominated understory. Other trees such as *Abies concolor, Pseudotsuga menziesii,* and *Pinus flexilis* may be present to codominant. Scattered shrubs may be present with less than <5% cover. **(7)**

7a) Woodland is dominated or codominated by *Picea engelmannii* with *Pinus flexilis* present to codominant. The understory is dominated by herbaceous species with *Carex rossii* or other dry upland sedge dominant or codominant. Other common graminoids include *Poa fendleriana* and *Poa secunda.*

***Picea engelmannii - (Pinus flexilis) / Carex rossii* Woodland**

7b) Herbaceous layer is dominated by other species. **(8)**

8a) Understory is dominated by mosses forming a non-vascular layer. Stands lack any significant vascular herbaceous cover.

***Picea engelmannii* / Moss Forest**

8b) Understory is dominated by other shrub or herbaceous species.

Unclassified *Picea engelmannii* Woodland with a sparse or herbaceous layer

9a) Shrubs in understory include *Ribes montigenum* and *Ericameria discoidea. Juniperus communis* may be present, but not dominant. Subalpine and alpine herbaceous species are typically present as this is a high elevation type.

***Picea engelmannii / Ribes montigenum* Forest**

9b) Shrub layer is dominated by other shrub species. **(10)**

10a) Shrubs in understory are dominated by *Juniperus communis*. If other shrubs are present then they have low cover.

***Picea engelmannii / Juniperus communis* Forest**

10b) Understory is dominated by other shrub species.

Unclassified *Picea engelmannii* Forest or Woodland with shrub understory

Mountain Mahogany Woodlands (and Shrublands)

1a) *Cercocarpus ledifolius* woodlands with short shrub layer in understory that has 10% or more cover or exceeds herbaceous layer if less than 10% cover. Dominant shrubs include species of *Arctostaphylos*, *Artemisia,* and *Symphoricarpos*. **(2)**
1b *Cercocarpus ledifolius* woodlands with shrubs absent or low cover (<5% cover) and higher herbaceous cover, especially of species of *Hesperostipa, Poa,* and *Pseudoroegneria*. **(5)**

2a) Shrub layer in understory is dominated by *Arctostaphylos patula.*
***Cercocarpus ledifolius / Arctostaphylos patula* Woodland [Provisional]**
2b) Shrub layer is dominated by other shrub species. **(3)**

3a) Shrub layer in understory is dominated by *Artemisia tridentata* ssp. *vaseyana.*
***Cercocarpus ledifolius / Artemisia tridentata* ssp. *vaseyana* Woodland**
3b) Shrub layer is dominated by other shrub species. **(4)**

4a) Shrub layer in understory is dominated by *Symphoricarpos oreophilus.*
***Cercocarpus ledifolius / Symphoricarpos oreophilus* Woodland**
4b) Shrub layer is dominated by other shrub species.
Unclassified *Cercocarpus ledifolius* Woodland

5a) Herbaceous layer in understory is dominated or codominated by *Pseudoroegneria spicata. Hesperostipa comata* and *Poa fendleriana* are often present to codominant.
***Cercocarpus ledifolius / Pseudoroegneria spicata* Shrubland**
5b) Herbaceous layer is dominated by other herbaceous species.
Unclassified *Cercocarpus ledifolius* Woodland or Shrubland

Narrowleaf Cottonwood Forests and Woodlands

1a) Woodlands dominated or codominated by *Populus angustifolia* in tree canopy with *Artemisia tridentata* ssp. *tridentata* dominating the open to dense shrub layer or codominating with widespread shrubs *Prunus virginiana* and *Chrysothamnus viscidiflorus*. Other shrubs may be present with lower cover. Stands occur on dryer stream terraces in canyon bottoms.
***Populus angustifolia / Artemisia tridentata* ssp. *tridentata - Prunus virginiana* Woodland [Park Special]**
1b) Woodland is not characterized by *Artemisia tridentata* ssp. *tridentata* dominating or codominating the shrub layer. If *Artemisia tridentata* ssp. *tridentata* is present, then understory is strongly dominated by *Cornus sericea, Prunus virginiana,* or *Rosa woodsii.* **(2)**

2a) Woodlands dominated or codominated by *Populus angustifolia* in tree canopy with *Cornus sericea* (usually > 15% cover) dominating or codominating the open to dense shrub layer with widespread *Prunus virginiana* and *Rosa woodsii*. Stands occur on mesic stream banks and terraces in canyon bottoms.

***Populus angustifolia / Cornus sericea* Woodland**

2b) Woodland is not characterized by *Cornus sericea* dominating or codominating the tall shrub layer. If *Cornus sericea* is present, then <15% cover and understory is strongly dominated by *Prunus virginiana, Rosa woodsii* or another shrub. **(3)**

3a) Woodlands dominated or codominated by *Populus angustifolia* in tree canopy with *Rosa woodsii* strongly dominating the open to dense shrub layer usually with twice the cover than all other shrubs combined. Other trees such as *Abies concolor, Juniperus scopulorum* or *Pinus monophylla* are often present. Stands occur on dryer stream terraces, especially disturbed sites.

***Populus angustifolia / Rosa woodsii* Forest**

3b) Woodland is not characterized by *Rosa woodsii* strongly dominating the shrub layer. **(4)**

4a) Woodlands dominated or codominated by *Populus angustifolia* in tree canopy with *Prunus virginiana* dominating or codominating the open to dense shrub layer or codominating with widespread *Rosa woodsii* or with other shrubs such as *Betula occidentalis, Rhus trilobata*, or *Salix* spp. (usually each < 15% cover). Other trees such as *Abies concolor, Juniperus scopulorum,* or *Pinus monophylla* are often present. Stands occur on mesic stream banks and terraces in canyon bottoms.

***Populus angustifolia / Prunus virginiana* Woodland**

4b) Woodland is not characterized by *Artemisia tridentata* ssp. *tridentata, Cornus sericea, Prunus virginiana,* or *Rosa woodsii.*

Unclassified *Populus angustifolia* Woodland

<u>**Pinyon Pine and Juniper Woodlands**</u>

1a) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma* trees. These woodlands are generally open (5-35% cover), but include some moderate to dense tree canopy stands (>35% cover). *Pinus monophylla* may dominate or have relatively low cover (2-10%). *Juniperus osteosperma* is often codominant, but may be absent or dominant. **(2)**

1b) Woodlands are generally open (5-30% canopy cover) and are dominated by *Juniperus osteosperma. Pinus monophylla* trees are absent or present with low (<2%) cover. Sites tend to occur at lower elevation than pinyon – juniper woodlands and are too hot or dry for *Pinus monophylla* to grow well. These woodlands are distinct stands rather than small inclusions that lack pinyon trees locally within a larger pinyon – juniper stand. Desert scrub such as *Atriplex* spp. or *Sarcobatus vermiculatus* may be present.

Unclassified *Juniperus osteosperma* Woodland

2a) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma* trees that lack a developed understory. Neither herbaceous nor shrub species has more than 5% cover, and most stands have less than 2% total understory cover. Stands may have a sparse understory because they are mature stands with relatively dense tree canopy that shades out understory or typically open stands occurring on harsh substrates such as on shale with poor water-holding capacity or limestone bedrock and colluvium.
***Pinus monophylla - Juniperus osteosperma* / Sparse Understory Woodland**

2b) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma* trees with a developed understory over 5% and composed of shrubs or herbaceous species. **(3)**

3a) Understory lacks a shrub layer (generally < 10%). If shrubs present with 5-10% cover then herbaceous cover exceeds shrub cover. **(4)**

3b) Understory has a shrub layer (generally > 10%) or if shrub cover is 5-10%, then shrub cover exceeds herbaceous cover. **(5)**

4a) Understory is characterized by an herbaceous layer dominated or codominated by *Poa fendleriana* and/or *Poa secunda*.
***Pinus monophylla - Juniperus osteosperma / Poa (fendleriana, secunda)* Woodland**

4b) Herbaceous layer is dominated by other species.
Unclassified *Pinus monophylla - Juniperus osteosperma* Woodland with an herbaceous layer

5a) Understory is characterized by tall mesic shrubs such as *Betula occidentalis, Prunus virginiana,* and *Rosa woodsii.* (**6)**

5b) Shrub layer is dominated by upland shrub species. **(7)**

6a) Understory is characterized by tall and short shrub layers dominated or codominated by *Betula occidentalis* and *Rosa woodsii*. This type is a riparian community. Other wet graminoids and forbs may be present to codominant.
***Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii* Woodland [Park Special]**

6b) Understory is characterized by a tall shrubs layer dominated or codominated by *Prunus virginiana. Betula occidentalis* is absent or has low cover. This type is a mesic community found at the base of a cliff, but may occur along moist drainages. Wet graminoids and forbs are not present.
***Pinus monophylla - Juniperus osteosperma / Prunus virginiana* Woodland**

7a) Understory is dominated by shrub species from the genus *Artemisia*. (**8)**

7b) Understory is dominated by shrub species from the genera *Cercocarpus, Glossopetalon, Peraphyllum,* or *Purshia*. *Artemisia* spp. may be present, but not dominant. **(12)**

8a) Understory is characterized by a dwarf-shrub layer dominated by *Artemisia arbuscula*. Sites are higher elevations, generally above 7000 feet.
***Pinus monophylla - Juniperus osteosperma / Artemisia arbuscula* Woodland**

8b) Understory is characterized by other woody species. **(9)**

9a) Understory is characterized by a dwarf-shrub layer dominated by *Artemisia nova*. Sites generally occur at lower elevations below 7200 feet near park boundary.
***Pinus monophylla - Juniperus osteosperma / Artemisia nova* Woodland**
9b) Understory is characterized by other woody species. **(10)**

10a) Understory is dominated or codominated by *Artemisia tridentata* ssp. *vaseyana*. **(11)**
10b) Understory is dominated or codominated by *Artemisia tridentata* ssp. *tridentata* or *Artemisia tridentata* ssp. *wyomingensis*. Stands typically occur at in bottomland and basins especially at lower elevations.
***Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Woodland**

11a) Understory is characterized by a shrub layer codominated by *Artemisia tridentata* ssp. *vaseyana* and other shrubs. Other shrubs such as *Amelanchier utahensis, Ephedra viridis, Holodiscus dumosus, Prunus virginiana, Purshia glandulosa,* or *Symphoricarpos oreophilus* are present to codominant. If present, *Cercocarpus ledifolius* and *Glossopetalon spinescens* have low cover (not codominant). The herbaceous layer is variable and may be sparse depending on shrub density. This type is an upper foothill/lower montane community.
Pinus monophylla - Juniperus osteosperma / Artemisia tridentata ssp. ***vaseyana* - Mixed Shrub Woodland**
11b) Understory is characterized by a shrub layer dominated by *Artemisia tridentata* ssp. *vaseyana* with a moderate to dense herbaceous layer dominated or codominated by *Pseudoroegneria spicata*. Other common graminoids include *Hesperostipa comata* and *Poa fendleriana*. This type is an upper foothill/lower montane community.
***Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* ssp. *vaseyana* / *Pseudoroegneria spicata* Woodland**

12a) Understory is characterized by a shrub layer dominated by *Cercocarpus ledifolius*.
***Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland**
12b) Understory is characterized by other woody species. **(13)**

13a) Understory is characterized by a shrub layer dominated or codominated by *Cercocarpus intricatus*. Other shrubs may be present with low cover such as *Artemisia nova, Artemisia tridentata, Ephedra viridis, Glossopetalon spinescens*, *Peraphyllum ramosissimum, Purshia stansburiana, Rhus trilobata* and *Symphoricarpos longiflorus.* Stands occur on rocky slopes.
***Pinus monophylla – (Juniperus osteosperma) / Cercocarpus intricatus* Woodland**
13b) Understory is characterized by other woody species. **(14)**

14a) Understory is characterized by an open shrub layer dominated by *Peraphyllum ramosissimum*. *Artemisia nova, Ephedra viridis* and *Rhus trilobata* may be present to codominant. Other shrubs may include *Arctostaphylos patula, Artemisia tridentata,* and *Symphoricarpos longiflorus*. *Cercocarpus intricatus* is absent or has low cover (<5%).
***Pinus monophylla - Juniperus osteosperma / Peraphyllum ramosissimum* Woodland**
14b) Understory is characterized by other woody species. **(15)**

15a) Understory is characterized by an open shrub layer characterized by *Glossopetalon spinescens***,** which codominates with *Purshia stansburiana* and *Artemisia tridentata.* Scattered *Ephedra viridis, Chrysothamnus viscidiflorus* and *Artemisia nova* may be present. Stands were sampled on steep limestone slope near Cave Creek.
***Pinus monophylla - Juniperus osteosperma / Glossopetalon spinescens - Artemisia tridentata - Purshia stansburiana* Woodland [Provisional]**

15b) Understory is characterized by other woody species. **(16)**

16a) Understory is characterized by a shrub layer dominated by *Purshia tridentata*. Other shrubs present may include *Artemisia nova*, *Artemisia tridentata* ssp. *vaseyana, Ephedra viridis,* and occasionally scattered *Cercocarpus ledifolius*.
***Pinus monophylla - Juniperus osteosperma / Purshia tridentata* Woodland [Park Special]**

16b) Understory is characterized by other woody species.
Unclassified *Pinus monophylla - Juniperus osteosperma* Woodland with a shrub layer

<u>**Ponderosa Pine Forest and Woodlands**</u>

1a) Mixed canopy forests occurring along drainages with *Pinus ponderosa* codominant or conspicuously present as large emergent trees over a subcanopy of *Abies concolor, Juniperus scopulorum, Pinus monophylla* and/or *Populus tremuloides.* Characteristic riparian and mesic site understory species are typically present such as *Betula occidentalis* and *Salix* spp. mixed with upland species. *Pinus ponderosa* is diagnostic.
***Pinus ponderosa - Abies concolor* Riparian Forest [Park Special]**

1b) Forests or woodlands dominated or codominated by *Pinus ponderosa* occurring on upland sites. Other trees such as *Abies concolor* or *Pinus monophylla* are often present and may codominate. **(3)**

2a) Open woodlands typically dominated or codominated by *Pinus ponderosa* with *Cercocarpus intricatus* typically dominant in the understory. Other characteristic understory shrubs are *Glossopetalon spinescens* and *Peraphyllum ramosissimum*. *Pinus longaeva* is often present to codominant in the tree canopy. It was only sampled in the Big Wash area.
***Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus* Woodland [Provisional]**

2b) Understory is dominated by other species. **(3)**

3a) Open woodlands typically dominated or codominated by *Pinus ponderosa* with *Arctostaphylos patula* dominant in the understory. *Abies concolor* is often present to codominant in the tree canopy.
***Pinus ponderosa / Arctostaphylos patula* Woodland**

3b) Understory is dominated by other species. **(4)**

4a) Open woodlands codominated by *Pinus ponderosa* with *Abies concolor.* The relatively mesic understory is variable but typically has an open shrub layer dominated by *Symphoricarpos oreophilus* with *Juniperus communis*. Other trees such as*, Juniperus scopulorum, Pinus flexilis* or *Pseudotsuga menziesii* are often present and may codominate, however *Pinus ponderosa* is diagnostic.

***Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland [Provisional]**

4b) Understory layer is dominated by other species.

Unclassified *Pinus ponderosa* Woodland

<u>White Fir and Douglas-fir Mixed Montane Forests and Woodlands</u>

1a) Stand is a forest or woodland dominated or codominated by *Abies concolor* and/or *Pseudotsuga menziesii* trees 5-30 m tall. **(2)**

1b) Stand is composed of short and broken *Abies concolor* and/or *Pseudotsuga menziesii* and *Populus tremuloides* trees < 5 m tall damaged by reoccurring avalanche.

***Abies concolor - Populus tremuloides* Avalanche Chute Shrubland**

2a) Montane forests and woodlands codominated by *Abies concolor* and/or *Pseudotsuga menziesii*. *Populus tremuloides* trees codominate with conifers. Other conifer trees such as *Picea engelmannii, Pinus flexilis* may be present with low cover (not codominant). **(3)**

2b) Montane forests and woodlands dominated or codominated by *Abies concolor* and/or *Pseudotsuga menziesii*. *Populus tremuloides* trees are absent or have low cover (not codominant). Other conifer trees such as *Picea engelmannii or Pinus flexilis* may be present, but are not codominant. **(12)**

3a) Understory lacks a shrub layer (generally < 10%). If shrubs are present with 5-10% cover then herbaceous cover exceeds shrub cover. **(4)**

3b) Understory has a shrub layer (generally > 10%) or if shrub cover is 5-10%, then shrub cover exceeds herbaceous cover. **(8)**

4a) Understory is characterized by an herbaceous layer dominated or codominated by *Carex scopulorum*. This type is a riparian community. Other wet graminoids and forbs may be present to codominant.

***Abies concolor - Populus tremuloides / Carex scopulorum* Woodland**

4b) Herbaceous layer is dominated by other species. **(5)**

5a) Understory is characterized by an herbaceous layer dominated or codominated by mesic forbs such as *Aconitum columbianum, Aquilegia formosa, Ligusticum porteri, Mertensia ciliata, Osmorhiza depauperata, O. occidentalis, and Saxifraga odontoloma*. *Populus tremuloides* is typically present to codominant. This forest is found in mesic bottomlands, riparian areas and seeps.

***Populus tremuloides - Abies concolor* / Mesic Forb Forest [Park Special]**

5b) Herbaceous layer is dominated by other species. **(6)**

6a) Understory is characterized by an herbaceous layer dominated by *Poa pratensis*. *Populus tremuloides* is typically present to codominant present. This is mesic forest is found in mesic bottomland and disturbed riparian areas.
***Populus tremuloides - Abies concolor* / *Poa pratensis* Semi-natural Forest**

6b) Understory is dominated by other herbaceous species or is sparse. **(7)**

7a) *Abies concolor* is present usually with 1% or more cover in tree canopy.
Unclassified Abies concolor - Populus tremuloides Forest or Woodland with an herbaceous or a sparse understory.

7b) *Pseudotsuga menziesii* dominates tree canopy. *Abies concolor* is absent or low cover (<1 % cover)
Unclassified Pseudotsuga menziesii - Populus tremuloides Forest or Woodland with an herbaceous or a sparse understory.

8a) Understory is dominated or codominated by *Salix boothii* with lush herbaceous layer typically dominated by *Carex scopulorum.* Other shrubs may be present but not dominant. This is a riparian or wetland community.
***Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum* Forest**

8b) Understory is dominated by other shrub species. **(9)**

9a) Understory is dominated or codominated by *Arctostaphylos patula*. This is an upland community.
***Populus tremuloides - Abies concolor / Arctostaphylos patula* Forest**

9b) Understory is dominated by other shrub species. **(10)**

10a) Understory is dominated by *Symphoricarpos oreophilus*. This is an upland community and is common on more mesic sites.
***Populus tremuloides - Abies concolor / Symphoricarpos oreophilus* Forest**

10b) Understory is dominated by other shrub species. **(11)**

11a) *Abies concolor* is present usually with 1% or more cover in tree canopy
Unclassified Abies concolor - Populus tremuloides Forest or Woodland with a shrub layer

11b) *Pseudotsuga menziesii* dominates tree canopy. *Abies concolor* is absent or low cover (<1 % cover).
Unclassified *Pseudotsuga menziesii - Populus tremuloides* Forest or Woodland with a shrub layer.

12a) Understory lacks a shrub layer (generally < 10%). If shrubs present with 5-10% cover then herbaceous cover exceeds shrub cover. **(13)**

12b) Understory has a shrub layer (generally > 10%) or if shrub cover is 5-10%, then shrub cover exceeds herbaceous cover. **(15)**

13a) Understory is characterized by an herbaceous layer dominated by *Carex rossii*. This is an upland forest.
***Abies concolor - Pseudotsuga menziesii / Carex rossii* Forest**
13b) Understory is dominated by other herbaceous species or is sparse. **(14)**

14a) *Abies concolor* is present usually with 1% or more cover in tree canopy.
Unclassified *Abies concolor – (Pseudotsuga menziesii)* Forest or Woodland with an herbaceous or a sparse understory.
14b) *Pseudotsuga menziesii* dominates tree canopy. *Abies concolor* is absent or low cover (<1 % cover).
Unclassified *Pseudotsuga menziesii* Forest or Woodland with an herbaceous or a sparse understory layer

15a) Shrubs in understory are dominated or codominated by *Cercocarpus ledifolius.* Other shrubs may be present but not dominant. This is typically an upland community.
***Abies concolor / Cercocarpus ledifolius* Woodland**
15b) Understory is dominated by other shrub species. **(16)**

16a) Shrubs in understory are dominated or codominated by *Arctostaphylos patula.* Other shrubs may be present but not dominant. This is typically an upland community. **(17)**
16b) Understory is dominated by other shrub species. **(18)**

17a) *Abies concolor* is present usually with 1% or more absolute cover in tree canopy.
Abies *concolor / Arctostaphylos patula* Forest
17b) *Pseudotsuga menziesii* dominates tree canopy. *Abies concolor* is absent or has low cover (<1 % absolute cover).
***Pseudotsuga menziesii / Arctostaphylos patula* Forest**

18a) Shrubs in understory are dominated by *Symphoricarpos oreophilus.* Other shrubs may be present with low cover.
***Abies concolor / Symphoricarpos oreophilus* Forest**
18b) Understory is dominated by other shrub species. **(19)**

19a) *Abies concolor* is present usually with 1% or more cover in tree canopy
Unclassified *Abies concolor – (Pseudotsuga menziesii)* Forest or Woodland with a shrub layer
19b) *Pseudotsuga menziesii* dominates tree canopy. *Abies concolor* is absent or low cover (<1 % cover
Unclassified *Pseudotsuga menziesii* Forest or Woodland with a shrub layer

KEY III: THE SHRUBLAND AND SHRUB STEPPE ASSOCIATION OF GREAT BASIN NATIONAL PARK

1a) Shrubland stand is composed of short and broken aspen and conifer trees < 5 m tall. **(2)**
1b) Shrubland stand is composed of a variety of broadleaf and microphyllus shrubs. **(5)**

2a) Stand is composed of short and broken trees < 5 m tall damaged by reoccurring avalanche. **(3)**
2b) Stand is a krummholz shrubland dominated by wind-stunted trees < 5 m tall occurring near upper tree line. **(4)**

3a) Stand is composed of short and broken *Abies concolor* and/or *Pseudotsuga menziesii* and *Populus tremuloides* trees < 5 m tall damaged by reoccurring avalanche.
Abies concolor - Populus tremuloides **Avalanche Chute Shrubland**
3b) Stand is composed of short and broken *Picea engelmannii* and *Populus tremuloides* damaged by reoccurring avalanche.
Picea engelmannii - Populus tremuloides **Avalanche Chute Shrubland**

4a) Stand is a krummholz shrubland dominated by wind-stunted *Pinus flexilis* < 5 m tall occurring near upper tree line.
Pinus flexilis / Selaginella watsonii **Krummholz Shrubland**
4b) Stand is a krummholz shrubland dominated by wind-stunted *Picea engelmannii* occurring near upper tree line.
Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis) **Krummholz Shrubland**

5a) Tall and short shrublands occurring within drainage bottoms or on mesic alluvial deposits (benches and terraces) that are dominated or codominated by species of *Acer, Betula, Prunus, Rosa* or *Salix*.
Go to **Montane Riparian Shrublands (pg 26)**
5b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of Arctostaphylos, *Atriplex, Artemisia, Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Gutierrezia, Krascheninnikovia, Peraphyllum, Prunus, Purshia, Ribes, Sarcobatus,* or *Symphoricarpos.* **(6)**

6a) Desert scrub typically occurring on lower elevation sites especially in Administrative Area near Baker. Vegetation is dominated or codominated by species of *Atriplex, Gutierrezia, Krascheninnikovia,* or *Sarcobatus* (sometimes codominated by *Artemisia*)
Go to **Desert Scrub (pg 25)**
6b) Shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Arctostaphylos, Artemisia, Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(7)**

7a) Shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Artemisia.*
Go to **Sagebrush Shrublands (pg 28)**

7b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Arctostaphylos, Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra, Gutierrezia, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos. Artemisia* ssp. may be present, but generally do not codominate. **(8)**

8a) Short shrublands (generally < 2m tall) occurring dry uplands that are dominated or codominated by *Arctostaphylos patula.* **(9)**

8b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Gutierrezia, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(10)**

9a) Shrublands dominated by *Arctostaphylos patula.*
Arctostaphylos patula **Shrubland**

9b) Shrublands codominated by *Arctostaphylos patula* and *Ceanothus martinii.*
Arctostaphylos patula / Ceanothus martinii **Shrubland**

10a) Tall shrublands occurring in dry uplands that are dominated or codominated by *Cercocarpus ledifolius*.
Cercocarpus ledifolius **Woodland and Shrubland Alliance**
Go to **Mountain Mahogany Woodlands (and Shrublands) (pg.13)**

10b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(11)**

11a) Short shrublands (generally < 2m tall) occurring in dry uplands that are dominated or codominated by *Cercocarpus intricatus* and/or *Glossopetalon spinescens. Ephedra viridis, Purshia tridentata, Peraphyllum ramosissimum,* and *Artemisia tridentata* may be present, but not codominant.
Cercocarpus intricatus - Glossopetalon spinescens **Shrubland**

11b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Chrysothamnus, Dasiphora, Ericameria, Prunus, Peraphyllum ramosissimum, Purshia, Ribes,* or *Symphoricarpos.* **(12)**

12a) Shrub layer is dominated or codominated by *Peraphyllum ramosissimum*. **(13)**

12b) Shrub layer is not dominated or codominated by *Peraphyllum ramosissimum.* **(14)**

13a) Shrub layer is codominated by *Peraphyllum ramosissimum* with indicator species *Chamaebatiaria millefolium.* This park special type is sampled from one site near North Fork of Big Wash.

***Artemisia tridentata* ssp. *tridentata - Peraphyllum ramosissimum - Chamaebatiaria millefolium* Shrubland [Park Special]**

13b) Shrub layer is dominated or codominated by *Peraphyllum ramosissimum* usually with *Artemisia tridentata* present to codominant. Scattered *Pinus monophylla, Juniperus osteosperma, and Cercocarpus ledifolius* trees may be present. This type is known from Big Wash area.

***Peraphyllum ramosissimum - Artemisia tridentata* Shrubland.**

14a) Short shrublands or shrub steppe (generally < 2m tall) that is occurring in dry uplands that are dominated by *Purshia tridentata*. *Artemisia nova, A. tridentata* or other shrubs may be present to codominant. The herbaceous layer dominated by *Hesperostipa comata* with other dry grasses. Known stands occur at relatively low elevation near Kious Basin near the eastern boundary.

***Purshia tridentata / Hesperostipa comata* Shrub Herbaceous Vegetation**

14b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Chrysothamnus, Dasiphora, Ericameria, Ribes, Prunus* or *Symphoricarpos.* **(15)**

15a) Short shrublands or shrub steppe (generally < 2m tall) occurring in dry uplands that are dominated by *Chrysothamnus viscidiflorus* sometimes with *Eriogonum microthecum* codominant. The herbaceous layer is dominated by *Pseudoroegneria spicata.*

***Chrysothamnus viscidiflorus* Shrub Herbaceous Vegetation [Provisional]**

15b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ephedra*, *Ericameria*, *Prunus, Ribes,* or *Symphoricarpos.* **(16)**

16a) Short shrublands or shrub steppe (generally < 2m tall) occurring in dry valleys and uplands that are dominated by *Ericameria nauseosa* with an herbaceous layer dominated by *Bromus tectorum,* an introduced annual grass. Sites have been disturbed in past and may have scattered *Artemisia tridentata* is some stands.

***Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland**

16b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ephedra*, *Ericameria, Prunus, Ribes,* or *Symphoricarpos.* **(17)**

17a) Short shrublands (generally < 2m tall) occurring somewhat mesic high elevation uplands that are dominated by *Ribes cereum* or *R. montigenum* and *Ericameria discoidea. Juniperus communis* may be present to codominant. Sites occur in upper subalpine near tree line.

***Ribes (cereum, montigenum) - Ericameria discoidea* Shrubland [Provisional]**

17b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ephedra*, *Prunus,* or *Symphoricarpos.* **(18)**

18a) Patchy, relatively mesic short mixed shrublands (generally < 2m tall) occurring on steep talus slopes on south facing slope in Big Wash. Stands are dominated by *Prunus virginiana* with *Holodiscus dumosus, Ephedra viridis, Artemisia tridentata* or *Acer glabrum* present to codominant.

Prunus virginiana **- Mixed Shrub Talus Shrubland [Provisional]**

18b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Dasiphora* or *Symphoricarpos.* **(19)**

19a) Relatively mesic short open shrublands from montane to subalpine meadows occurring on gentle slopes. Stands are dominated by *Dasiphora fruticosa* ssp. *floribunda* with *Elymus trachycaulus* dominating the moderately dense herbaceous layer. .

Dasiphora fruticosa **ssp.** ***floribunda / Elymus trachycaulus*** **Shrub Herbaceous Vegetation [Park Special]**

19b) Tall and short shrublands occurring in mesic or dry uplands that are not dominated or codominated by species of *Dasiphora fruticosa* ssp. *floribunda.* **(20)**

20a) Relatively mesic short open shrublands from montane to subalpine meadows occurring on gentle slopes. Stands are dominated by *Symphoricarpos oreophilus* with *Elymus trachycaulus* dominating the moderately dense herbaceous layer.

Symphoricarpos oreophilus **Shrubland**

20b) Undescribed shrubland occurring at GRBA

Shrubland Groups

(Alphabetized by Common Name of Dominant Species)

Desert Scrub

1a) Open low shrubland dominated by *Gutierrezia sarothrae.* This type has not been sampled within GRBA boundaries, but is a disturbance type that could be found there.

Gutierrezia sarothrae **Dwarf-shrubland Alliance**

1b) Short or dwarf shrublands dominated or codominated by *Krascheninnikovia lanata, Atriplex confertifolia or Sarcobatus vermiculatus.* **(2)**

2a) Open dwarf-shrubland dominated by *Krascheninnikovia lanata.* This type has not been sampled within GRBA boundaries.

Krascheninnikovia lanata **Dwarf-shrubland**

2b) Short shrublands dominated or codominated by *Atriplex confertifolia or Sarcobatus vermiculatus.* **(3)**

3a) Shrublands dominated or codominated by *Atriplex confertifolia.* **(4)**

3b) Shrublands dominated or codominated by *Sarcobatus vermiculatus.* **(6)**

4a) Shrublands dominated by *Atriplex confertifolia.* This type has not been sampled within GRBA boundaries.

Atriplex confertifolia **Great Basin Shrubland**

4b) Shrublands codominated by *Atriplex confertifolia.* **(5)**

5a) Shrublands codominated by *Atriplex confertifolia, Picrothamnus desertorum* and *Krascheninnikovia lanata.* This type has not been sampled within GRBA boundaries.
***Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata* Shrubland**

5b) Shrublands codominated by *Atriplex confertifolia* and *Sarcobatus vermiculatus.* Not sampled within park boundaries.
***Atriplex confertifolia - Sarcobatus vermiculatus* Shrubland**

6a) Shrublands dominated by *Sarcobatus vermiculatus.* **(7)**

6b) Shrublands codominated by *Sarcobatus vermiculatus.* **(8)**

7a) Shrublands dominated by *Sarcobatus vermiculatus* with an herbaceous layer dominated by *Distichlis spicata.* This type has not been sampled within GRBA boundaries.
***Sarcobatus vermiculatus / Distichlis spicata* Shrubland**

7b) Shrublands dominated by *Sarcobatus vermiculatus* with evidence of disturbances such as *Chrysothamnus viscidiflorus* in shrub layer and annuals like *Kochia americana* in the herbaceous layer. This type has not been sampled within GRBA boundaries.
***Sarcobatus vermiculatus* Disturbed Shrubland**

8a) Open shrublands codominated by *Sarcobatus vermiculatus* and *Artemisia tridentata.* Found on sand deposits near the GRBA visitor center near Baker.
***Sarcobatus vermiculatus / Artemisia tridentata* Shrubland**

8b) Open shrublands codominated by *Atriplex confertifolia* and *Sarcobatus vermiculatus.* This type has not been sampled within GRBA boundaries.
***Atriplex confertifolia - Sarcobatus vermiculatus* Shrubland**

Montane Riparian Shrublands

1a) Tall shrublands dominated or codominated by *Betula occidentalis or Salix* spp. **(2)**

1b) Tall shrublands dominated or codominated by species of *Acer, Prunus, and Rosa.* **(7)**

2a) Shrublands dominated by *Betula occidentalis.* **(3)**

2b) Shrublands dominated by *Salix* spp. *Betula occidentalis* may be present to codominant **(4)**

3a) *Betula occidental* dominates the tall shrub and *Cornus sericea* dominates the short shrub layers.
***Betula occidentalis / Cornus sericea* Shrubland**

3b) *Betula occidental* dominates the tall shrub layer and mesic graminoids such as *Carex* sp., *Juncus* sp., *Leymus cinereus, Poa pratensis,* and *Scirpus microcarpus* dominate the herbaceous layer. Mesic forbs are present to codominant. Scattered upland trees may be present in narrow stands.
***Betula occidentalis* / Mesic Graminoids Shrubland**

4a) Shrublands dominated by *Salix boothii.* **(5)**
4b) Shrublands dominated by *Salix bebbiana* or *Salix exigua*. **(6)**

5a) *Salix boothii* dominates the tall shrub and mesic graminoids such as *Carex aquatilis, C. disperma, C. praegracilis, Elymus glaucus, Equisetum arvense, Glyceria striata,* and *Juncus balticus* dominate the herbaceous layer. Mesic introduced forage grasses such as *Agrostis stolonifera, Dactylis glomerata, Phleum pratense,* and *Poa pratensis* are often present to codominant.
***Salix boothii* / Mesic Graminoids Shrubland**
5b) *Salix boothii* dominates the tall shrub and mesic to wet forbs such as *Aconitum columbianum, Angelica kingii, Dodecatheon alpinum, Mertensia franciscana, Osmorhiza occidentalis, Potentilla gracilis* and *Vicia americana* dominates the herbaceous layer.
***Salix boothii* / Mesic Forbs Shrubland**

6a) *Salix bebbiana* dominates the tall shrub and mesic graminoids such as *Carex aquatilis, C. disperma, C. scopulorum, C. subfusca, Equisetum arvense* and *Glyceria striata* dominates the herbaceous layer. Mesic introduced forage grasses such as *Agrostis stolonifera, Dactylis glomerata, Phleum pretense,* and *Poa pratensis* are often present to codominant.
***Salix bebbiana* / Mesic Graminoids Shrubland**
6b) *Salix exigua* dominates the tall shrub and mesic graminoids dominate the herbaceous layer.
***Salix exigua* / Mesic Graminoids Shrubland**

7a) Shrublands dominated by *Acer glabrum or Rosa woodsii*. **(8)**
7b) Shrublands dominated or codominated by *Prunus virginiana.* **(9)**

8a) Tall shrublands dominated by *Acer glabrum.*
***Acer glabrum* Drainage Bottom Shrubland**
8b) Tall shrublands dominated by *Rosa woodsii.*
***Rosa woodsii* Shrubland**

9a) Tall shrublands dominated by *Prunus virginiana* with *Penstemon rostriflorus* characteristic of the post-burn conditions of the type. Site was mesic lowland
***Prunus virginiana - Penstemon rostriflorus* Post-burn Shrubland [Park Special]**
9b) Tall shrublands dominated by *Prunus virginiana* with *Symphoricarpos oreophilus* dominating the short shrub layer and *Elymus* the herbaceous layer. Not sampled within GRBA boundaries.
***Prunus virginiana - Symphoricarpos oreophilus / Elymus trachycaulus* Shrubland [Park Special)**

Sagebrush Shrublands

1a) Short or dwarf-shrublands dominated or codominated by *Artemisia arbuscula* ssp. *arbuscula* with *Pseudoroegneria spicata* dominant or codominant in the herbaceous layer. *Artemisia tridentata* is absent or has low cover. Includes stands with *Poa fendleriana* dominant as long as *Pseudoroegneria spicata* is present with >25% relative cover. If *Artemisia tridentata* is present, then *A. arbuscula* ssp. *arbuscula* has equal or greater cover.
Artemisia arbuscula **ssp.** ***arbuscula / Pseudoroegneria spicata*** **Shrub Herbaceous Vegetation**

1b) Short or dwarf-shrublands dominated or codominated by species of *Artemisia nova* or *Artemisia tridentata.* **(2)**

2a) Shrublands dominated by *Artemisia nova. Artemisia tridentata* is absent or has low cover. **(3)**

2b) Shrublands dominated by *Artemisia tridentata* either ssp. *tridentata* or ssp. *vaseyana* unless specified in couplet. *Artemisia tridentata* ssp. *wyomingensis* is not reported from GRBA **(5)**

3a) *Achnatherum hymenoides* dominates the herbaceous layer.
Artemisia nova / Achnatherum hymenoides **Shrubland**

3b) *Achnatherum hymenoides* does not dominate herbaceous layer. **(4)**

4a) *Pseudoroegneria spicata* dominates the herbaceous layer.
Artemisia nova / Pseudoroegneria spicata **Shrubland**

4b) *Poa fendleriana* dominates the herbaceous layer.
Artemisia nova / Poa fendleriana **Shrubland**

5a) Shrubland is dominated or codominated by *Artemisia tridentata* with herbaceous layer dominated by annual introduced grass, *Bromus tectorum.* These are generally disturbed stands often with *Ericameria nauseosa* present to codominant.
Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum **Semi-natural Shrubland**

5b) Shrublands are not as above. **(6)**

6a) Shrubland has mixed canopy codominated by *Artemisia tridentata* and other shrub species. **(7)**

6b) Shrubland is strongly dominated by *Artemisia tridentata.* If present other shrub species have low cover and do not codominate. **(12)**

7a) Mixed shrub layer is codominated by *Symphoricarpos oreophilus*. **(8)**

7b) Mixed shrub layer is codominated by *Amelanchier utahensis, Chamaebatiaria millefolium, Peraphyllum ramosissimum* or *Purshia tridentata. Symphoricarpos oreophilus* may be present but not codominant. **(9)**

8a) Herbaceous layer is characterized by *Elymus trachycaulus* ssp. *trachycaulus* and other relatively mesic species.
***Artemisia tridentata* ssp. *vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus* ssp. *trachycaulus* Shrubland**

8b) Herbaceous layer is characterized by *Pseudoroegneria spicata* and other relatively xeric species.
***Artemisia tridentata* ssp. *vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland**

9a) Shrub layer is codominated by *Amelanchier utahensis* and in some stands forms an emergent tall shrub layer. *Peraphyllum ramosissimum* is absent or has low cover.
***Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland**

9b) Shrub layer is codominated by *Peraphyllum ramosissimum* or *Purshia tridentata*. **(10)**

10a) Shrub layer is codominated by *Purshia tridentata* and *Artemisia tridentata*.
***Purshia tridentata - Artemisia tridentata* ssp. *tridentata* Shrubland**

10b) Shrub layer is codominated by *Peraphyllum ramosissimum.* **(11)**

11a) Shrub layer is codominated by *Peraphyllum ramosissimum* with indicator species *Chamaebatiaria millefolium.* This park special type is sampled from one site near North Fork of Big Wash.
***Artemisia tridentata* ssp. *tridentata - Peraphyllum ramosissimum - Chamaebatiaria millefolium* Shrubland [Park Special]**

11b) Shrub layer is codominated by *Peraphyllum ramosissimum.* Scattered *Pinus monophylla, Juniperus osteosperma, and Cercocarpus ledifolius* trees may be present. This type is known from Big Wash area.
***Peraphyllum ramosissimum - Artemisia tridentata* Shrubland.**

12a) Sites are relatively mesic and are found in valley bottoms mesic sites on stream terraces and near seeps. **(13)**

12b) Sites relatively dry and often rocky upland slopes. **(16)**

13a) Herbaceous layer is mesic and is dominated or codominated by *Leymus cinereus*. Stands are found in mesic sites on stream terraces and seeps.
***Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Shrubland**

13b) Herbaceous layer is not dominated or codominated by *Leymus cinereus*. **(14)**

14a) Herbaceous layer is relatively mesic and is dominated by *Agropyron cristatum,* an introduced forage grass. Stands are found in valley bottoms up lower Snake Creek Canyon.
***Artemisia tridentata* ssp. *tridentata / Agropyron cristatum* Semi-natural Shrubland**

14b) Herbaceous layer is not dominated by *Agropyron cristatum.* **(15)**

15a) Herbaceous layer is dominated or codominated by *Pleuraphis jamesii*. *Poa fendleriana* may be present to codominant.
***Artemisia tridentata* ssp. *tridentata / Pleuraphis jamesii* Shrubland**

15b) Herbaceous layer is dominated by *Elymus elymoides*. *Elymus lanceolatus* may be present to codominant. *Artemisia tridentata* ssp. *tridentata* or *A. t.* ssp. *vaseyana* typically dominate.
***Artemisia tridentata / Elymus elymoides* Shrubland**

16a) Herbaceous layer is dominated or codominated by *Poa glauca* and/or *Poa secunda.* Stands are usually found in subalpine sites above 9,000 feet elevation.
***Artemisia tridentata* ssp. *vaseyana / Poa (glauca, secunda)* Shrubland**

16b) Herbaceous layer is dominated or codominated by *Poa fendleriana*. *Poa secunda* or *Hesperostipa comata* may be present to codominant. Stands are usually found in montane sites below 9,000 feet elevation.
***Artemisia tridentata* ssp. *vaseyana / Poa fendleriana* Shrubland**

KEY IV: THE HERBACEOUS ASSOCIATIONS OF GREAT BASIN NATIONAL PARK

1a) Herbaceous vegetation dominated by introduced herbaceous species. **(2)**

1b) Herbaceous vegetation dominated by native herbaceous species. **(4)**

2a) Herbaceous vegetation dominated by annual introduced herbaceous species, *Bromus tectorum* or other introduced annual brome grasses.
***Bromus tectorum* Semi-natural Herbaceous Vegetation**

2b) Herbaceous vegetation dominated by perennial introduced herbaceous species.

3a) Herbaceous vegetation dominated by perennial introduced herbaceous species, *Bromus inermis*.
***Bromus inermis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation**

3b) Herbaceous vegetation dominated by introduced perennial herbaceous species, *Agropyron cristatum*, sometimes with remnant native grasses.
***Agropyron cristatum* - (*Pascopyrum smithii, Hesperostipa comata*) Semi-natural Herbaceous Vegetation**

4a) Herbaceous vegetation dominated by alpine species.
Go to **Alpine Herbaceous Vegetation (pg 31)**

4b) Herbaceous vegetation dominated by foothill, montane and subalpine herbaceous species. **(5)**

5a) Herbaceous vegetation occupies mesic sites, including wetlands, perennial drainages, seeps, and springs, mesic meadows and depressions. Dominant and codominant species of *Carex, Dodecatheon, Elymus, Juncus, Leymus* and *Polygonum.*

Go to **Mesic and Wet Herbaceous Vegetation (pg 33)**

5b) Herbaceous vegetation occupies relatively xeric upland sites, including valley bottoms, terraces, slopes and benches; community not controlled by mesic conditions.

Go to **Upland Dry Herbaceous Vegetation (pg 34)**

Herbaceous Groups
(Alphabetized by Common Name of Dominant Species)

Alpine Herbaceous Vegetation

1a) Herbaceous vegetation occupies mesic to wet snow bed site including, depressions and seeps below snow depositions sites in alpine (snow bed community). Dominant species are *Carex subnigricans* and *Geum rossii* with wetland indicator species *Sibbaldia procumbens*.

***Carex subnigricans - Geum rossii - Sibbaldia procumbens* Herbaceous Vegetation [Provisional]**

1b) Herbaceous vegetation occupies relatively xeric upland sites in alpine. The community not controlled by mesic conditions. **(2)**

2a) Herbaceous vegetation is dominated or codominated by *Carex elynoides, Calamagrostis purpurascen*s and *Geum rossii* forming alpine turf. *Phlox pulvinata* and *Poa secunda* may be present to codominant. **(3)**

2b) Herbaceous vegetation is dominated by cushion plants forming alpine fell-field. Characteristic species are *Aquilegia scopulorum, Astragalus kentrophyta, Eriogonum holmgrenii, Cymopterus nivalis, Erigeron leiomerus,* and *Phlox pulvinata.* **(6)**

3a) Herbaceous vegetation is strongly dominated by *Geum rossii.*

***Geum rossii* Herbaceous Vegetation**

3b) Herbaceous vegetation is codominated by *Calamagrostis purpurascens*, *Carex elynoides, Phlox pulvinata,* and *Poa secunda.* If present, *Geum rossii* is not dominant, only codominant or with low cover. **(4)**

4a) Herbaceous vegetation is dominated or codominated by *Calamagrostis purpurascens* and *Geum rossii.* If present, *Phlox pulvinata,* and *Poa secunda* have low cover.

***Geum rossii - Calamagrostis purpurascens* Herbaceous Vegetation [Park Special]**

4b) Herbaceous vegetation is dominated or codominated by *Carex elynoides.* **(5)**

5a) Herbaceous vegetation is dominated or codominated by *Carex elynoides, Phlox pulvinata,* and *Poa secunda.* If present, *Geum rossii* has low cover.
***Carex elynoides - Phlox pulvinata - Poa secunda* Herbaceous Vegetation**

5b) Herbaceous vegetation is dominated or codominated by *Carex elynoides* and *Geum rossii. If present, Phlox pulvinata,* and *Poa secunda* have low cover.
***Carex elynoides - Geum rossii* Herbaceous Vegetation**

6a) Herbaceous vegetation is strongly dominated by *Phlox pulvinata.*
***Phlox pulvinata* Herbaceous Vegetation [Provisional]**

6b) Herbaceous vegetation is dominated or codominated by *Aquilegia scopulorum, Astragalus kentrophyta, Eriogonum holmgrenii Cymopterus nivalis, Erigeron leiomerus, Geum rossii,* or *Poa secunda.* If present, *Phlox pulvinata* is not dominant, only codominant or with low cover. **(7)**

7a) Herbaceous vegetation is codominated by *Phlox pulvinata* and *Geum rossii.*
***Geum rossii - Phlox pulvinata* Fell-field Herbaceous Vegetation**

7b) Herbaceous vegetation is dominated or codominated by *Aquilegia scopulorum, Astragalus kentrophyta, Eriogonum holmgrenii Cymopterus nivalis, Erigeron leiomerus,* or *Poa secunda.* If present, *Phlox pulvinata* and *Geum* only have low cover (not codominant). **(8)**

8a) Herbaceous vegetation is codominated by *Cymopterus nivalis, Erigeron leiomerus,* and *Poa secunda*. If present, *Aquilegia scopulorum, Astragalus kentrophyta,* and *Eriogonum holmgrenii* have low cover.
***Cymopterus nivalis - Erigeron leiomerus - Poa secunda* Herbaceous Vegetation [Park Special**

8b) Herbaceous vegetation is codominated by *Eriogonum holmgrenii.* **(9)**

9a) Herbaceous vegetation is codominated by *Aquilegia scopulorum* and *Eriogonum holmgrenii.* If present, *Astragalus kentrophyta* has low cover.
***Aquilegia scopulorum - Eriogonum holmgrenii* Fell-field Herbaceous Vegetation**

9b) Herbaceous vegetation is dominated or codominated by *Astragalus kentrophyta* and *Eriogonum holmgrenii.* If present*, Aquilegia scopulorum* has low cover.
***Astragalus kentrophyta- Eriogonum holmgrenii* Herbaceous Vegetation [Park Special]**

<u>Mesic and Wet Herbaceous Vegetation</u>

1a) Forb dominated herbaceous vegetation occupying wet to mesic sites, including wetlands, perennial drainages, seeps and springs, mesic meadows and depressions. Dominant and codominant species are *Dodecatheon alpinum* and *Polygonum bistortoides.* Wet graminoids are often present, but do not dominate. **(2)**

1b) Graminoid dominated herbaceous vegetation occupying wet to mesic sites, including wetlands, perennial drainages, seeps and springs, mesic meadows and depressions. Dominant and codominant species are *Carex nebrascensis, Carex scopulorum*, *Elymus trachycaulus, Juncus balticus, Juncus nevadensis,* and *Leymus cinereus*. **(3)**

2a) Herbaceous vegetation dominated by wet to mesic forbs. *Dodecatheon alpinum* is dominant, but other species such as *Geum macrophyllum, Mimulus guttatus,* or *Polygonum bistortoides* may be present. **(3)**
***Dodecatheon alpinum* Herbaceous Vegetation [Park Special]**

2b) Herbaceous vegetation dominated by wet to mesic forbs. *Polygonum bistortoides* is dominant, but other species such as *Achillea millefolium, Juncus balticus, Poa pratensis* or *Trifolium longipes* spp. *hansenii* may be present.
***Polygonum bistortoides* Herbaceous Vegetation [Park Special]**

3a) Herbaceous vegetation dominated or codominated by *Carex nebrascensis* or *Carex scopulorum.* **(4)**

3b) Herbaceous vegetation dominated or codominated by *Elymus trachycaulus, Juncus balticus, Juncus nevadensis,* or *Leymus cinereus.* **(5)**

4a) Herbaceous vegetation dominated or codominated by *Carex nebrascensis.* Sites are generally montane.
***Carex nebrascensis* Herbaceous Vegetation**

4b) Herbaceous vegetation dominated or codominated by *Carex scopulorum.* Sites are generally subalpine.
***Carex scopulorum* Herbaceous Vegetation**

5a) Herbaceous vegetation dominated or codominated by *Juncus* spp. **(6)**

5b) Herbaceous vegetation dominated or codominated by *Elymus trachycaulus* or *Leymus cinereus.* **(7)**

6a) Herbaceous vegetation dominated or codominated by *Juncus balticus.* Sites are often disturbed.
***Juncus balticus* Herbaceous Vegetation**

6b) Herbaceous vegetation dominated or codominated by *Juncus nevadensis - Poa secunda.* Sites are wet meadows.
***Juncus nevadensis - Poa secunda* Herbaceous Vegetation [Park Special]**

7a) Herbaceous vegetation dominated or codominated by *Leymus cinereus.* Sites are generally near seeps or above wet meadows.
***Leymus cinereus* Herbaceous Vegetation**

7b) Herbaceous vegetation dominated or codominated by *Elymus trachycaulus.* Sites are generally mesic meadows.
***Elymus trachycaulus* Herbaceous Vegetation**

__**Upland Dry Herbaceous Vegetation**__

1a) Montane to foothill herbaceous vegetation dominated or codominated by *Balsamorhiza sagittata, Hesperostipa comata,* and *Pseudoroegneria spicata.* **(2)**

1b) Subalpine herbaceous vegetation dominated or codominated by *Achnatherum lettermanii*, *Arenaria congesta, Astragalus kentrophyta, Cirsium eatonii, Lomatium graveolens* var. *alpinum, Poa fendleriana,* and *Poa secunda.* **(5)**

2a) Herbaceous vegetation is strongly dominated by *Balsamorhiza sagittata.*
***Balsamorhiza sagittata* Herbaceous Vegetation [Park Special]**

2b) Herbaceous vegetation is dominated or codominated by *Hesperostipa comata* and *Pseudoroegneria spicata*. **(3)**

3a) Herbaceous vegetation is strongly dominated by *Pseudoroegneria spicata*. **(3)**
***Pseudoroegneria spicata* Herbaceous Vegetation**

3b) Herbaceous vegetation is codominated by *Hesperostipa comata* and *Pseudoroegneria spicata*. **(3)**
***Pseudoroegneria spicata - Hesperostipa comata* Herbaceous Vegetation**

4a) Herbaceous vegetation dominated or codominated by *Achnatherum lettermanii*. *Arenaria congesta* and *Monardella odoratissima* may be present to codominant.
***Achnatherum lettermanii* Herbaceous Vegetation**

4b) Herbaceous vegetation dominated or codominated by *Arenaria congesta, Astragalus kentrophyta, Cirsium eatonii, Lomatium graveolens* var. *alpinum, Poa fendleriana,* or *Poa secunda* **(4)**

5a) Herbaceous vegetation is strongly dominated by *Lomatium graveolens* var. *alpinum*. There was a single stand sampled in a high elevation avalanche chute. It may be more widespread in the alpine.
***Lomatium graveolens* var. *alpinum* Herbaceous Vegetation [Park Special]**

5b) Herbaceous vegetation dominated or codominated by *Arenaria congesta, Astragalus kentrophyta, Cirsium eatonii, Poa fendleriana,* or *Poa secunda* **(6)**

6a) Herbaceous vegetation is codominated by *Poa fendleriana* and *Astragalus kentrophyta*. There was a single stand sampled in a high elevation park below Lincoln Peak
***Poa fendleriana - Astragalus kentrophyta* Herbaceous Vegetation [Park Special]**

6b) Herbaceous vegetation dominated or codominated by *Arenaria congesta, Cirsium eatonii,* or *Poa secunda* **(7)**

7a) Herbaceous vegetation codominated by *Poa secunda* and *Arenaria congesta.* If present, *Cirsium eatonii* has low cover.
***Poa secunda - Arenaria congesta* Herbaceous Vegetation [Park Special]**

7b) Mixed herbaceous vegetation codominated by *Poa secunda* and *Cirsium eatonii*. Other abundant species are *Elymus scribneri, Erigeron simplex, Penstemon pachyphyllus, Phacelia hastata,* and *Symphyotrichum spathulatum.* If present, *Arenaria congesta* has low cover. This type was sampled once in a post-burn area.
***Poa secunda - Cirsium eatonii* Post-burn Herbaceous Vegetation [Park Special]**

KEY V: THE SPARSE ASSOCIATIONS OF GREAT BASIN NATIONAL PARK

1a) Montane to foothill sparsely vegetated rock outcrop sites with less than 10% total vegetation cover and characterized by *Abies concolor* or *Cercocarpus ledifolius.* **(2)**

1b) Subalpine sparsely vegetated rock outcrop sites with less than 10% total vegetation cover and characterized by *Castilleja nana, Hulsea algida, Petrophyton caespitosum, Pinus flexilis,* or *Polemonium viscosum.* **(3)**

2a) Sparse vegetation on rock outcrop characterized by *Abies concolor*.
***Abies concolor* Rock Outcrop Sparse Vegetation [Park Special]**

2b) Sparse vegetation on rock outcrop characterized by *Cercocarpus ledifolius*.
***Cercocarpus ledifolius* Rock Outcrop Sparse Vegetation [Park Special]**

3a) Sparse vegetation on bedrock characterized by *Pinus flexilis* trees.
***Pinus flexilis* Bedrock Sparse Vegetation [Park Special]**

3b) Sparse vegetation on rock characterized by shrubs and herbs. **(4)**

4a) Sparse vegetation on bedrock characterized by *Petrophyton caespitosum*
***Petrophyton caespitosum* Sparse Vegetation [Park Special]**

4b) Sparse vegetation on rock characterized by other shrubs and herbs. **(5)**

5a) Sparse vegetation on bedrock characterized by *Hulsea algida.* **(4)**
***Hulsea algida* Alpine Rock Sparse Vegetation [Provisional]**

5b) Sparse vegetation on bedrock characterized by *Castilleja nana* and *Polemonium viscosum.*
***Polemonium viscosum - Castilleja nana* Alpine Rock Sparse Vegetation [Provisional]**

APPENDIX G: PLANT ALLIANCE AND ASSOCIATION DESCRIPTIONS FOR GREAT BASIN NATIONAL PARK, NEVADA

REVISED US NATIONAL VEGETATION CLASSIFICATION

Vegetation Communities of Great Basin National Park

31 January 2011

by

NatureServe

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This subset of the International Ecological Classification Standard covers vegetation communities of Great Basin National Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC mary_russo@natureserve.org, and/or Keith Schulz, Vegetation Ecologist, Boulder, CO <keith_schulz@natureserve.org>.

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The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2011. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 31 January 2011.

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These data are extracted from:

NatureServe. 2011. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 31 January 2011.

This document may be generally cited as follows:

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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States
Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

TABLE OF CONTENTS

1. FOREST & WOODLAND

1.B.2. Cool Temperate Forest

1.B.2.Nb. Western North American Cool Temperate Forest

M020. Rocky Mountain Subalpine & High Montane Conifer Forest

G224. Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland

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Great Basin *Pinus flexilis* Woodland Alliance
Great Basin Limber Pine Woodland Alliance
Identifier: A2035

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland (G224)
Alliance	**Great Basin *Pinus flexilis* Woodland Alliance (A2035)**

GRBA COMPONENT ASSOCIATIONS

Association	*Pinus flexilis - (Populus tremuloides) / Arctostaphylos patula* Forest (CEGL005434)
	Pinus flexilis / Artemisia tridentata ssp. *vaseyana* Woodland [Park Special] (CEPS009588)
	Pinus flexilis / Symphoricarpos oreophilus Woodland (CEGL005321)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland (CES304.790)
GRBA Biophysical Setting (BpS)	Limber-Bristlecone Pine Woodland (1020)
	Limber-Bristlecone Pine Woodland – mesic (1020m)
NPS-VIP Map Unit	Great Basin *Pinus flexilis* Woodland Alliance (W_PIFL)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: Woodlands included in this alliance occur intermittently from timberline to lower montane and foothill zones in mountains in the Great Basin and southern California. Elevations range from 850-3500 m. Sites are typically xeric on exposed, wind-swept rocky slopes and ridges from subalpine to foothills and prairie breaks. Some stands are on eroded substrates and resemble 'badlands' while others may occur on lava flows. These open woodlands occur on all aspects, but are most common on dry south- and west-facing slopes. Soils are typically shallow, skeletal and coarse-textured, such as gravelly, sandy loams or loams, but may include alkaline clays. Exposed bedrock is common and many stands have over 50% bare soil. The vegetation is characterized by an open canopy typically 3-10 m tall, but individuals may reach 15 m. Stands are solely dominated or codominated by the evergreen needle-leaved tree *Pinus flexilis*. Other trees species that may be present to codominant vary by geography and elevation zones throughout the woodland's range and include *Picea engelmannii*, or *Pseudotsuga menziesii* in the subalpine; *Pinus contorta, Pinus ponderosa*, or *Pseudotsuga menziesii* in the montane zone; and *Juniperus osteosperma* or *Juniperus scopulorum* in the lower montane transition zone from woodlands to grasslands or shrublands. In California, other associates may include *Abies concolor, Pinus albicaulis, Pinus balfouriana, Pinus contorta, Pinus jeffreyi*, and *Pinus longaeva*.

The understory vegetation is typically sparse because sites are dry and have a large cover of rock. A sparse shrub layer may be present that includes tall shrubs such as *Arctostaphylos patula, Artemisia tridentata, Cercocarpus ledifolius, Rhus trilobata,* and *Symphoricarpos oreophilus*. *Arctostaphylos uva-ursi, Artemisia arbuscula, Artemisia nova, Juniperus communis, Mahonia repens,* and *Purshia tridentata*, are the most frequent low shrubs. The herbaceous layer is often sparse and is composed of graminoids such as *Poa fendleriana Carex rossii,* and *Pseudoroegneria spicata*. Scattered forbs may include species of *Antennaria, Arenaria, Astragalus, Erigeron, Eriogonum, Hymenoxys,* Penstemon and *Thermopsis*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from 2908-3090 m (9535-10,140 feet) in elevation on gentle to steep slopes (10-53% grades). Topographic positions include low slopes, channel beds, high slopes, ridges and summits. Substrates are rocky and include colluvium, scree, bedrock and till, most composed of granite and quartzite. Soils are moderately to rapidly drained and composed of loam, loamy sand, sandy loam, silt loam, and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This woodland alliance is characterized by a sparse to open canopy. Total canopy cover may be as low as 10% and as high as 50%. Most stands have a sparse subcanopy ranging from 5-15% cover. *Pinus flexilis* is clearly the dominant species occurring in all strata with *Populus tremuloides* codominating in some stands, most frequently in the subcanopy. *Picea engelmannii, Abies concolor, Pseudotsuga menziesii*, and *Pinus longaeva* are canopy associates in some stands. Understories are shrubby with *Arctostaphylos patula, Symphoricarpos oreophilus*, or *Artemisia tridentata* ssp. *vaseyana* dominant. Other shrub associates include *Amelanchier utahensis, Ceanothus martinii, Chrysothamnus viscidiflorus, Juniperus communis, Mahonia repens, Ribes cereum*, and *Sambucus caerulea (= Sambucus nigra* ssp. *caerulea)*. Herbaceous cover is absent, sparse or open (not exceeding 15%), the only constant species being *Carex rossii* and *Poa fendleriana*. Other herbaceous species may include *Antennaria microphylla, Antennaria parvifolia, Aquilegia caerulea, Arabis drummondii, Arabis holboellii, Balsamorhiza sagittata, Erigeron pumilus, Erigeron tener, Monardella odoratissima, Penstemon speciosus, Pseudostellaria jamesiana*, and *Thalictrum fendleri*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus flexilis*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*, *Pinus flexilis*, *Populus tremuloides*, *Symphoricarpos oreophilus*

CLASSIFICATION

Global Comments: It may be difficult to determine which tree species are dominant in a mixed, montane or subalpine forest stand, especially when *Pinus flexilis* is seral on *Pseudotsuga menziesii* habitat type sites. Some stands included in this alliance are too sparse to be classified as woodlands, especially those growing on lava (Eggler 1941).

Global Related:
- Limber Pine Forest (#86700) (Holland 1986b) ?
- Limber Pine Series (Sawyer and Keeler-Wolf 1995) ?
- Limber Pine: 219 (Eyre 1980) ?
- Southern California Subalpine Forest (#86500) (Holland 1986b) ?

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Sierra Look, near Dead Lake, Baker Creek Trail, Wheeler Peak Road, Blue Ridge, Lehman Creek Trail and Highland Ridge.
Global Range: Stands included in this woodland alliance occur on mountains and plateaus in the Great Basin and Colorado Plateau, southern California. **Nations:** US
States/Provinces: CA, NV, UT
Federal Lands: NPS (Great Basin, Yosemite);

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (12 plots): GRBA.144, GRBA.159, GRBA.161, GRBA.166, GRBA.167, GRBA.176, GRBA.177, GRBA.178, GRBA.253, GRBA.255, GRBA.511, GRBA.743.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Eddleman and Jaindl 1994, Eyre 1980, Holland 1986b, Keeler-Wolf and Thomas 2000, L Sawyer and Keeler-Wolf 1995

Pinus longaeva Woodland Alliance
Great Basin Bristlecone Pine Woodland Alliance
Identifier: A0518

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland (G224)
Alliance	***Pinus longaeva* Woodland Alliance (A0518)**

GRBA COMPONENT ASSOCIATIONS

Association	*Pinus longaeva / (Ericameria discoidea, Ribes montigenum)* Woodland (CEGL005447)
	Pinus longaeva / Arctostaphylos patula Woodland [Park Special](CEPS009591)
	Pinus longaeva / Symphoricarpos oreophilus Woodland [Park Special] (CEPS009593)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland (CES304.790)
GRBA Biophysical Setting (BpS)	Limber-Bristlecone Pine Woodland (1020)
	Limber-Bristlecone Pine Woodland – mesic (1020m)
NPS-VIP Map Unit	*Pinus longaeva* Subalpine Woodland (W_PILO1)
	Pinus longaeva Montane Woodland (W_PILO2)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This widely scattered subalpine woodland alliance grows on all slopes, especially ridges and upper slopes below timberline. It grows on dolomitic, limestone- or granite-derived soils. This woodland may occur under the driest conditions of the California subalpine woodlands. The growing season is limited by drought in the summer and cold in the winter. Precipitation, mostly as snow, falls in the winter. Stands are found between 2600 and 3600 m elevation. This alliance is dominated by *Pinus longaeva* as the sole or dominant tree in the canopy. *Pinus flexilis* may also be present. The shrub *Cercocarpus intricatus* is often present.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland alliance is known from elevations ranging from 2843-3450 m (9325-11,320 feet) on gentle to steep slopes. Sites include midslopes, high slopes, ridges, summits, plateaus and moraines on all aspects. Substrates are typically rocky and composed of bedrock, till and colluvium with moderately to rapidly drained soils of silt loam, clay loam, silty clay, sandy loam, loamy sand and sandy clay loam. At some sites soil is not present.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This needle-leaved woodland alliance is characterized by a relatively short-statured sparse to open canopy (5-55% cover) dominated by *Pinus longaeva*. *Pinus flexilis* is the most consistent canopy associate and may occasionally codominate. Other canopy species often present at lower covers include *Picea engelmannii, Abies concolor, Populus tremuloides*, and *Pseudotsuga menziesii*. Subcanopies are strongly dominated by *Pinus longaeva*. Understories are shrub-dominated with sparse to open cover (5-35%). Dominants include *Ericameria discoidea, Ribes montigenum, Symphoricarpos oreophilus, Arctostaphylos patula*, and/or *Artemisia tridentata* ssp. *vaseyana*. Other shrub associates may include *Cercocarpus ledifolius, Chrysothamnus viscidiflorus, Juniperus communis, Mahonia repens*, and *Ribes cereum*. Herbaceous cover is inconsistent and may be almost absent to open (up to 25% total cover). However, no single species was observed to exceed 3% cover. The most constant herbaceous species are the graminoids *Carex rossii* and *Poa fendleriana*. Forbs include *Astragalus platytropis, Castilleja nana, Cymopterus nivalis, Erigeron jonesii, Erigeron tener, Pedicularis centranthera, Penstemon leiophyllus var. francisci-pennellii, Phlox pulvinata, Physaria chambersii, Selaginella watsonii, Stenotus acaulis, Trifolium gymnocarpon*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus flexilis*, *Pinus longaeva*
Short shrub/sapling	Broad-leaved deciduous shrub	*Ribes montigenum*, *Symphoricarpos oreophilus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*, *Pinus longaeva*, *Ribes montigenum*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Penstemon leiophyllus* var. *francisci-pennellii* (globally imperiled, G3T2)

CLASSIFICATION

Global Comments: *Pinus longaeva* is the sole or dominant tree in the canopy.

Global Related Concepts:

- Bristlecone Pine Forest (Holland 1986b) ?

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Mount Washington, Pole Canyon, above Brown Lake, Highland Ridge, Lincoln Canyon, Big Springs Wash, Decathon Canyon, and Chinese Wall.
Global Range: Scattered stands of this subalpine woodland occur in California and Nevada's White Mountains, in the Desert Ranges, and in isolated pockets throughout the Intermountain West.
Nations: US
States/Provinces: CA, NV, UT
Federal Lands: NPS (Bryce Canyon, Capitol Reef, Cedar Breaks, Great Basin); USFS (Dixie)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (19 plots): GRBA.195, GRBA.199, GRBA.200, GRBA.201, GRBA.227, GRBA.233, GRBA.254, GRBA.262, GRBA.263, GRBA.264, GRBA.427, GRBA.500, GRBA.501. GRBA.504, GRBA.505, GRBA.517, GRBA.711, GRBA.813, GRBA.816.
Local Description Authors: M. Hall
Global Description Authors: M. Schindel
References: Faber-Langendoen et al. 2011, Holland 1986b, Sawyer and Keeler-Wolf 1995

Pinus longaeva / (Ericameria discoidea, Ribes montigenum) Woodland

Great Basin Bristlecone Pine / (White-stem Goldenbush, Western Prickly Gooseberry) Woodland
Identifier: CEGL005447

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Intermountain Basins Subalpine Limber Pine - Bristlecone Pine Woodland (G224)
Alliance	*Pinus longaeva* Woodland Alliance (A0518)
Association	***Pinus longaeva / (Ericameria discoidea, Ribes montigenum)* Woodland (CEGL005447)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland (CES304.790)
GRBA Biophysical Setting (BpS)	Limber-Bristlecone Pine Woodland (1020) Limber-Bristlecone Pine Woodland – mesic (1020m)
NPS-VIP Map Unit	*Pinus longaeva* Subalpine Woodland (W_PILO1)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging from 3020-3450 m (9905-11320 feet) on gentle to somewhat steep slopes. Sites include mid to high slopes, plateaus, ridges and summits on all aspects. Substrates are rocky and composed of bedrock, glacial till and colluvium. Soils are moderately to rapidly drained and composed of silty clay, loamy sand, and clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to moderately closed (10-55%) canopy dominated by *Pinus longaeva* with *Pinus flexilis* sometimes codominant. Other canopy associates include *Abies concolor, Pseudotsuga menziesii, Populus tremuloides*, and *Picea engelmannii*. The understory is characterized by a very sparse to open (5-35%) shrub layer dominated by *Ericameria discoidea* and/or *Ribes montigenum*. Other common shrub species include *Arctostaphylos patula, Juniperus communis, Ribes cereum, Rubus idaeus*, and *Symphoricarpos oreophilus*. The herbaceous is very sparse to open (5-35% cover) and typically dominated by the graminoids *Carex rossii* and *Poa fendleriana*, although in some stands *Phlox pulvinata* may codominate. A variety of forbs may be present and include *Aquilegia scopulorum, Arabis drummondii, Astragalus platytropis, Castilleja nana, Cymopterus nivalis, Erigeron jonesii, Penstemon leiophyllus var. francisci-pennellii, Trifolium gymnocarpon*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus flexilis*, *Pinus longaeva*
Short shrub/sapling	Broad-leaved deciduous shrub	*Ericameria discoidea*, *Ribes montigenum*
Herb (field)	Forb	*Cymopterus nivalis*
Herb (field)	Graminoid	*Carex rossii*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Carex rossii*, *Cymopterus nivalis*, *Ericameria discoidea*, *Pinus flexilis*, *Pinus longaeva*, *Ribes montigenum*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Aquilegia scopulorum* (endemic, G3?); **Other**: *Penstemon leiophyllus* var. *francisci-pennellii* (endemic, G3T2)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (12-Jan-2011).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Chinese Wall, Mount Washington, between Snake Creek and Big Wash, south of Brown Lake, Baker Lake, Pole Canyon, and Highland Ridge.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (15 plots): GRBA.199, GRBA.200, GRBA.201, GRBA.227, GRBA.233, GRBA.262, GRBA.263, GRBA.264, GRBA.427, GRBA.500, GRBA.501, GRBA.504, GRBA.505, GRBA.813, GRBA.816.
Local Description Authors: M. Hall
References: Western Ecology Working Group n.d.

G222. Rocky Mountain Subalpine & Montane Aspen Forest & Woodland

Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance
Rocky Mountain Quaking Aspen Forest & Woodland Alliance
Identifier: A2036

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine & Montane Aspen Forest & Woodland (G222)
Alliance	**Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance (A2036)**

GRBA COMPONENT ASSOCIATIONS

Association	*Populus tremuloides / Artemisia tridentata* Forest (CEGL000572)
	Populus tremuloides / Bromus carinatus Forest (CEGL000573)
	Populus tremuloides / Invasive Perennial Grasses Forest (CEGL003748)
	Populus tremuloides / Juniperus communis Forest (CEGL000587)
	Populus tremuloides / Ribes spp. Woodland [Park Special] (CEPS009589)
	Populus tremuloides / Symphoricarpos oreophilus Forest (CEGL000610)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Aspen Forest and Woodland (CES306.813)
GRBA Biophysical Setting (BpS)	Aspen Woodland (1011)
NPS-VIP Map Unit	Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance (F_POTR1)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This alliance is widespread in the western United States. Stands are found on a variety of landscape positions but are consistently in mesic habitats. Stands in this alliance often occur between grasslands and other forest types. The soils are usually deep, well-developed, and loamy. Stands in this alliance often originate following disturbance. The dominant species of the canopy is *Populus tremuloides*. Common associates include *Acer glabrum, Amelanchier alnifolia, Symphoricarpos oreophilus, Bromus carinatus (=Bromus marginatus), Calamagrostis rubescens, Thalictrum fendleri, Carex siccata (= Carex foenea), Carex geyeri, Carex rossii*, and *Hesperostipa comata (= Stipa comata)*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from 2086-3048 m (6842-10,000 feet) in elevation on gentle to steep slopes. Sites include low levels, low slopes, toeslopes, midslopes and high slopes on all aspects often on colluvial slopes. Soils are moderately well-drained to well-drained and composed of loam, loamy sand, silt loam, sandy clay and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This woodland and forest alliance is characterized by an open to dense canopy (20-80% cover) of *Populus tremuloides* which is the clear dominant. *Pinus flexilis, Picea engelmannii*, and *Abies concolor* may be present but are never codominant. Stands may have either shrub- or herbaceous-dominated understories. In shrub-dominated communities, total shrub cover can be very dense (up to 90%) and be dominated by *Artemisia tridentata, Juniperus communis, Ribes* spp., or *Symphoricarpos oreophilus*. Other shrub associates may include *Amelanchier utahensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Mahonia repens, Prunus virginiana, Rosa woodsii, Rubus idaeus*, and *Sambucus caerulea (= Sambucus nigra* ssp. *caerulea)*. Herbaceous communities are variable, but may be dominated by *Achillea millefolium, Juncus balticus, Poa secunda, Poa wheeleri*, and/or *Elymus trachycaulus*. Other herbaceous associates include *Allium bisceptrum, Antennaria microphylla, Astragalus piutensis, Castilleja linariifolia, Collinsia parviflora, Fritillaria atropurpurea, Lithospermum ruderale, Lupinus argenteus, Monardella odoratissima, Pedicularis centranthera, Penstemon watsonii, Poa fendleriana, Pseudostellaria jamesiana, Senecio integerrimus, Stellaria longipes*, and *Trifolium gymnocarpon*. Some occurrences are highly degraded and the dominant herbaceous vegetation is non-native.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Tall shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata*
Short shrub/sapling	Needle-leaved shrub	*Juniperus communis*
Herb (field)	Forb	*Achillea millefolium*
Herb (field)	Graminoid	*Elymus trachycaulus*, *Juncus balticus*, *Poa secunda*, *Poa wheeleri*

CHARACTERISTIC SPECIES

Great Basin National Park: *Populus tremuloides*

CLASSIFICATION

Global Comments: This alliance is floristically similar to other forest alliances that are dominated by *Populus tremuloides* alone or in combination with *Betula papyrifera*. Among these are *Populus tremuloides - Betula papyrifera* Forest Alliance (A269), *Populus tremuloides* Temporarily Flooded Forest Alliance (A300), and *Picea glauca - Abies balsamea - Populus* ssp. Forest Alliance (A418). Stands in Texas may best be treated as *Populus tremuloides* communities or merely as other communities with a component of aspen. Texas stands of *Populus tremuloides* are of limited extent and variable in structure. Further information is needed. Stands in Nevada, described by Blackburn et al. (1968a, 1968b, 1971), are restricted to stream terraces, do not have enough tree canopy cover to be classified as forests, and would be better classified as woodlands. More study is needed especially if these sites have a flood regime. Stands in California need association-level description.

Global Related Concepts:

- Aspen Forest (Holland 1986b) ?
- Aspen Series (Sawyer and Keeler-Wolf 1995) ><
- Aspen: 16 (Eyre 1980) ><
- Aspen: 217 (Eyre 1980) ><

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Snake Creek Trail, Shingle Canyon, Lions Meadow, Wheeler Peak Campground, Horse Heaven, Big Springs Wash and Decathon Canyon.

Global Range: Forests included in the alliance have been described from across the western United States including the Black Hills. Its northern extent is in Canada in Saskatchewan. Additional associations need to be described in California, Arizona, and western Texas.

Nations: CA, US

States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, SD, TX, UT, WA, WY

Federal Lands: BIA (Blackfeet); NPS (Bandelier, Black Canyon of the Gunnison, Bryce Canyon, Capitol Reef, Cedar Breaks, Colorado, Craters of the Moon, Curecanti, Dinosaur, Florissant Fossil Beds, Fossil Butte, Glacier, Grand Canyon, Grand Teton, Great Basin, Great Sand Dunes, Jewel Cave, Rockefeller, Rocky Mountain, Yosemite, Zion); PC (Waterton Lakes); USFS (Arapaho-Roosevelt, Ashley, Bighorn, Black Hills, Bridger-Teton, Caribou-Targhee, Custer, Deschutes, Dixie, Fishlake, Fremont, Grand Mesa, Gunnison, Humboldt-Toiyabe, Manti-La Sal, Medicine Bow, Pike-San Isabel, Rio Grande, Routt, San Juan, Shoshone, Uinta, Uncompahgre, Valles Caldera, Wasatch-Cache, White River NF)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (9 plots): GRBA.141, GRBA.143, GRBA.154, GRBA.191, GRBA.512, GRBA.713, GRBA.719, GRBA.730, GRBA.738.

Local Description Authors: M. Hall

Global Description Authors: A.S. Weakley, mod. K.A. Schulz and J. Drake

References: Alexander 1986, Bader 1932, Baker 1982b, Baker and Kennedy 1985, Blackburn et al. 1968b, Blackburn et al. 1968c, Blackburn et al. 1969b, Blackburn et al. 1969d, Blackburn et al. 1971, Bond 1959, Boyce 1977, Bunin 1975a, Bunin 1975c, Cooper and Heidel 1997, Cooper and Pfister 1981, Costello 1954, Cox 1968, Crouch 1983, Curry 1962, DeByle 1985, DeByle and Winokur 1985, Dick-Peddie 1993, Dorn 1969, Eyre 1980, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 2011, Ferchau 1973, Giese 1975, Girard et al. 1989, Hansen et al. 1988a, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hoffman and Alexander 1987, Holland 1986b, Johnston 1987, Johnston and Hendzel 1985, Jones 1985, Keammerer and Peterson 1981, Keammerer and Stoecker 1975, Keammerer and Stoecker 1980, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999b, Knight 1994, Komarkova et al. 1988a, Komarkova et al. 1988b, Langenheim 1962, Lewis 1975a, Lynn et al. n.d., MNNHP 1993, MTNHP unpubl. data, Marr et al. 1973a, Marr et al. 1973b, Morgan 1969, Mueggler 1988, Mueggler and Campbell 1982, Mueggler and Campbell 1986, Murphy 1982, Mutel 1976, Paulsen 1969, Peet 1975, Peet 1981, Plumb 1988, Potter and Moir 1961, Powell 1988a, Reed 1971, Richard et al. 1996, Rominger and Paulik 1983, Sawyer and Keeler-Wolf 1995, Severson and Thilenius 1976, Shepherd 1975, Shepperd 1990, Smith 1991, Terwilliger et al. 1979a, Wasser and Hess 1982, Williams and Lillybridge 1983, Youngblood and Mueggler 1981

G219. Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland

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Picea engelmannii Dry-Mesic Forest Alliance

Engelmann Spruce Dry-Mesic Forest Alliance
Identifier: A2103

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland (G219)
Alliance	***Picea engelmannii* Dry-Mesic Forest Alliance (A2103)**

GRBA COMPONENT ASSOCIATIONS

Association	*Picea engelmannii - (Pinus flexilis) / Carex rossii* Woodland (CEGL005433)
	Picea engelmannii / Juniperus communis Forest CEGL005925)
	Picea engelmannii / Moss Forest (CEGL000371)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland (CES306.828)
GRBA Biophysical Setting (BpS)	Spruce (1011)
NPS-VIP Map Unit	*Picea engelmannii* Forest Complex (F_PIEN1)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is found at high elevations throughout the park from 2840-3279 m (9320-10,760 feet) on gentle to steep slopes (up to 65% gradients). Sites include low slopes, midslopes, high slopes, ridges and summits mostly on north-, northeast-, and northwest-facing aspects. Substrates are rocky and are composed of colluvium, bedrock and till. Soils include sandy loam, sandy clay loam, silt loam and loamy clay.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This woodland and forest alliance is characterized by an open canopy dominated by *Picea engelmannii* or codominated by *Pinus flexilis*. Canopy cover ranges from 20-55%. *Pseudotsuga menziesii, Populus tremuloides, Abies concolor*, and *Pinus longaeva* may be found scattered in some stands. The subcanopy and shrub layer tend to be very poorly developed, sparse or absent. The shrub layer consists mostly of regenerating *Picea engelmannii* and *Pinus flexilis* with *Juniperus communis* dominant in some stands. *Ericameria discoidea* may be present at low cover. The herbaceous layer ranges from absent, sparse or open up to 25%; the most consistent associates being the graminoids *Carex rossii* and *Poa fendleriana* present at low covers. The spikemoss *Selaginella watsonii* is also commonly present at low cover. A variety of forbs are common and may include *Antennaria microphylla, Arenaria congesta, Arnica cordifolia, Chamerion angustifolium, Comandra umbellata, Erigeron pumilus, Erigeron tener, Eriogonum umbellatum, Lupinus argenteus, Monardella odoratissima, Orthilia secunda, Polemonium pulcherrimum, Pseudostellaria jamesiana, Trifolium gymnocarpon*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea engelmannii*, *Pinus flexilis*
Short shrub/sapling	Needle-leaved shrub	*Juniperus communis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Ericameria discoidea*, *Picea engelmannii*, *Pinus flexilis*, *Pseudostellaria jamesiana*, *Selaginella watsonii*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Johnson Lake, Dead Lake, Baker Creek, near Teresa Lake, Shingle Creek, Blue Canyon, south of Brown Lake, Stella Lake, Lehman and Shingle divides, Buck Mountain and Blue Ridge.

Global Range: This alliance occurs in Rocky Mountains and in high plateaus and mountains in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: AZ, CO, ID, MT, NM, NV, OR, WA, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (27 plots): GRBA.146, GRBA.160, GRBA.162, GRBA.165, GRBA.193, GRBA.202, GRBA.203, GRBA.204, GRBA.205, GRBA.206, GRBA.207, GRBA.209, GRBA.211, GRBA.213, GRBA.214, GRBA.217, GRBA.218, GRBA.223, GRBA.226, GRBA.258, GRBA.259, GRBA.421, GRBA.502, GRBA.739, GRBA.812, GRBA.224, GRBA.225.
Local Description Authors: M. Hall
Global Description Authors:
References: Faber-Langendoen et al. 2011

Picea engelmannii - (Pinus flexilis) Great Basin Krummholz Alliance
Engelmann Spruce - (Limber Pine) Great Basin Krummholz Alliance
Identifier: A2102

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland (G219)
Alliance	***Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz Alliance (A2102)**

GRBA COMPONENT ASSOCIATIONS

Association	*Picea engelmannii - (Pinus flexilis) / (Astragalus platytropis)* Krummholz (CEGL005432)
	Pinus flexilis / Selaginella watsonii Krummholz (CEGL005435)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland (CES306.828)
GRBA Biophysical Setting (BpS)	Spruce (1011)
NPS-VIP Map Unit	*Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz Shrubland Alliance (S_PIEN)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is restricted to high-elevation krummholz over 3300 m (10,800 feet) in elevation on moderate to steep slopes. Sites include exposed high slopes, summits and ridges on all aspects and are subject to desiccating winds. Soils include loam and loamy sand derived from granite, quartzite and limestone.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This sparse and windswept alliance is characterized by stunted and matted *Picea engelmannii* with *Pinus flexilis* sometimes codominant which form a open to dense short- or tall-shrub layer (25-70% cover) often with an understory of *Astragalus platytropis* and/or *Erigeron leiomerus*. Emergent canopy trees may be present and may reach 40% cover. No other tree associates were recorded during sampling. This environment supports few other species. Shrubs include *Juniperus communis, Ribes montigenum*, and *Rubus idaeus*.

Herbaceous cover is absent to sparse. Species may include *Aquilegia caerulea, Arenaria congesta, Astragalus platytropis, Calamagrostis purpurascens, Carex elynoides, Carex rossii, Castilleja nana, Cymopterus nivalis, Elymus elymoides, Erigeron compositus, Eriogonum holmgrenii, Festuca minutiflora, Geum rossii var. turbinatum, Leptodactylon pungens, Mertensia franciscana, Minuartia obtusiloba, Minuartia rubella, Oxytropis parryi, Poa secunda, Polemonium pulcherrimum, Polemonium viscosum, Potentilla glandulosa* ssp. *nevadensis, Silene acaulis, Trifolium gymnocarpon*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea engelmannii*, *Pinus flexilis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Astragalus platytropis*, *Erigeron leiomerus*, *Picea engelmannii*, *Pinus flexilis*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Eriogonum holmgrenii* (globally critically imperiled, G1)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from high-elevation areas of Baker Ridge, Pyramid Peak and Lincoln Peak.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (6 plots): GRBA.145, GRBA.328, GRBA.423, GRBA.425, GRBA.904, GRBA.905.
Local Description Authors: M. Hall
Global Description Authors:
References: Faber-Langendoen et al. 2011

G218. Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland

Picea engelmannii / Ribes montigenum Forest

Engelmann Spruce / Western Prickly Gooseberry Forest
Identifier: CEGL000374

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland (G218)
Alliance	*Picea engelmannii* Mesic-Wet Forest Alliance (A2104)
Association	***Picea engelmannii / Ribes montigenum* Forest**

OTHER CLASSIFICATIONS

Ecological System:	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (CES306.830)
GRBA Biophysical Setting (BpS)	Spruce (1011)
NPS-VIP Map Unit	*Picea engelmannii* Forest Complex (F_PIEN1)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This Engelmann spruce forest association is found in Wyoming, Colorado, Utah and Nevada and may extend as far south as Arizona and New Mexico. *Picea engelmannii* forms a sparse to dense canopy of with scattered *Pinus flexilis, Pseudotsuga menziesii* or *Populus tremuloides*. *Ribes montigenum* is the dominant shrub in an otherwise sparse understory with 5-30% cover. *Acer glabrum*, typical of drainage channels, is present in the tall-shrub layer. Short shrubs include *Ericameria discoidea, Juniperus communis, Sambucus racemosa* and *Symphoricarpos* sp. *Oreochrysum parryi, Fragaria vesca* and *Carex rossii* are the most abundant plants in the herbaceous layer.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is found at elevations from 3011-3310 m (9880-10,860 feet) on moderate to steep slopes (16-70%). Sites include midslopes and high slopes on colluvium, bedrock and till. Soils are well- to rapidly drained and composed of silt loam, loamy sand, clay loam, and silt.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This forest and woodland alliance is characterized by a sparse to dense (10-75% cover) canopy dominated by *Picea engelmannii* often with lesser amounts of *Pinus flexilis*. *Pseudotsuga menziesii* is present in some stands. The understory is composed of a sparse to open short-shrub layer with *Ribes montigenum* dominating, often with equal amounts of regenerative *Picea engelmannii*. The only other frequent shrub species include. The herbaceous layer may be absent, sparse or open (up to 25% cover) with no clear dominants. Common graminoids include *Poa fendleriana* and *Carex rossii*. Common forbs include *Achillea millefolium, Antennaria microphylla, Arenaria congesta, Arnica cordifolia, Chamerion angustifolium, Erigeron tener, Heuchera rubescens var. alpicola, Osmorhiza depauperata, Polemonium pulcherrimum, Primula parryi*, and *Stellaria longifolia*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Needle-leaved shrub	*Picea engelmannii*
Short shrub/sapling	Broad-leaved deciduous shrub	*Ribes montigenum*

CHARACTERISTIC SPECIES

Great Basin National Park: *Chamerion angustifolium*, *Erigeron tener*, *Picea engelmannii*, *Pinus flexilis*, *Ribes montigenum*

Global: *Oreochrysum parryi*, *Sambucus racemosa*

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Aquilegia scopulorum* (G3?)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5? (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Related Concepts:

- *Picea engelmannii/Ribes montigenum* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.A.9.c. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from the Baker Creek cliff base, Summit Trail trailhead, Alpine Lakes Trail, Buck Mountain Peak, and the west slope of Blue Ridge.
Global Range: This forest association is found in Wyoming, Colorado, Utah and Nevada and may extend as far south as Arizona and New Mexico.
Nations: US
States/Provinces: AZ?, CO, NM?, NV, UT:S5, WY:S4
Federal Lands: NPS (Great Basin, Great Sand Dunes); USFS (Shoshone)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (8 plots): GRBA.169, GRBA.189, GRBA.194, GRBA.219, GRBA.220, GRBA.221, GRBA.222, GRBA.712.
Local Description Authors: M. Hall
Global Description Authors: K. Forrest, mod. M.J. Russo and K. A. Schulz
References: Billings 1969, Bourgeron and Engelking 1994, Driscoll et al. 1984, Jones and Ogle 2000, Larson and Moir 1987, Pfister 1972, Steele et al. 1983, Wasser and Hess 1982, Western Ecology Working Group n.d., Youngblood and Mauk 1985

Populus tremuloides - (*Picea engelmannii, Abies* spp., *Pseudotsuga menziesii*) Avalanche Chute Shrubland Alliance

Quaking Aspen - (Engelmann Spruce, Fir species, Douglas-fir) Avalanche Chute Shrubland Alliance
Southern Rocky Mountain Avalanche Chute Shrubland Alliance
Identifier: A2712

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland (G218)
Alliance	***Populus tremuloides* - (*Picea engelmannii, Abies* spp., *Pseudotsuga menziesii*) Avalanche Chute Shrubland Alliance (A2712)**

GRBA COMPONENT ASSOCIATIONS

Association	*Abies concolor - Populus tremuloides* Avalanche Chute Shrubland (CEGL005420)
	Picea engelmannii - Populus tremuloides Avalanche Chute Shrubland (CEGL005431)

OTHER CLASSIFICATIONS

Ecological System:	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland (CES306.830)
GRBA Biophysical Setting (BpS)	Aspen-Mixed Conifer (1061)
	Aspen-Subalpine Conifer (1061s)
NPS-VIP Map Unit	Southern Rocky Mountain Avalanche Chute Shrubland Complex (S_AVAL)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from elevations ranging from 2858-3013 m (9377-9880 feet) on moderate to steep slopes. Sites include colluvial slopes on north and northeast aspects in avalanche chutes. Some sites are upland slopes and others are mesic with a channel running down it. Soils are well-drained and composed of loam, loamy sand and silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance has two distinct expressions. The first and more common expression is a stunted, short-statured spruce-fir-aspen shrubland dominated by *Populus tremuloides* codominant with either *Abies concolor* or *Picea engelmannii*. Cover may be open to almost completely closed. Short and dwarf-shrubs may contribute substantial relative cover. Species include *Amelanchier utahensis, Ericameria discoidea, Juniperus communis, Ribes cereum, Ribes inerme, Ribes montigenum*, and *Symphoricarpos oreophilus*. Herbaceous cover may be as high as 40%. Dominant species include *Aquilegia caerulea, Artemisia michauxiana, Chamerion angustifolium*, and *Monardella odoratissima*. Other species may include *Achnatherum lettermanii, Arenaria congesta, Carex rossii, Castilleja linariifolia, Crepis acuminata, Elymus lanceolatus, Frasera speciosa, Heuchera rubescens*, and *Woodsia oregana*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tall shrub/sapling	Needle-leaved shrub	*Abies concolor*, *Picea engelmannii*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Populus tremuloides*
Short shrub/sapling	Broad-leaved deciduous shrub	*Ribes inerme*, *Ribes montigenum*
Herb (field)	Forb	*Aquilegia caerulea*, *Artemisia michauxiana*, *Chamerion angustifolium*, *Monardella odoratissima*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Aquilegia caerulea*, *Artemisia michauxiana*, *Chamerion angustifolium*, *Monardella odoratissima*, *Picea engelmannii*, *Populus tremuloides*, *Ribes inerme*, *Ribes montigenum*

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance was sampled from Mount Washington and mountains above Baker Creek and west of Lexington Arch, but is more widespread at higher elevations in the park where snow accumulates.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2008 field data (3 plots): GRBA.168, GRBA.314, GRBA.321.
Local Description Authors: M.E. Hall
References: Western Ecology Working Group n.d.

G221. Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland

***Populus tremuloides - Pinus flexilis* Forest**
Quaking Aspen - Limber Pine Forest
Identifier: CEGL000540

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Rocky Mountain Subalpine & High Montane Conifer Forest (M020)
Group	Rocky Mountain Subalpine-Montane Limber Pine - Bristlecone Pine Woodland (G221)
Alliance	*Pinus flexilis - Populus tremuloides* Forest Alliance (A0425)
Association	***Populus tremuloides - Pinus flexilis* Forest**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland (CES304.776)
GRBA Biophysical Setting (BpS)	Aspen-Mixed Conifer (1061) Aspen-Subalpine Conifer (1061s)
NPS-VIP Map Unit	*Populus tremuloides - Pinus flexilis* Forest (F_PTPF)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This mixed deciduous-and-evergreen woodland occurs on mountain slopes from western Wyoming south to southern Utah and west to eastern Nevada. Stands generally grow on fairly steep, south-facing slopes with a variety of geologic substrates, at altitudes above 2650 m (8700 feet). *Populus tremuloides* dominates the tree overstory, and *Pinus flexilis* contributes substantial cover. Other conifers may be present, but *Pinus flexilis* clearly contributes more cover. The composition of the undergrowth varies widely among stands, and no species is present in all stands. The large amount of *Pinus flexilis* in the overstory, relative to other conifers, sets this association apart from other *Populus tremuloides* - conifer associations.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging from 3011-3279 m (9880-10,760 feet) on moderate to steep slopes. Sites include low to high slopes on all aspects. Substrates are rocky and include bedrock, till and colluvium. Soils include well-drained sandy clay loam, silty clay loam, silty clay, and silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This forest and woodland association is characterized by a short-statured canopy codominated by *Populus tremuloides* and *Pinus flexilis*. Canopy cover is sparse to open ranging from 10-55% cover. Regenerative *Populus tremuloides* may be quite dense in some stands. The shrub layer is variable with *Juniperus communis* typically forming an open short-shrub layer. Other shrub species may include *Ericameria discoidea, Symphoricarpos oreophilus*, and *Mahonia repens*. The herbaceous layer is sparse to open (5-35% cover) and dominated by graminoids, including *Carex rossii, Poa fendleriana*, and *Elymus elymoides* ssp. *brevifolius*. Forbs are present at low cover and may include *Achillea millefolium, Arenaria congesta, Erigeron pumilus, Erigeron tener, Eriogonum umbellatum, Lupinus argenteus, Monardella odoratissima, Pseudostellaria jamesiana*, and *Trifolium gymnocarpon*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus flexilis*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Short shrub/sapling	Needle-leaved shrub	*Juniperus communis*
Herb (field)	Graminoid	*Carex rossii*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Pinus flexilis*, *Populus tremuloides*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: **Exotic/Invasive**: *Poa pratensis* (exotic/invasive, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (27-Sep-2004). The G2G3 rank is based on the assumptions that this association occurs over a fairly wide geographic range, but that there are few occurrences in that range and they are small.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Mueggler (1988), in his classification of aspen types in the U.S. Forest Service's Intermountain Region, recognized a number of community types in which *Populus tremuloides* shares the overstory with *Abies lasiocarpa, Abies concolor, Pinus contorta*, or *Pseudotsuga menziesii*. He named the *Populus tremuloides - Pinus flexilis* cover type to recognize those uncommon stands in which *Pinus flexilis* is the dominant conifer and the overstory is a mixture of *Populus tremuloides* and *Pinus flexilis*.
Global Related Concepts:

- *Populus tremuloides - Pinus flexilis* Cover Type (Mueggler 1988) =
- *Populus tremuloides - Pinus flexilis* Potential Native Plant Community (Eddleman and Jaindl 1994) =
- *Populus tremuloides-Pinus flexilis* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.B.2.b. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Wheeler Peak Campground, Shingle Creek, Stella Lake and Bald Mountain.
Global Range: The geographic range is estimated to encompass 186,480 square km (72,000 square miles), primarily on the Colorado Plateau and in the Great Basin, from the Gros Ventre Mountains of northwestern Wyoming south to the Paunsaugunt Plateau of southern Utah, and west to the Snake Mountains of eastern Nevada. This is the area over which Mueggler (1988) documented his cover type.
Nations: US
States/Provinces: CO, ID, NV:S2S3, UT:S2S3, WY
Federal Lands: NPS (Craters of the Moon, Great Basin, Great Sand Dunes)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 field data (6 plots): GRBA.190, GRBA.192, GRBA.210, GRBA.212, GRBA.215, GRBA.216.
Local Description Authors: M.E. Hall
Global Description Authors: G.P. Jones, mod. K.A. Schulz

References: Bell et al. 2009, Bourgeron and Engelking 1994, Driscoll et al. 1984, Eddleman and Jaindl 1994, Mueggler 1988, Peterson pers. comm., Western Ecology Working Group n.d.

M022. Southern Rocky Mountain Lower Montane Forest

G225. Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest

Abies concolor - Populus tremuloides Mesic Forest Alliance

White Fir - Quaking Aspen Mesic Forest Alliance
Identifier: A2112

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest (G225)
Alliance	***Abies concolor - Populus tremuloides* Mesic Forest Alliance (A2112)**

GRBA COMPONENT ASSOCIATIONS

Association	*Populus tremuloides - Abies concolor / Poa pratensis* Semi-natural Forest (CEGL002947)
	Populus tremuloides - Abies concolor / Symphoricarpos oreophilus Forest (CEGL000523)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland (CES304.776)
GRBA Biophysical Setting (BpS)	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland (gb1061)
	Aspen-Mixed Conifer (1061)
NPS-VIP Map Unit	*Abies concolor - Populus tremuloides* Forest Complex (F_ABPO)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is found at Great Basin at elevations from 2536-2828 m (8320-9280 feet) on gentle to somewhat steep slopes (6-49%) on all aspects. Sites include low and middle slopes and floodplains with substrates comprised mainly of colluvium. Soils include sandy clay loam, silty clay loam, loam and silt loam. In some cases little to no soil is present and there is high cover of large rock (67%); however, most stands have high cover (50-95%) of litter/duff on the soil surface.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by an open to somewhat closed canopy dominated by *Abies concolor* and *Populus tremuloides* with total canopy cover ranging from 15-75%. Both conifers and aspen have 25-75% relative tree canopy cover. Other canopy associates may include *Pseudotsuga menziesii, Pinus flexilis, Picea engelmannii*, and *Pinus longaeva*. Tall-shrub cover is sparse to very open (5-15%) with *Ribes cereum* and *Prunus virginiana* as the most common species. Regenerative tree seedlings are common. The short-shrub layer varies from sparse to very dense (5-85% cover) with *Symphoricarpos oreophilus* being the most constant dominant species. Other short-shrub associates include *Juniperus communis, Rosa woodsii, Rubus idaeus*, and *Cercocarpus ledifolius*. Herbaceous cover is typically low and ranges from 5-15%, but occasionally exceeds 50% cover of introduced species *Poa pratensis*. Graminoids are the most consistent lifeforms and may include *Poa fendleriana, Carex rossii, Elymus trachycaulus*, and *Pseudoroegneria spicata*. Forb cover is low and may include *Trifolium gymnocarpon, Achillea millefolium, Arabis holboellii, Pseudostellaria jamesiana*, and *Lupinus argenteus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*
Herb (field)	Graminoid	*Elymus trachycaulus*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Carex rossii*, *Elymus trachycaulus*, *Ligusticum porteri*, *Poa fendleriana*, *Populus tremuloides*, *Symphoricarpos oreophilus*, *Thalictrum fendleri*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: **Exotic/Invasive**: *Poa pratensis* (invasive/exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (24-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Baker Creek, Dead Lake Trail, Snake Creek, upper Strawberry Creek, and Lehman Creek.
Global Range: This alliance occurs in Southern Rocky Mountains and in high plateaus and mountains in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: AZ, CO, NM, NV, UT
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (7 plots): GRBA.104, GRBA.138, GRBA.147, GRBA.152, GRBA.156, GRBA.186, GRBA.710.
Local Description Authors: M.E. Hall
Global Description Authors:
References: Western Ecology Working Group n.d.

Abies concolor / Symphoricarpos oreophilus Forest

White Fir / Mountain Snowberry Forest
Identifier: CEGL000263

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Rocky Mountain Douglas-fir - White Fir - Blue Spruce Mesic Forest (G225)
Alliance	*Abies concolor - Pseudotsuga menziesii* Mesic Forest Alliance (A0553)
Association	***Abies concolor / Symphoricarpos oreophilus* Forest**

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (CES306.825)
GRBA Biophysical Setting (BpS)	Mixed Conifer
NPS-VIP Map Unit	*Abies concolor - Pseudotsuga menziesii* Forest & Woodland Complex (W_ACPM)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This forest association has been reported from mountains in Colorado, Utah, New Mexico and Arizona along the Mogollon Rim. Elevation ranges from 2075-3200 m (6800-10,500 feet). Stands are found on cool, dry sites often occurring on moderate to steep mid slopes with northern aspects, but they also occur on southern and western slopes at the higher elevations. Parent material often is limestone and Tertiary sandstone. Soil surface textures are sandy loam to loam and contain little gravel. The upper tree canopy is typically dominated by either *Pinus ponderosa* or *Pseudotsuga menziesii* with scattered *Abies concolor*. This association is characterized by the presence of successfully reproducing *Abies concolor*, which may also dominate or codominate the tree canopy or shrub layers. Associated trees include *Pinus flexilis, Populus angustifolia*, and *Populus tremuloides*. The sparse to moderately dense short-shrub layer is characteristically dominated by *Symphoricarpos oreophilus* often with *Rosa woodsii, Amelanchier alnifolia*, or several other shrubs present. The herbaceous layer is sparse. Common graminoids are *Carex rossii* and *Poa fendleriana*. Forbs are noticeably sparse.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging from 2465-2926 m (8085-9600 feet) on moderate to steep slopes. Sites include low slopes, midslopes, high slopes, ridges and summits with surficial geology composed of limestone, granite and quartzite often in the form of colluvium. Soils are well- to rapidly drained and composed of loam, silt loam, clay loam, loamy sand, sandy clay loam, and silty clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by an open to closed canopy (15-75% cover) clearly dominated by *Abies concolor*. Other canopy species which may occur at lower cover include *Picea engelmannii, Pinus flexilis*, and *Pseudotsuga menziesii*, but these are never codominant. The understory is shrubby and varies from nearly absent to open and dominated by *Symphoricarpos oreophilus*. *Mahonia repens* is often present but not dominant. Herbaceous cover is usually sparse with *Poa fendleriana* frequently present.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*
Herb (field)	Graminoid	*Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: Two similar associations, *Abies concolor* / *Erigeron eximius* and *Abies concolor* / Sparse, are described by DeVelice et al. (1986) for northern New Mexico and southern Colorado.

Global Similar Associations:
Global Related Concepts:
- *Abies concolor - Pseudotsuga menziesii / Symphoricarpos oreophilus* Plant Association (Johnston 1987) =
- *Abies concolor - Pseudotsuga menziesii / Symphoricarpos oreophilus* Plant Association (Johnston 1984) =
- *Abies concolor / Symphoricarpos oreophilus* (Freeman and Dick-Peddie 1970) ?
- *Abies concolor / Symphoricarpos oreophilus* Habitat Type (Youngblood and Mauk 1985) =
- *Abies concolor / Symphoricarpos oreophilus* Plant Association (Larson and Moir 1987) =
- *Abies concolor / Symphoricarpos oreophilus* Plant Association (Stuever and Hayden 1997b) =
- *Abies concolor/Symphoricarpos oreophilus* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.A.9.c. (Driscoll et al. 1984) >
- White-fir / Snowberry (Roberts et al. 1992) =

ELEMENT DISTRIBUTION

Great Basin National Park Range: This forest association is common at the park especially on cooler northerly slopes and relatively mesic mid and low slopes and was sampled from near Buck Mountain in the north to Highland Ridge in the southern part of the park.
Global Range: This coniferous forest association has been reported from mountains and high plateaus in New Mexico, Colorado, Utah, and in Arizona along the Mogollon Rim.
Nations: US
States/Provinces: AZ:S4, CO:SU, NM:S5, NV, UT:S5, WY
Federal Lands: NPS (Bryce Canyon, Cedar Breaks, Grand Canyon, Great Basin, Great Sand Dunes, Zion); USFS (Pike-San Isabel, San Juan)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (10 plots): GRBA.106, GRBA.108, GRBA.109, GRBA.249, GRBA.250, GRBA.252, GRBA.256, GRBA.257, GRBA.333, GRBA.707.
Local Description Authors: M. Hall
Global Description Authors: L.D. Engelking
References: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cogan et al. 2004, DeVelice et al. 1986, Driscoll et al. 1984, Edwards 1987, Freeman and Dick-Peddie 1970, Johnston 1984, Johnston 1987, Lamb 1975, Larson and Moir 1987, Roberts et al. 1992, Stuever and Hayden 1997b, Western Ecology Working Group n.d., Youngblood and Mauk 1985

G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland

***Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland [Provisional]**
Ponderosa Pine - White Fir / Mountain Snowberry Woodland
Identifier: CEGL005442

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland (G228)
Alliance	*Pinus ponderosa* / Mixed Shrub Woodland Alliance (A1986)
Association	***Pinus ponderosa - Abies concolor / Symphoricarpos oreophilus* Woodland [Provisional]**

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Ponderosa Pine Woodland (CES306.648
GRBA Biophysical Setting (BpS)	Ponderosa Pine (1054)
NPS-VIP Map Unit	*Pinus ponderosa* – (*Pseudotsuga menziesii*) Woodland Complex (W_PPPM1)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 2411-2509 m (7912-8229 feet) on gentle to somewhat steep slopes. Sites include stream terraces, low slopes and high slopes on north, east and northwest aspects. Substrates are rocky with variable soil drainage composed of sandy loam, loamy sand, clay loam, and silty clay.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to open (10-30% cover) canopy dominated by *Pinus ponderosa* or codominated by *Abies concolor* and *Pseudotsuga menziesii*. Other canopy associates may include *Pinus flexilis* and *Pinus longaeva* at low covers. A sparse canopy of *Juniperus scopulorum* and *Cercocarpus ledifolius* may be present. The understory is characterized by an open shrub layer dominated by *Symphoricarpos oreophilus*. Other shrub associates may include *Acer glabrum, Apocynum cannabinum, Arctostaphylos patula, Artemisia tridentata* ssp. *vaseyana, Ceanothus martinii, Chrysothamnus viscidiflorus, Gutierrezia sarothrae*, and *Holodiscus dumosus*. The herbaceous layer is sparse without apparent dominants. Species may include *Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum nevadense, Arabis drummondii, Artemisia dracunculus, Astragalus calycosus, Bromus inermis, Cirsium arizonicum, Ipomopsis aggregata, Solidago canadensis*, and *Symphyotrichum spathulatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*, *Pinus ponderosa*, *Pseudotsuga menziesii*
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Pinus ponderosa*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: **Exotic/Invasive**: *Bromus tectorum* (exotic/invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Dec-2010).

CLASSIFICATION

Status: Provisional

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association was sampled on north aspects above South Fork Big Wash and North Fork Big Wash on slopes and in canyon bottoms.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2008 and 2009 field data (4 plots): GRBA.311, GRBA.312, GRBA.450, GRBA.452.
Local Description Authors: M.E. Hall
References: Western Ecology Working Group n.d.

Pinus ponderosa / Interior Chaparral Woodland Alliance
Ponderosa Pine Interior Chaparral Woodland Alliance
Identifier: A2110

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland (G228)
Alliance	***Pinus ponderosa* / Interior Chaparral Woodland Alliance (A2110)**

GRBA COMPONENT ASSOCIATIONS

Association	*Pinus ponderosa / Arctostaphylos patula* Woodland (CEGL000842)
	Pinus ponderosa - (Pinus longaeva) / Cercocarpus intricatus Woodland [Provisional] (CEGL005441)

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Ponderosa Pine Woodland (CES306.648
GRBA Biophysical Setting (BpS)	Ponderosa Pine (1054)
NPS-VIP Map Unit	*Pinus ponderosa – (Pseudotsuga menziesii)* Woodland Complex (W_PPPM1)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland alliance is known from elevations ranging from 2177-2520 m (7140-8270 feet) on somewhat steep to steep slopes. Sites include rocky summits, ridges, toeslopes and midslopes on variable aspects. Soils are rapidly drained and composed of loamy sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by an extremely sparse to open canopy (5-20% cover) of *Pinus ponderosa* occasionally codominant with *Abies concolor*. The subcanopy is sparse and may include scattered individuals of *Juniperus scopulorum* and *Pinus monophylla*. The understory is characterized by a sparse to moderately dense (5-40% cover) shrub layer dominated by *Cercocarpus intricatus* or *Arctostaphylos patula*. Other shrubs may include *Ceanothus martinii, Ephedra viridis, Glossopetalon spinescens, Gutierrezia sarothrae, Mahonia repens*, and *Peraphyllum ramosissimum*. Herbaceous cover is extremely sparse with no apparent dominants and was never observed to exceed 5%.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*, *Pinus ponderosa*
Tall shrub/sapling	Broad-leaved evergreen shrub	*Cercocarpus intricatus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Arctostaphylos patula*

CHARACTERISTIC SPECIES

Great Basin National Park: *Cercocarpus intricatus*, *Pinus ponderosa, Cercocarpus intricatus, Arctostaphylos patula*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (4-Jan-2011).

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance was sampled from slopes above South Fork of Big Wash and on the trail to Dead Lake from Snake Creek drainage. Stands were also observed about 3 km northwest of Lexington Arch, although a recent fire had killed many of the ponderosa pines.

Global Range: This alliance occurs in Southern Rocky Mountains and in high plateaus and mountains in the Colorado Plateau and Great Basin.

Nations: US

States/Provinces: AZ, NM, NV, UT

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2009 field data (3 plots): GRBA.701, GRBA.741, GRBA.818.

Local Description Authors: M.E. Hall

References: Western Ecology Working Group n.d.

G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest

Abies concolor - Pseudotsuga menziesii Dry Forest & Woodland Alliance

White Fir - Douglas-fir Dry Forest & Woodland Alliance
Identifier: A2100

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest (G226)
Alliance	***Abies concolor - Pseudotsuga menziesii* Dry Forest & Woodland Alliance (A2100)**

GRBA COMPONENT ASSOCIATIONS

Association	*Abies concolor - Pseudotsuga menziesii / Carex rossii* Forest	(CEGL000431)
	Abies concolor / Arctostaphylos patula Forest	(CEGL000242)
	Abies concolor / Cercocarpus ledifolius Woodland	(CEGL000885)

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)
GRBA Biophysical Setting (BpS)	Mixed Conifer
NPS-VIP Map Unit	*Abies concolor - Pseudotsuga menziesii* Forest & Woodland Complex (W_ACPM)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is found at elevations ranging from 2331-2962 m (7650-9720 feet) on gentle to somewhat steep (2-43%) slopes with northwest-, east-, northeast-, and north-facing slopes. Sites are found on low slopes, midslopes, stream terraces and interfluves with rocky substrates including glacial deposits, colluvium, and bedrock. Soils include sandy and silty loam and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by an open (10-40%) canopy of *Abies concolor*. *Pinus flexilis, Picea engelmannii, Pinus ponderosa*, and *Pseudotsuga menziesii* are frequently scattered throughout stands but never codominate. *Populus tremuloides* may contribute substantial cover in some stands, and *Juniperus scopulorum* may occasionally form a subcanopy. The shrub layer is sparse to open (1-25% cover) with *Symphoricarpos oreophilus, Mahonia repens*, and *Arctostaphylos patula* the most common dominants. Other shrub associates may include *Juniperus communis, Gutierrezia sarothrae, Artemisia tridentata, Ribes cereum, Cercocarpus ledifolius*, and *Prunus virginiana*. Herbaceous cover is sparse to open (1-15%) with individual species rarely attaining more than 10% cover. Common species include *Pseudostellaria jamesiana, Carex rossii, Poa fendleriana, Penstemon watsonii, Trifolium gymnocarpon, Collinsia parviflora*, and *Erigeron jonesii*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Arctostaphylos patula*, *Mahonia repens*, *Symphoricarpos oreophilus*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Osceola/Strawberry Crossing, Blue Canyon, Baker Creek, Dead Lake, Snake Creek and upper Mill Creek.
Global Range: This alliance occurs from Southern Rocky Mountains west into the high plateaus and mountains in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (12 plots): GRBA.049, GRBA.105, GRBA.107, GRBA.125, GRBA.149, GRBA.153, GRBA.158, GRBA.163, GRBA.715, GRBA.174, GRBA.451, GRBA.810.
Local Description Authors: M. Hall
Global Description Authors: K. A. Schulz
References: Faber-Langendoen et al. 2011

Populus tremuloides - Abies concolor / Arctostaphylos patula Forest

Quaking Aspen - White Fir / Greenleaf Manzanita Forest
Identifier: CEGL000522

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.B.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest (G226)

Alliance	*Abies concolor - Populus tremuloides* Dry Forest Alliance (A2111)
Association	***Populus tremuloides - Abies concolor / Arctostaphylos patula* Forest (CEGL000522)**

OTHER CLASSIFICATIONS

Ecological Systems:	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland (CES304.776) Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)
GRBA Biophysical Setting (BpS)	Aspen-Mixed Conifer (1061)
NPS-VIP Map Unit	*Abies concolor - Populus tremuloides* Forest Complex (F_ABPO)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This forest association is known from the Snake River Range in east-central Nevada and on the Markagunt Plateau in southwestern Utah. Stands occur from 2500 to 2900 m (8300-9500 feet) in elevation, on gentle to steep slopes, at all aspects. Soils are derived from quartz, silts and sandstones. The forest canopy is dominated by a combination of *Populus tremuloides* (15-50%) and *Abies concolor* (5-30%). The shrub layer consists of predominantely *Arctostaphylos patula*. Other shrubs that may be present include *Juniperus communis, Paxistima myrsinites*, and *Mahonia repens*. The herbaceous layer contributes sparse cover and includes graminoids *Carex rossii* and *Bromus anomalus*. Forbs include *Achillea millefolium* and *Cirsium wheeleri*. *Populus tremuloides* and *Abies concolor* seedlings provide sparse cover.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is found at Great Basin at elevations from 2570-2990 m (8440-9800 feet) on gentle to somewhat steep slopes (8-44%) on all aspects. Sites include low, middle and upper slopes with substrates comprised mainly of colluvium. Soils include sandy loam, silty clay loam, and sandy clay loam. In some cases little to no soil is present. Soil surface has 40-80% litter/duff cover and up to 29% rock cover.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This community is characterized by an open to somewhat closed canopy codominated by *Populus tremuloides* and *Abies concolor* and other conifers with total canopy cover ranging from 15-75%. Both conifers and aspen have 25-75% relative tree canopy cover. Other canopy associates may include *Pseudotsuga menziesii, Pinus flexilis, Picea engelmannii*, and *Pinus longaeva*. The short-shrub layer varies from sparse to very dense (5-80% cover) with *Arctostaphylos patula* typically dominant. Regeneration of *Abies concolor* is common. Other short-shrub associates include *Amelanchier utahensis, Mahonia repens*, and *Symphoricarpos oreophilus*. If *Cercocarpus ledifolius* is present, then the understory is strongly dominated by *Arctostaphylos patula*. Herbaceous cover is typically low and ranges from 5-15%. Graminoids are the most consistent lifeforms and may include *Poa fendleriana, Carex rossii, Bromus carinatus (=Bromus marginatus), Elymus trachycaulus*, and *Pseudoroegneria spicata*. Forb cover is low and may include *Trifolium gymnocarpon, Achillea millefolium, Arabis holboellii, Pseudostellaria jamesiana*, and *Lupinus argenteus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Short shrub/sapling	Broad-leaved evergreen shrub	*Arctostaphylos patula*
Herb (field)	Graminoid	*Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Arctostaphylos patula*, *Carex rossii*, *Poa fendleriana*, *Populus tremuloides*, *Symphoricarpos oreophilus*

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (23-Feb-1994).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Great Basin National Park Comments: Some of these stands are seral *Abies concolor / Arctostaphylos patula* Forest (CEGL000242).
Global Similar Associations:

- *Populus tremuloides - Abies concolor / Symphoricarpos oreophilus* Forest (CEGL000523)

Global Related Concepts:

- *Populus tremuloides-Abies concolor/Arctostaphylos patula* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.B.2.b. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Baker Creek, Dead Lake Trail, Snake Creek, Wheeler Peak Overlook, and Lehman Creek.
Global Range: This forest association is known from the Snake River Range in east-central Nevada and on the Markagunt Plateau in southwestern Utah.
Nations: US
States/Provinces: NV:S4, UT
Federal Lands: NPS (Cedar Breaks, Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (8 plots): GRBA.124, GRBA.126, GRBA.148, GRBA.157, GRBA.164, GRBA.179, GRBA.185, GRBA.744.
Local Description Authors: M. Hall
Global Description Authors: G. Kittel
References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Mueggler 1988, Western Ecology Working Group n.d.

1.B.2.Nc. Western North American Cool Temperate Woodland & Scrub

M026. Intermountain Singleleaf Pinyon - Western Juniper Woodland

G247. Great Basin Pinyon - Juniper Woodland

***Pinus monophylla - Juniperus osteosperma / Artemisia nova* Woodland**
Singleleaf Pinyon - Utah Juniper / Black Sagebrush Woodland
Identifier: CEGL000831

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance (A2108)

Association ***Pinus monophylla - Juniperus osteosperma / Artemisia nova*** **Woodland (CEGL000831)**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019) Black Sagebrush (1079an), Class D
NPS-VIP Map Unit	*Pinus monophylla - (Juniperus osteosperma) / Artemisia* spp. Woodland Complex (W_PJSG)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This woodland association occurs in the Great Basin. Elevations range from 1830-2030 m (6000-6650 feet). Stands occur on mesas, hills and rocky ridges. Aspects are variable with southeast and northeast reported. Slopes are gentle to moderate. The soils are variable but typically shallow, fine-textured and lithic. Clay loams are common, but soil texture ranges to clay. Litter from trees may cover up to half the ground surface. Pavement is often high with 30-40% cover. Cover of rock or bare ground may also be significant (to 25%). The vegetation is characterized by an open to dense tree canopy (10-80% cover) typically codominated by *Pinus monophylla* and *Juniperus osteosperma*. The short-shrub layer is sparse to moderately dense (10-25% cover) and is dominated by *Artemisia nova*. *Chrysothamnus viscidiflorus* and *Gutierrezia sarothrae* are frequent associates. Other associated shrubs may include low cover of *Ephedra nevadensis, Ericameria nauseosa, Grayia spinosa*, and trace *Quercus gambelii*. The sparse to moderately dense herbaceous layer is dominated by graminoids with scattered forbs. Associated graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides, Hesperostipa comata, Achnatherum thurberianum, Poa secunda*, and *Pseudoroegneria spicata* ssp. *inermis*. Although forb cover is generally sparse, it may be very diverse. Common forbs include *Cryptantha cinerea var. jamesii (= Cryptantha jamesii), Eriogonum caespitosum, Gilia ochroleuca, Lomatium foeniculaceum* ssp. *macdougalii (= Lomatium macdougalii)*, and *Sphaeralcea coccinea*. Disturbed stands may have high cover of the introduced annual grass *Bromus tectorum* or *Halogeton glomeratus*, an introduced forb.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 1825-2195 m (5990-7200 feet) on gentle to steep slopes. Sites include low, high slopes, alluvial fan remnants, and ridges on all aspects. Parent materials are alluvium or colluvium derived from limestone or quartzite. Soils are composed of poorly drained to well-drained sandy loams, silt loams, sandy clay, loamy sand, or sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to open (10-50% cover) canopy dominated by *Pinus monophylla* and *Juniperus osteosperma*. No other canopy associates were observed. The understory is characterized by a sparse to open shrub layer dominated by *Artemisia nova*. Other common shrub species include *Cercocarpus intricatus, Chrysothamnus viscidiflorus, Ephedra nevadensis, Ephedra viridis, Opuntia erinacea, Purshia stansburiana*, and *Symphoricarpos longiflorus*. The herbaceous layer is absent, sparse or open. *Elymus elymoides* and *Poa fendleriana* are the most constant herbaceous species but were never observed to exceed10% cover. A variety of forbs are common and may include *Arabis holboellii, Chaenactis douglasii, Cryptantha confertiflora, Cryptantha humilis, Descurainia sophia, Eriogonum heracleoides, Pedicularis centranthera, Penstemon pachyphyllus, Stenotus acaulis*, and *Streptanthus cordatus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Herb (field)	Dwarf-shrub	*Artemisia nova*
Herb (field)	Graminoid	*Elymus elymoides*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia nova*, *Elymus elymoides*, *Juniperus osteosperma*, *Pinus monophylla*, *Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5? (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Related Concepts:

- *Pinus - Juniperus - Artemisia* Association (Ostler et al. 2000) >
- *Pinus monophylla / Juniperus osteosperma / Artemisia nova / Agropyron inerme* Community (Blackburn et al. 1968c) =
- *Pinus monophylla / Juniperus osteosperma / Artemisia nova* Community (Blackburn et al. 1969c) =
- *Pinus monophylla / Juniperus osteosperma / Artemisia nova* Community (Blackburn et al. 1969d) =
- *Pinus monophylla-Juniperus osteosperma/Artemisia nova* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Swallow Canyon, Lexington Creek, Chokeberry Creek, Lincoln Canyon, near Snake Creek, near Mill Creek, Big Wash, and Pine Creek.
Global Range: This Great Basin woodland association is reported from Nevada, southwestern Utah, California, and southern Idaho.
Nations: US
States/Provinces: CA:S3, ID:S2S3, NV:S5, UT, WY
Federal Lands: NPS (Great Basin, Zion)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003field data (14 plots): GRBA.025, GRBA.034, GRBA.041, GRBA.043, GRBA.045, GRBA.046, GRBA.071, GRBA.079, GRBA.081, GRBA.121, GRBA.123, GRBA.173, GRBA.182, GRBA.266.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Blackburn et al. 1968c, Blackburn et al. 1969c, Blackburn et al. 1969d, Bourgeron and Engelking 1994, Bradley et al. 1992, Cogan et al. 2004, Driscoll et al. 1984, Ostler et al. 2000, Peterson 2008, Western Ecology Working Group n.d., Wright et al. 1979

***Pinus monophylla* - *Juniperus osteosperma* / *Artemisia tridentata* ssp. *vaseyana* - Mixed Shrub Woodland**

Singleleaf Pinyon - Utah Juniper / Mountain Big Sagebrush - Mixed Shrub Woodland
Identifier: CEGL005436

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance (A2108)
Association	***Pinus monophylla* - *Juniperus osteosperma* / *Artemisia tridentata* ssp. *vaseyana* - Mixed Shrub Woodland**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019) Montane Sagebrush Steppe-upland (1126u), Class D
NPS-VIP Map Unit	*Pinus monophylla - (Juniperus osteosperma) /Artemisia* spp. Woodland Complex (W_PJSG)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 2157-2414 m (7080-7920 feet) on moderate to steep slopes. Sites include low to high slopes, ridges and summits on all aspects. Substrates are rocky and composed of colluvium, bedrock, and glacial deposits derived from granite and limestone.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to moderately dense (10-50% cover) canopy dominated by *Pinus monophylla* and *Juniperus osteosperma*. Occasionally, *Abies concolor* or *Cercocarpus ledifolius* may occur as canopy associates. The understory is characterized by sparse to moderately dense (5-50%) shrub layer dominated by *Artemisia tridentata* ssp. *vaseyana*. In some stands *Amelanchier utahensis* or *Ephedra viridis* may codominate. Other common shrub associates include *Chrysothamnus viscidiflorus, Ericameria nauseosa, Eriogonum microthecum, Gutierrezia sarothrae, Holodiscus dumosus, Mahonia repens, Prunus virginiana, Purshia glandulosa*, and *Symphoricarpos oreophilus*. The herbaceous layer may be very sparse to moderately dense (up 50% cover), the most common dominants being *Poa fendleriana* and *Pseudoroegneria spicata*. The exotic *Bromus tectorum* has invaded many stands and may be the dominant herbaceous species. Forbs are of little importance and no species has high constancy.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Amelanchier utahensis*
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	Dwarf-shrub	*Ephedra viridis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata* ssp. *vaseyana*, *Juniperus osteosperma*, *Pinus monophylla*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Dec-2010).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Can Young Canyon, Pine Creek, Chokecherry Canyon, near Snake Creek, Baker Creek, Lexington Arch, Lexington Creek, Board Creek, and between Burnt Mill and Lehman canyons.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (12 plots): GRBA.031, GRBA.053, GRBA.080, GRBA.084, GRBA.086, GRBA.116, GRBA.134, GRBA.183, GRBA.239, GRBA.242, GRBA.115, GRBA.803.
Local Description Authors: M. Hall
References: Western Ecology Working Group n.d.

Pinus monophylla - Juniperus osteosperma / Artemisia tridentata Woodland

Singleleaf Pinyon - Utah Juniper / Big Sagebrush Woodland
Identifier: CEGL000832

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance (A2108)
Association	***Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Woodland (CEGL000832)**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019) Montane Sagebrush Steppe-upland (1126u), Class D
NPS-VIP Map Unit	*Pinus monophylla - (Juniperus osteosperma) / Artemisia* spp. Woodland Complex (W_PJSG)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This woodland association occurs in the Great Basin. Elevations range from 1220-2300 m (4000-7550 feet). Stands occur on mesas, hills and rocky ridges on gentle to steep slopes on all aspects. The soils are shallow to moderately deep, calcareous, lithic loams or clays. The vegetation is characterized by an open to moderately dense tree canopy (10-40% cover) typically codominated by *Pinus monophylla* and *Juniperus osteosperma*. *Juniperus osteosperma* is often more abundant at lower elevation. The short-shrub layer is typically sparse (10-15% cover) and is dominated by *Artemisia tridentata*. *Chrysothamnus viscidiflorus* or *Purshia tridentata* are frequent associates. Other associated shrubs may include low cover of *Amelanchier* spp., *Ephedra nevadensis, Ephedra viridis, Ericameria nauseosa, Grayia spinosa*, and species of *Gutierrezia, Opuntia, Tetradymia*, and *Yucca*. The sparse to moderately dense herbaceous layer is dominated by graminoids with scattered forbs. Frequent graminoids are *Elymus elymoides* and *Poa secunda*. Although forb cover is generally sparse, it may be very diverse. Frequent forbs include species of *Astragalus, Balsamorhiza, Machaeranthera, Eriogonum*, and *Phlox*. Disturbed stands may have high cover of the introduced annual grass *Bromus tectorum*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 1801-2139 m (5910-7020 feet) on gentle to steep slopes. Sites include channel beds, low to middle slopes and alluvial fan remnants on all aspects on substrates of colluvium, alluvium, and bedrock derived from granite, limestone and quartzite. Soils are composed of moderately well-drained to well-drained silt loam, sandy loam, loamy sand, and silty clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to open (10-45% cover) canopy dominated by *Pinus monophylla* and *Juniperus osteosperma*. The understory is characterized by a sparse to moderately dense (5-50%) shrub layer dominated by *Artemisia tridentata* ssp. *wyomingensis* or *Artemisia tridentata* ssp. *tridentata*. Other common shrub associates include *Artemisia nova, Ephedra nevadensis, Ephedra viridis, Gutierrezia sarothrae, Opuntia erinacea, Opuntia polyacantha, Peraphyllum ramosissimum, Purshia stansburiana*, and *Symphoricarpos longiflorus*. The herbaceous layer may be nearly absent or dominated by bunch grasses. Species include *Poa fendleriana, Elymus elymoides*, and *Achnatherum hymenoides*. A variety of forbs may be present and common species include *Allium nevadense, Balsamorhiza hookeri, Cryptantha humilis, Descurainia sophia, Erigeron argentatus, Lathyrus brachycalyx*, and *Packera multilobata*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	Graminoid	*Achnatherum hymenoides*, *Elymus elymoides*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Juniperus osteosperma*, *Pinus monophylla*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5? (19-Sep-2000).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Related Concepts:

- *Pinus - Juniperus - Artemisia* Association (Ostler et al. 2000) >
- *Pinus monophylla - Juniperus osteosperma / Artemisia tridentata / Bromus tectorum* Community (Blackburn et al. 1969b) =

- *Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Community (Blackburn et al. 1968a) =
- *Pinus monophylla - Juniperus osteosperma / Artemisia tridentata* Community (Blackburn et al. 1969c) =
- *Pinus monophylla-Juniperus osteosperma/Artemisia tridentata* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Spring Creek, Swallow Canyon, Strawberry Creek, Lexington Creek Cave Canyon, Snake Creek, Kious Basin, and Cedar Spur.
Global Range: This Great Basin association is known from Nevada and Utah.
Nations: US
States/Provinces: AZ, NV:S5, UT
Federal Lands: NPS (Grand Canyon, Grand Canyon-Parashant, Great Basin, Zion)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (15 plots): GRBA.027, GRBA.029, GRBA.030, GRBA.035, GRBA.036, GRBA.048. GRBA.068, GRBA.070, GRBA.087, GRBA.096, GRBA.097, GRBA.120, GRBA.181, GRBA.260, GRBA.411.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Barney and Frischknecht 1974, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1969b, Blackburn et al. 1969c, Bourgeron and Engelking 1994, Bradley et al. 1992, Bunting 1987, Cogan et al. 2004, Driscoll et al. 1984, Everett 1987, Johnson and Payne 1968, Koniak 1985, Ostler et al. 2000, Peterson 2008, Western Ecology Working Group n.d., Wright et al. 1979

Pinus monophylla - (Juniperus osteosperma) / Cercocarpus intricatus Woodland
Singleleaf Pinyon - (Utah Juniper) / Littleleaf Mountain-mahogany Woodland
Identifier: CEGL005437

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance (A2108)
Association	***Pinus monophylla - (Juniperus osteosperma) / Cercocarpus intricatus* Woodland**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019)
NPS-VIP Map Unit	*Pinus monophylla - (Juniperus osteosperma) /* Mixed Shrub Woodland Complex (W_PJMX)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 2026-2406 m (6650-7891 feet) on flat to steep slopes. Sites include channel beds, gullies, low to high slopes, and ridges on all aspects. Substrates include alluvium, bedrock and colluvium derived of limestone, granite, quartzite, and schist. Soils are well- to rapidly drained and composed of sandy clay loam, sandy loam, loamy sand, silty clay loam, and clay sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to moderately dense (10-65% cover) canopy codominated by *Pinus monophylla* and *Juniperus osteosperma*. The understory is characterized by sparse to open tall-shrub layer and subcanopy dominated by *Cercocarpus intricatus*. Other shrubs may be subdominant and include *Artemisia nova, Brickellia microphylla, Ephedra viridis, Glossopetalon spinescens, Peraphyllum ramosissimum*, and *Symphoricarpos longiflorus*. The herbaceous layer may be essentially absent or dominated by bunch grasses including *Poa fendleriana* and *Elymus elymoides*. Common forbs include *Arabis holboellii, Collinsia parviflora, Descurainia sophia, Eriogonum racemosum, Lathyrus brachycalyx, Petradoria pumila, Phlox longifolia*, and *Stephanomeria spinosa*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Short shrub/sapling	Broad-leaved evergreen shrub	*Cercocarpus intricatus*
Herb (field)	Graminoid	*Elymus elymoides*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Cercocarpus intricatus*, *Juniperus osteosperma*, *Pinus monophylla*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: **Exotic/Invasive**: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Dec-2010).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Chokecherry Canyon, Snake Creek granite quarry, Baker Creek, Everett Mine, Young Canyon, Upper Sage Creek, McGraff Canyon, and Lexington Creek.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (16 plots): GRBA.055, GRBA.077, GRBA.078, GRBA.129, GRBA.170, GRBA.171,
Local Description Authors: M.E. Hall
Global Description Authors:
References: Western Ecology Working Group n.d.

***Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland**
Singleleaf Pinyon - Utah Juniper / Curl-leaf Mountain-mahogany Woodland
Identifier: CEGL000828

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Shrub Understory Woodland Alliance (A2108)
Association	***Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland (CEGL000828)**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019)
NPS-VIP Map Unit	*Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland (W_PJCL)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This widespread woodland association is known from elevations ranging from 2057-2406 m (6746-7891 feet) on gentle to steep slopes. Sites are variable and range from gullies, low slopes, midslopes, high slopes and toeslopes on all aspects. Substrates include colluvium and alluvium derived from limestone, quartzite, granite and schist. Soils are somewhat well-drained to rapidly drained and composed of sandy loam, loamy sand, silt loam, silty clay, and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by an open to dense (15-55% cover) canopy dominated by *Pinus monophylla* or codominated by *Juniperus osteosperma*. No other canopy associates were documented. The understory is characterized by a subcanopy or shrub layer which may be sparse to somewhat dense ranging from 5-50% cover and dominated by *Cercocarpus ledifolius*. Numerous other shrubs occur and include *Amelanchier utahensis, Artemisia tridentata* ssp. *vaseyana, Chrysothamnus viscidiflorus, Ephedra viridis, Eriogonum microthecum, Gutierrezia sarothrae, Mahonia repens, Opuntia erinacea, Opuntia polyacantha, Purshia glandulosa*, and *Symphoricarpos oreophilus*. The herbaceous layer is absent to open, not exceeding 25% cover, often without one species occurring as a clear dominant, although the graminoids *Poa fendleriana, Elymus elymoides*, and *Pseudoroegneria spicata* may contribute as much as 10% cover in some stands. Forbs are present at very low cover, the most frequent of which are *Arabis holboellii, Collinsia parviflora, Descurainia sophia, Lathyrus brachycalyx, Petradoria pumila, Phlox longifolia*, and *Stephanomeria spinosa*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Tree subcanopy	Broad-leaved evergreen tree	*Cercocarpus ledifolius*
Herb (field)	Graminoid	*Elymus elymoides*, *Poa fendleriana*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Cercocarpus ledifolius*, *Juniperus osteosperma*, *Pinus monophylla*, *Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (invasive/exotic, High), *Poa pratensis* (invasive/exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Related Concepts:

- *Pinus monophylla/Cercocarpus ledifolius* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Chokecherry Canyon, Can Young Canyon, Upper Sage Creek, McGraff Canyon, Lexington Creek, Pole Canyon, and Baker Creek.
Nations: US
States/Provinces: NV:S5
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (10 plots): GRBA.075, GRBA.082, GRBA.089, GRBA.091, GRBA.180, GRBA.240, GRBA.241, GRBA.705, GRBA.714, GRBA.717.
Local Description Authors: M. Hall
References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Heinze et al. 1962, Western Ecology Working Group n.d.

Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii Woodland [Park Special]

Singleleaf Pinyon - Utah Juniper / Water Birch - Woods' Rose Woodland
Identifier: CEPS009607

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla – (Juniperus osteosperma)* Riparian Woodland Alliance (A2710)]
Association	***Pinus monophylla - Juniperus osteosperma / Betula occidentalis - Rosa woodsii* Woodland [Park Special] (CEPS009607)**

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019) Montane Riparian (1154)
NPS-VIP Map Unit	*Pinus monophylla - Juniperus osteosperma /* Mixed Riparan Shrub Woodland Complex (W_PJRP)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 2109-2209 m (6920-7250 feet) on moderate and gentle slopes. Sites include temporarily flooded benches and stream terraces on southeast and east aspects. Soils are poorly to well-drained sandy loam or loamy sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a closed (50-65% cover) canopy dominated by *Pinus monophylla* and *Juniperus osteosperma*. Scattered *Populus tremuloides* may be present. The understory is characterized by a sparse to open shrub layer dominated by *Betula occidentalis, Rhus trilobata var. trilobata*, and *Rosa woodsii*. Other common shrub species include *Artemisia tridentata* ssp. *vaseyana, Gutierrezia sarothrae, Mahonia repens, Opuntia erinacea, Opuntia polyacantha*, and *Sambucus caerulea (= Sambucus nigra* ssp. *caerulea)*. The herbaceous layer is graminoid-dominated by *Juncus balticus, Pseudoroegneria spicata*, and *Leymus cinereus*. The only notable forbs are *Lithospermum ruderale* and *Lupinus argenteus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula occidentalis*
Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa woodsii*
Herb (field)	Graminoid	*Juncus balticus*, *Leymus cinereus*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Betula occidentalis*, *Juniperus osteosperma*, *Pinus monophylla*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Lehman Creek and Strawberry Creek.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 field data (2 plots): GRBA.056, GRBA.095.
Local Description Authors: M. Hall
Global Description Authors:
References: Western Ecology Working Group n.d.

Pinus monophylla - (Juniperus osteosperma) / Herbaceous Understory Woodland Alliance
Singleleaf Pinyon - (Utah Juniper) / Herbaceous Understory Woodland Alliance
Identifier: A2109

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	***Pinus monophylla - (Juniperus osteosperma)*** **/ Herbaceous Understory Woodland Alliance (A2109)**

GRBA COMPONENT ASSOCIATIONS

Association	*Pinus monophylla - Juniperus osteosperma / Poa (fendleriana, secunda)* Woodland (CEGL005440)

OTHER CLASSIFICATIONS

Ecological System	Great Basin Pinyon-Juniper Woodland (CES304.773)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019)
NS-VIP Map Unit	*Pinus monophylla - (Juniperus osteosperma) /* Herbaceous Understory Woodland Alliance (W_PJGR)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland alliance is known from elevations ranging from 2031-2135 m (6660-7000 feet) on gentle. Sites sampled include a step in lower slope and bench on high slope. Substrates are alluvium and colluvium derived of deltaic deposits and quartzite. Soils are composed of moderately well-to well drained drained sandy loams and sandy clay.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This needle-leaved woodland is characterized by an open to moderately dense canopy (20-45% cover) dominated by *Pinus monophylla* and *Juniperus osteosperma*. No other canopy associates were documented. Scattered shrubs may be present, but sparse and do not form a layer. However, some stands may have substantial regenerative *Pinus monophylla* and *Juniperus osteosperma*. The understory is characterized by an open to moderately dense herbaceous layer (15-35% cover) composed of a variety of graminoids and forbs. Characteristic graminoids include *Elymus elymoides, Poa fendleriana*, and *Poa secunda*. No forbs achieve high cover, but diversity may be quite high. Species include *Arabis holboellii, Astragalus lentiginosus, Atriplex rosea, Balsamorhiza hookeri, Cryptantha humilis, Descurainia californica, Descurainia sophia, Eriogonum* spp., *Frasera albomarginata, Packera multilobata, Pedicularis centranthera, Penstemon pachyphyllus, Petradoria pumila*, and *Streptanthus cordatus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*
Herb (field)	Graminoid	*Poa fendleriana*, *Poa secunda*

CHARACTERISTIC SPECIES

Great Basin National Park: *Juniperus osteosperma*, *Pinus monophylla*, *Poa fendleriana*, *Poa secunda*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: **Exotic/Invasive**: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (12-Jan-2011).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Baker Flat, Big Wash, Strawberry Creek, Can Young Canyon, Lower Snake Creek, Cottontail Creek, and Sage Creek.
Nations: US
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (10 plots): GRBA.003, GRBA.054,
Local Description Authors: M. Hall mod by K. A. Schulz
Global Description Authors:
References: Faber-Langendoen et al. 2011

Pinus monophylla - Juniperus osteosperma / Sparse Understory Woodland

Singleleaf Pinyon - Utah Juniper / Sparse Understory Woodland
Identifier: CEGL000829

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Great Basin Pinyon - Juniper Woodland (G247)
Alliance	*Pinus monophylla - (Juniperus osteosperma) /* Sparse Understory Woodland Alliance (A2709)
Association	***Pinus monophylla - Juniperus osteosperma* / Sparse Understory Woodland (CEGL000829)**

OTHER CLASSIFICATIONS

Ecological Systems	Great Basin Pinyon-Juniper Woodland (CES304.773) Inter-Mountain Basins Cliff and Canyon (CES304.779)
GRBA Biophysical Setting (BpS)	Pinyon-Juniper Woodland (1019)
NPS-VIP Map Unit	*Pinus monophylla* – (*Juniperus osteosperma*) / Grass & Sparse Understory Woodland Complex (W_PJSP)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This widespread woodland association is known from the Great Basin and northern Mojave Desert. Elevations normally range from 1370-2314 m (4500-7589 feet). Stands occur on flat to moderately sloping sites on all aspects. The soils are variable, but typically shallow and lithic. Litter from trees often covers about half the ground surface. Cover of rock, pavement or bare ground may also be significant depending on the site. The vegetation is characterized by an open to moderately dense tree canopy (10-65% cover) dominated by *Pinus monophylla* without a significant understory. *Juniperus osteosperma* may be present to codominant. Shrub cover, if present, is sparse (<10% cover). *Artemisia tridentata, Purshia tridentata*, and *Chrysothamnus viscidiflorus* are most consistent. Other shrubs include *Amelanchier* spp., *Eriogonum microthecum, Cercocarpus montanus, Gutierrezia sarothrae,* *Purshia tridentata, Quercus gambelii, Quercus turbinella*, and species of *Opuntia*. Herbaceous cover is typically sparse and dominated by perennial graminoids with scattered forbs.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This woodland association is known from elevations ranging from 1978-2314 m (6490-7589 feet) on moderate to steep slopes. Sites include low to high slopes, draws, floodplains and remnant alluvial fans on all aspects. Substrates are rocky with parent materials of colluvium and alluvium derived of granitic quartzite, granite and limestone. Soils are composed of well- to rapidly drained sandy loam, loamy sand, and sandy silt.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This woodland association is characterized by an open to moderately closed (10-65% cover) canopy dominated by *Pinus monophylla* and *Juniperus osteosperma*. No other canopy associates were observed. The shrub stratum is sparse to almost absent, although on some sites regenerative *Pinus monophylla* and *Juniperus osteosperma* may be present at high cover. Shrub species have low constancy, the most common of which include *Artemisia tridentata* ssp. *vaseyana, Artemisia tridentata* ssp. *wyomingensis, Ephedra viridis, Eriogonum microthecum, Gutierrezia sarothrae*, and *Opuntia erinacea*. The herbaceous layer is very sparse with graminoids contributing the most cover, but no one species exceeding 5% cover. Forb cover is very sparse, but diversity may be quite high. Species include *Arabis holboellii, Astragalus lentiginosus, Atriplex rosea, Balsamorhiza hookeri, Cryptantha humilis, Descurainia californica, Descurainia sophia, Frasera albomarginata, Packera multilobata, Pedicularis centranthera, Penstemon pachyphyllus, Petradoria pumila*, and *Streptanthus cordatus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus osteosperma*, *Pinus monophylla*

CHARACTERISTIC SPECIES

Great Basin National Park: *Juniperus osteosperma*, *Pinus monophylla*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This pinyon-juniper type may have several shrub species but all occur in small amounts usually totaling less than 10% cover.
Global Related Concepts:

- *Juniperus osteosperma / Pinus monophylla* Community (Blackburn et al. 1969d) =
- *Pinus monophylla - Juniperus osteosperma* Association (Peterson 1984) =
- *Pinus monophylla / Juniperus osteosperma* Dominated Community (Blackburn et al. 1968c) =
- *Pinus monophylla-Juniperus osteosperma* (Bourgeron and Engelking 1994) =
- *Pinus monophylla* Association (Peterson 1984) =

- DRISCOLL FORMATION CODE:II.A.2.a. (Driscoll et al. 1984) >
- Singleleaf pinyon-Utah juniper Series (Sawyer and Keeler-Wolf 1995) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Big Wash, Strawberry Creek, Can Young Canyon, Lower Snake Creek, Cottontail Creek, and Sage Creek.
Global Range: This woodland association occurs in the Great Basin and northern Mojave Desert.
Nations: US
States/Provinces: AZ, CA:S4, NV:S5, UT
Federal Lands: NPS (Grand Canyon, Grand Canyon-Parashant, Great Basin, Zion)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (8 plots): GRBA.054, GRBA.083,GRBA.093, GRBA.102, GRBA.172, GRBA.265, GRBA.732, GRBA.808.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Armstrong 1969, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1969e, Bourgeron and Engelking 1994, Bradley et al. 1992, Cogan et al. 2004, Driscoll et al. 1984, Heinze et al. 1962, Peterson 1984, Peterson 2008, Sawyer and Keeler-Wolf 1995, Western Ecology Working Group n.d., Wright et al. 1979

G249. Intermountain Basins Curl-leaf Mountain-mahogany Scrub & Woodland

Cercocarpus ledifolius Woodland Alliance
Curl-leaf Mountain-mahogany Woodland Alliance
Identifier: A0586

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Temperate Woodland & Scrub (1.B.2.Nc)
Macrogroup	Intermountain Singleleaf Pinyon - Western Juniper Woodland (M026)
Group	Intermountain Basins Curl-leaf Mountain-mahogany Scrub & Woodland (G249)
Alliance	***Cercocarpus ledifolius* Woodland Alliance (A0586)**

GRBA COMPONENT ASSOCIATIONS

Association	*Cercocarpus ledifolius / Arctostaphylos patula* Woodland [Provisional] (CEGL005355)
	Cercocarpus ledifolius / Artemisia tridentata ssp. *vaseyana* Woodland (CEGL001022)
	Cercocarpus ledifolius / Pseudoroegneria spicata Scrub (CEGL000967)
	Cercocarpus ledifolius / Symphoricarpos oreophilus Woodland (CEGL000970)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Curl-leaf Mountain-mahogany Woodland and Shrubland (CES304.772)
GRBA Biophysical Setting (BpS)	Mountain-Mahogany (1062)
NPS-VIP Map Unit	*Cercocarpus ledifolius* Shrubland & Woodland Complex (W_CELE)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: Plant associations in this alliance occur in semi-arid, mountainous habitats of the interior western United States. Annual precipitation averages 25-45 cm, with a significant proportion falling as winter snow. These woodlands often form small patchy stands on rocky outcrops or escarpments in forested areas, or may form the only tree cover in steppe regions. Elevations where the alliance is found range from 600 m to over 2650 m. Soils are typically rocky and immature, and are always of coarser texture than soils of adjacent coniferous woodlands or forests. The vegetation in this alliance is characterized by an open canopy of *Cercocarpus ledifolius*. These woodlands may occur as scattered communities in arid steppe or on rocky outcrops or steep escarpments within forests. Steppe woodlands typically have only *Cercocarpus ledifolius* in the overstory canopy, but *Juniperus occidentalis, Juniperus osteosperma, Juniperus scopulorum, Pinus edulis*, or *Pinus monophylla* occur in local areas. Evergreen or cold-deciduous shrubs often grow in these woodlands and include *Artemisia tridentata* ssp. *vaseyana, Purshia tridentata, Artemisia tridentata, Amelanchier alnifolia, Holodiscus dumosus, Ericameria nauseosa (= Chrysothamnus nauseosus), Ribes* spp., *Prunus virginiana*, and *Symphoricarpos* spp. The understory is typically dominated by bunch grasses, including *Festuca idahoensis, Leymus ambiguus, Pseudoroegneria spicata, Elymus elymoides, Calamagrostis rubescens*, and *Achnatherum* spp. Adjacent vegetation is usually *Pinus ponderosa* forest, *Artemisia* shrubland, or *Festuca - Achnatherum* grassland.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from 2456-3044 m (8060-9990 feet) in elevation on gentle to steep slopes. Sites include low, middle and high slopes on all aspects often on talus and colluvium derived from quartzite. Soils are sand, loamy sand, sandy clay loam and silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This woodland alliance is characterized by a sparse to almost completely closed canopy dominated by *Cercocarpus ledifolius*. Scattered *Abies concolor, Pinus monophylla, Pinus flexilis*, and *Populus tremuloides* are common in the canopy and subcanopy. The understory of this alliance is typically shrub-dominated and varies from sparse to dense (5-70% cover) and, less commonly, graminoid and dominated by *Festuca idahoensis* or *Pseudoroegneria spicata*. Shrub dominants include *Arctostaphylos patula, Artemisia tridentata* ssp. *vaseyana*, and *Symphoricarpos oreophilus*. Other shrub associates include *Amelanchier utahensis, Artemisia nova, Chrysothamnus viscidiflorus, Eriogonum microthecum, Gutierrezia sarothrae, Holodiscus dumosus, Mahonia repens, Opuntia polyacantha, Prunus virginiana*, and *Sambucus caerulea (= Sambucus nigra* ssp. *caerulea)*. Herbaceous cover varies from absent to open, and diversity can be quite high. Common graminoids include *Elymus trachycaulus, Hesperostipa comata, Poa fendleriana, Poa secunda*, and *Pseudoroegneria spicata*. Common forbs include *Balsamorhiza sagittata, Collinsia parviflora, Comandra umbellata, Descurainia californica, Descurainia sophia, Erigeron jonesii, Eriogonum umbellatum, Fritillaria atropurpurea, Hackelia patens, Lithospermum ruderale, Machaeranthera canescens, Packera multilobata, Pseudostellaria jamesiana*, and *Viola purpurea*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved evergreen tree	*Cercocarpus ledifolius*

CHARACTERISTIC SPECIES

Great Basin National Park: *Arctostaphylos patula*, *Artemisia tridentata* ssp. *vaseyana*, *Cercocarpus ledifolius*, *Festuca idahoensis*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CLASSIFICATION

Global Comments: The *Cercocarpus ledifolius* woodland and shrubland alliances are poorly distinguished in the literature, as most authors describe the species as having either a tall-shrub or small-tree growth form within a single association. Some associations may have shrub-dominated stands in one area and also have a woodland physiognomy in another. The woodland physiognomy appears to be more typical, based on available literature. Near the northern edge of its range in Montana and Idaho, *Cercocarpus ledifolius* is described as occurring primarily in the shrub form (Mueggler and Stewart 1980, Tisdale 1986). These northern variants are the only described stands which appear to be clearly distinct from the woodland alliance.

The woodland stands may have a different subspecies (or variety) as a dominant than the shrubland. In Wyoming, the heritage program is proposing to recognize two *Cercocarpus ledifolius* alliances, based upon varieties of *Cercocarpus ledifolius*. The most widespread proposed alliance (in Wyoming) is dominated by *Cercocarpus ledifolius var. ledifolius*, which grows up to about 1.5 m tall. The other proposed alliance, dominated by *Cercocarpus ledifolius var. intercedens*, is found only along the western border of the state, and the growth form is as small trees 4-5 m tall. The two taxa are obviously different in Wyoming, in stature and leaf characteristics, and are easily separated. Further review of the two current *Cercocarpus ledifolius* alliances may warrant treatment as proposed for Wyoming.

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Snake Meadows, Snake Creek divide, Baker Creek, below Wheeler Peak, Mather Creek and Lehman Creek.

Global Range: This alliance occurs in the northern Great Basin, from northeastern California north across Nevada, into southeastern Oregon, southern Idaho, western Montana, and southern Utah. It has not been reported from Wyoming or Colorado, or further south in the western U.S., but may occur there.

Nations: US

States/Provinces: NV

Federal Lands: NPS (Bryce Canyon, Capitol Reef, Cedar Breaks, Dinosaur, Grand Canyon, Great Basin, John Day Fossil Beds, Yosemite)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (19 plots): GRBA.004, GRBA.514, GRBA.052, GRBA.103, GRBA.136, GRBA.137, GRBA.142, GRBA.150, GRBA.151, GRBA.187, GRBA.188, GRBA.244, GRBA.245, GRBA.509, GRBA.704, GRBA.708, GRBA.720, GRBA.729, GRBA.805.

Local Description Authors: M. Hall

Global Description Authors: M.S. Reid/D. Sarr

References: Beatley 1976, Blackburn et al. 1969d, Cooper et al. 1995, DeVelice 1992, Dealy 1975, Faber-Langendoen et al. 2011, Gruell et al. 1985, Hall 1973, Heinze et al. 1962, Moseley 1987b, Mozingo 1987, Mueggler and Stewart 1980, Sawyer and Keeler-Wolf 1995, Tisdale 1986

1.B.3. Temperate Swamp & Flooded Forest

1.B.3.Nc. Western North American Flooded & Swamp Forest

M034. Rocky Mountain & Great Basin Flooded & Swamp Forest

G506. Rocky Mountain & Great Basin Montane Riparian Forest

Abies concolor Riparian Forest & Woodland Alliance

White Fir Riparian Forest & Woodland Alliance
Identifier: A2707

REVISED USNVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.B.3.Nc)
Macrogroup	Rocky Mountain & Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest (G506)
Alliance	***Abies concolor* Riparian Forest & Woodland Alliance (A2707)**

GRBA COMPONENT ASSOCIATIONS

Association	*Abies concolor - (Populus tremuloides) / Salix boothii / Carex scopulorum* Forest (CEGL005418)
	Abies concolor - Populus tremuloides / Carex scopulorum Forest (CEGL005419)
	Populus tremuloides - Abies concolor / Mesic Graminoid Forest [Park Special] (CEPS009586)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine-Montane Riparian Woodland (CES306.833)
GRBA Biophysical Setting (BpS)	Montane Riparian (1154)
NPS-VIP Map Unit	*Abies concolor* Riparian Forest & Woodland Alliance (W_ACRIP)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This palustrine alliance is known from 2307-2529 m (7571-8300 feet) elevation on moderate slopes. Positions include seasonally or intermittently flooded stream terraces along valleys on north and northeast aspects. Substrates include fluvial deposits of well-drained sandy or silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This forest and woodland alliance is characterized by a sparse to open (10-50%) canopy dominated by *Abies concolor* or codominated by *Populus tremuloides*. *Juniperus scopulorum* and *Pseudotsuga menziesii* may occasionally contribute up to 10% cover. In most stands the understory is characterized by an open (10-25% cover) tall-shrub layer dominated by *Salix boothii*. Other shrub associates may include *Betula occidentalis, Mahonia repens, Prunus virginiana, Rosa woodsii, Salix bebbiana*, and *Symphoricarpos oreophilus*. All stands with or without shrubby understories have an open to dense (10-60%) graminoid herbaceous layer dominated by *Carex scopulorum* or *Bromus carinatus*. Other graminoids may include *Juncus balticus, Carex nebrascensis*, *Carex vallicola*, and *Glyceria striata*. The exotic *Poa pratensis* is present in all sampled stands at low cover. A variety of forbs may be present at low cover and can include *Achillea millefolium, Aconitum columbianum, Angelica kingii, Arnica cordifolia, Cardamine cordifolia, Cicuta maculata, Geum macrophyllum, Mertensia franciscana, Osmorhiza occidentalis, Pseudostellaria jamesiana, Thermopsis rhombifolia, Trifolium repens, Urtica dioica*, and *Vicia americana*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Salix boothii*
Herb (field)	Graminoid	*Carex scopulorum*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Carex scopulorum*, *Populus tremuloides*, *Salix boothii*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Dactylis glomerata* (exotic/invasive, Medium/Insignificant), *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Lehman Creek and Mill Creek.
Global Range: This alliance is known from the Southern Rocky Mountains west into the high plateaus and mountains in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: AZ, NM, NV, UT
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (5 plots): GRBA.609, GRBA.610, GRBA.613, GRBA.620, GRBA.621.
Local Description Authors: M.E. Hall
Global Description Authors: K. A. Schulz
References: Western Ecology Working Group n.d.

Picea engelmannii Riparian Forest & Woodland Alliance
Engelmann Spruce Riparian Forest & Woodland Alliance
Identifier: A2105

REVISED USNVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain & Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest (G506)
Alliance	***Picea engelmannii* Riparian Forest & Woodland Alliance (2105)**

GRBA COMPONENT ASSOCIATIONS

Association	*Picea engelmannii - Populus tremuloides /* Mesic Forb Forest [Park Special] (CEPS009587)
	Picea engelmannii / Carex scopulorum Woodland (CEGL005446)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine-Montane Riparian Woodland (CES306.833)
GRBA Biophysical Setting (BpS)	Subalpine-Upper Riparian (1160)
NPS-VIP Map Unit	*Picea engelmannii* Riparian Forest & Woodland Alliance (F_PIEN2)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This palustrine alliance occurs at elevations from 2610-2938 m (8460-9636 feet) on moderate to somewhat steep slopes (12-30% grades). Sites include channel walls, stream terraces, seeps, and basin floors on all aspects. Some stands occupy upland areas that would otherwise support mesophytic vegetation, but soil conditions are saturated as a result of their proximity to seeps and springs. Soils are saturated, poorly drained, somewhat poorly drained and moderately well-drained and composed of clay loam, silt loam and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by a sparse to dense canopy dominated by short to medium-statured *Picea engelmannii* or codominated by *Populus tremuloides*. *Abies concolor, Pseudotsuga menziesii*, and *Pinus flexilis* may be present at lower cover but never codominate. Understories are herb-dominated with a sparse or absent shrub stratum. *Mahonia repens, Symphoricarpos oreophilus, Juniperus communis, Ribes montigenum*, and *Salix boothii* may be present but at low covers. The herbaceous layer may be sparse to very dense (up to 85% cover) and characterized by graminoids or mesic forbs. In graminoid-dominated communities, *Carex scopulorum* is dominant and forms open to dense stands (30-60% cover). Forb-dominated communities are diverse and variable. Species may include *Achillea millefolium, Angelica kingii, Aquilegia formosa, Arnica cordifolia, Corallorhiza maculata, Dodecatheon alpinum, Epilobium ciliatum, Mimulus guttatus, Osmorhiza depauperata, Osmorhiza occidentalis, Phleum alpinum, Platanthera dilatata var. leucostachys (= Platanthera leucostachys), Pseudostellaria jamesiana, Pyrola minor, Saxifraga odontoloma, Stellaria calycantha, Symphyotrichum foliaceum var. apricum, Taraxacum officinale, Trifolium gymnocarpon*, and *Trifolium repens*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea engelmannii*
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Herb (field)	Graminoid	*Carex scopulorum*

CHARACTERISTIC SPECIES

Great Basin National Park: *Angelica kingii*, *Aquilegia formosa*, *Carex scopulorum*, *Picea engelmannii*, *Populus tremuloides*, *Saxifraga odontoloma*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Taraxacum officinale* (exotic/invasive)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Baker Creek, Pine Creek, Ridge Creek, Snake Creek and Lehman Creek.
Great Basin National Park Range: This subalpine riparian forest alliance is known from the Rocky Mountains west into the high plateaus and mountain ranges in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: AZ, CO, ID, MT, NM, OR, NV, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (7 plots): GRBA.135, GRBA.605, GRBA.606, GRBA.607, GRBA.155, GRBA.709, GRBA.750.
Local Description Authors: M. Hall
Global Description Authors: K. A. Schulz

References: Faber-Langendoen et al. 2011

Populus angustifolia Riparian Forest & Woodland Alliance
Narrowleaf Cottonwood Riparian Forest & Woodland Alliance
Identifier: A0641

REVISED USNVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain & Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest (G506)
Alliance	***Populus angustifolia* Riparian Forest & Woodland Alliance (A0641)**

GRBA COMPONENT ASSOCIATIONS

Association	*Populus angustifolia / Artemisia tridentata* ssp. *tridentata - Prunus virginiana* Woodland [Park Special] (CEPS009614)
	Populus angustifolia / Cornus sericea WoodlandCEGL002664)
	Populus angustifolia / Prunus virginiana Woodland (CEGL000651)
	Populus angustifolia / Rosa woodsii Forest (CEGL000653)

OTHER CLASSIFICATIONS

Ecological Systems	Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland (CES304.045)
	Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)
GRBA Biophysical Setting (BpS)	Montane Riparian System **(**1154)
NPS-VIP Map Unit	*Populus angustifolia* Riparian Forest & Woodland Alliance (F_POAN)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This riparian forest and woodland alliance is known from elevations ranging from 2084-2353 m (6835-7720 feet). Sites include gentle to moderately sloping channel beds and stream terraces which are seasonally or intermittently flooded. Substrates include fluvium and alluvium composed of moderately poorly drained to well-drained loam and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by a short-statured open to somewhat closed canopy dominated by *Populus angustifolia*. Other tree species present at lower cover may include *Abies concolor, Juniperus scopulorum*, and *Pinus monophylla*. *Cornus sericea* forms a subcanopy in some stands. Understories are mainly sparsely to moderately densely shrub-dominated by *Artemisia tridentata* ssp. *tridentata, Prunus virginiana, Rosa woodsii*, and *Betula occidentalis*. Other shrub associates include *Symphoricarpos oreophilus, Acer glabrum, Chrysothamnus viscidiflorus, Ericameria nauseosa, Peraphyllum ramosissimum*, and *Rhus trilobata*. Herbaceous cover is sparse to dense, ranging from 5-60% cover, but few species have high constancy. Species may include *Maianthemum stellatum, Achillea millefolium, Ambrosia psilostachya, Aquilegia formosa, Artemisia ludoviciana, Leymus cinereus, Lupinus argenteus, Penstemon eatonii*, and *Thalictrum fendleri*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus angustifolia*
Tree subcanopy	Broad-leaved deciduous tree	*Cornus sericea*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula occidentalis*, *Prunus virginiana*

Tall shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *tridentata*
Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa woodsii*

CHARACTERISTIC SPECIES

Great Basin National Park: *Betula occidentalis*, *Cornus sericea*, *Populus angustifolia*, *Rosa woodsii*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This riparian alliance was sampled along Snake Creek, South Fork Big Wash, and North Fork Big Wash drainages.
Great Basin National Park Range: This foothill to montane riparian forest alliance is known from the Rocky Mountains west into the high plateaus and mountain ranges in the Colorado Plateau and Great Basin.
Nations: US
States/Provinces: AZ, CO, ID, MT, NM, OR, NV, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (6 plots): GRBA.139, GRBA.140, GRBA.406, GRBA.414, GRBA.416, GRBA.747.
Local Description Authors: M.E. Hall
Global Description Authors:
References: Western Ecology Working Group n.d.

Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance

Rocky Mountain Quaking Aspen Riparian Forest & Woodland Alliance
Identifier: A2106

REVISED USNVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.B.3.Nc)
Macrogroup	Rocky Mountain & Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest (G506)
Alliance	**Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance (A2106)**

GRBA COMPONENT ASSOCIATIONS

Association	*Populus tremuloides / Betula occidentalis* Forest (CEGL002650)
	Populus tremuloides / Prunus virginiana - Symphoricarpos oreophilus Forest [Park Special] (CEPS009645)
	Populus tremuloides / Rosa woodsii Forest (CEGL003149)

OTHER CLASSIFICATIONS

Ecological Systems	Rocky Mountain Subalpine-Montane Riparian Woodland (CES306.833)
	Rocky Mountain Aspen Forest and Woodland (CES306.813)
GRBA Biophysical Setting (BpS)	Aspen Forest and Woodland (1011)
	Montane Riparian System (1154)
	Subalpine-Upper Riparian (1160)
NPS-VIP Map Unit	Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance (F_POTR2)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This palustrine alliance is occurs at elevations between 2084 and 2297 m (6835-7538 feet) on gentle to moderately sloping channel beds, stream terraces, and benches on all aspects. Sites are seasonally or intermittently flooded or saturated; standing water is often present. Surficial geology is composed of alluvium and fluvium. Soils vary from well-drained to poorly drained and are composed of sandy loam, loamy sand and loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This forest and woodland alliance is characterized by a sparse to dense canopy (10-90% cover) dominated by *Populus tremuloides*. *Abies concolor* is constant in most stands but never codominant. Other canopy associates may include *Pinus monophylla, Juniperus scopulorum*, and *Picea engelmannii* at low covers. Understories tend to be shrub-dominated by *Betula occidentalis, Prunus virginiana*, or *Rosa woodsii* and range from sparse to open cover. Other shrub associates may include *Amelanchier utahensis, Artemisia tridentata, Chrysothamnus viscidiflorus, Mahonia repens, Salix boothii, Salix exigua*, and *Symphoricarpos oreophilus*. Herbaceous cover ranges from open to dense (15-80% cover) and a variety of species may occur, but the exotic graminoid *Poa pratensis* is dominant, ranging from 10-40% cover, with no other species attaining high cover. Other frequently occurring species include *Achillea millefolium, Allium bisceptrum, Aquilegia formosa, Cardamine breweri, Glyceria striata, Juncus balticus, Ligusticum porteri, Lupinus argenteus, Maianthemum stellatum, Mertensia franciscana, Rumex crispus, Stellaria longipes, Thalictrum fendleri, Thermopsis rhombifolia, Trifolium repens*, and *Viola nephrophylla*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula occidentalis*
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus virginiana*, *Rosa woodsii*
Herb (field)	Graminoid	*Poa pratensis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Betula occidentalis*, *Populus tremuloides*, *Prunus virginiana*, *Rosa woodsii*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Snake Creek Trail, Shingle Canyon, Lions Meadow, Wheeler Peak Campground, Horse Heaven, Big Springs Wash and Decathon Canyon.

Global Range: This subalpine riparian forest alliance is known from the Rocky Mountains west into the high plateaus and mountain ranges in the Colorado Plateau and Great Basin.

Nations: US

States/Provinces: AZ, CO, ID, MT, NM, OR, NV, WY

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (6 plots): GRBA.101, GRBA.402, GRBA.600, GRBA.601, GRBA.602, GRBA.615.
Local Description Authors: M. Hall
Global Description Authors:
References: Faber-Langendoen et al. 2011

2. SHRUBLAND & GRASSLAND

2.B.2. Temperate Grassland, Meadow & Shrubland

2.B.2.Na. Western North American Grassland & Shrubland

M168. Rocky Mountain-Vancouverian Subalpine & High Montane Mesic Grass & Forb Meadow

Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow

Festuca viridula - Deschampsia caespitosa - Ligusticum spp. Rocky Mountain-Vancouverian Meadow Group

Greenleaf Fescue - Tufted Hairgrass - Wild Lovage species Rocky Mountain-Vancouverian Meadow Group
Identifier: G271

REVISED USNVC CLASSIFICATION

Division	Western North American Grassland & Shrubland (2.B.1.Na)
Macrogroup	Rocky Mountain-Vancouverian Subalpine & High Montane Mesic Grass & Forb Meadow (M168)
Group	**Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow (G271)**
Group (Scientific)	***Festuca viridula - Deschampsia caespitosa - Ligusticum* spp. Rocky Mountain-Vancouverian Meadow Group (G271)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Dasiphora fruticosa* ssp. *floribunda* Shrub Herbaceous Alliance (A1534)
Association	*Dasiphora fruticosa* ssp. *floribunda / Elymus trachycaulus* Shrub Herbaceous Vegetation [Park Special] (CEPS009601)
Alliance	*Elymus trachycaulis* Herbaceous Alliance (A2706)
Association	*Elymus trachycaulis* Herbaceous Vegetation (CEGL005427)
Alliance	*Juncus nevadensis* Herbaceous Alliance [Provisional] (A2037)
Association	*Juncus nevadensis - Poa secunda* Herbaceous Vegetation [Park Special] (CEPS009603)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine-Montane Mesic Meadow (CES306.829)
GRBA Biophysical Setting (BpS)	Wet Meadow (1145)
NPS-VIP Map Unit	Montane Mesic Meadow Complex (H_MESC)
USFWS Wetland Classification	Palustrine

ELEMENT CONCEPT

Global Summary: This Rocky Mountain and northern Vancouverian group is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, rocky substrates, or windswept dry conditions limit tree establishment. Many occurrences are small-patch in spatial character, and are often found in mosaics with woodlands, more dense shrublands, or just below alpine communities. This group is typically found above 2000 m in elevation in the southern part of its range and above 600 m in the northern part. These upland communities occur on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring but, if so, will dry out later in the growing season. These sites are not as wet as those found in Vancouverian & Rocky Mountain Alpine Snowbed, Wet Meadow & Dwarf-Shrubland Group (G520) and Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521), although some species are certainly shared with wet meadows, such as *Deschampsia*. These are typically lush meadows dominated by a diversity of tall forbs, with grasses intermingled in many of them. The vegetation is typically forb-rich, with forbs often contributing more to overall herbaceous cover than graminoids. However, some stands are comprised of dense grasslands, these often being taxa with relatively broad and soft blades, but where the moist habitat promotes a rich forb component. Important taxa include *Erigeron* spp., many Asteraceae spp., *Mertensia* spp., *Penstemon* spp., *Campanula* spp., *Lupinus* spp., *Solidago* spp., *Ligusticum* spp., *Phlox* spp., *Lomatium* spp., *Thalictrum occidentale, Valeriana sitchensis, Rudbeckia occidentalis, Xerophyllum tenax, Balsamorhiza sagittata*, and *Wyethia* spp. Important grasses include *Deschampsia caespitosa, Koeleria macrantha*, perennial *Bromus* spp., *Luzula glabrata*, and a number of *Carex* species. In the Cascades, this group includes *Festuca viridula* meadows. *Dasiphora fruticosa* ssp. *floribunda* and *Symphoricarpos* spp. are occasional but not abundant. Burrowing mammals can increase the forb diversity.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This ecological group is known from elevations ranging from 2694-2929 m (8836-9607 feet) on gentle slopes. Sites include seasonally or temporarily flooded basin floors in mountain valleys and occasionally in seepage areas on midslopes. Soils are moderately well-drained to well-drained and composed of sandy loam, loam, clay loam, and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This ecological group is characterized by mixed herbaceous and perennial graminoid vegetation. Total herbaceous cover is moderately dense to dense (50-90 %). The two dominant graminoids are *Elymus trachycaulus* and *Juncus nevadensis*. Dominant forbs include *Achillea millefolium, Dodecatheon alpinum, Elymus trachycaulus, Lewisia pygmaea, Polygonum bistortoides, Ranunculus alismifolius*, and *Trifolium longipes*. Some stands are heavily invaded by *Taraxacum officinale*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Elymus trachycaulus*, *Juncus nevadensis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Achillea millefolium*, *Elymus trachycaulus*, *Juncus nevadensis*, *Lewisia pygmaea*, *Polygonum bistortoides*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Taraxacum officinale* (exotic/invasive)

CLASSIFICATION

Global Comments: For now, this group is kept as a separate unit, but it probably should be merged with the Middle-Southern Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow Group (G269). The Rockies and Cascades support a number of forb types found on talus and rocky scree slopes, which are not sparsely vegetated, and which often have little to no grass component, though Carices may be abundant. These types often have heavy snow loading in winter, or are adjacent to snowfields, and subsurface moisture below the rocks/scree is significant throughout the growing season. These forb types are poorly documented; for now they are placed in this group, as many of the taxa are also found in mesic grassy meadows. Splitting them into a separate group would be hard to justify floristically.

Global Related Concepts:

- Idaho Fescue - Tufted Hairgrass (308) (Shiflet 1994) ><
- Tall Forb (409) (Shiflet 1994) ><
- Tufted Hairgrass - Sedge (313) (Shiflet 1994) ><

ELEMENT DISTRIBUTION

Great Basin National Park Range: This group is known from Chinese Wall, the Glacier Trail and Pyramid Peak.

Global Range: This group is very widespread in the Rocky Mountain cordillera from New Mexico (where it is uncommon) and Colorado north into Canada, and west into the eastern Cascades. It also occurs in the mountain ranges of Nevada, northern Utah and Wyoming, as well as the "island ranges" of central Montana.

Nations: CA, US

States/Provinces: AB, BC, CO, ID, MT, NM, NV, OR, WA, WY

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (5 plots): GRBA.112, GRBA.128, GRBA.734, GRBA.736, GRBA.740.

Local Description Authors: M. Hall

Global Description Authors: M.S. Reid and T. Luna

References: Buckner 1977, Ellison 1954, Fritz 1981, Gregory 1983, Hall 1971, Marr 1977a, Meidinger and Pojar 1991, Potkin and Munn 1989, Shiflet 1994, Starr 1974, Western Ecology Working Group n.d.

M049. Southern Rocky Mountain Montane Grassland & Shrubland

G276. Southern Rocky Mountain Cercocarpus-Mixed [Dry] Foothill Shrubland Group

Cercocarpus intricatus - Glossopetalon spinescens Shrubland

Littleleaf Mountain-mahogany - Spiny Greasebush Shrubland

Identifier: CEGL005426

REVISED USNVC CLASSIFICATION

Division	Western North American Grassland & Shrubland (2.C.1.Na)
Macrogroup	Southern Rocky Mountain Montane Grassland & Shrubland (M049)
Group	Southern Rocky Mountain Cercocarpus-Mixed [Dry] Foothill Shrubland (G276)
Alliance	*Cercocarpus intricatus* Shrubland Alliance (A2659)
Association	**Cercocarpus intricatus - Glossopetalon spinescens Shrubland (CEGL005426)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Cliff and Canyon (CES304.779)
GRBA Biophysical Setting (BpS)	Antelope Bitterbrush (1144) Montain Shrub (1126ms)
NPS-VIP Map Unit	*Cercocarpus intricatus* – (*Peraphyllum ramosissimum*) Shrubland Complex (S_CIPR)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association occurs at elevations from 2036-2231 m (6680-7320 feet) on moderate to steep slopes. Sites include ridges, sloped benches on midslopes and high slopes on warmer east to southwest aspects. Substrates are rocky with 28 to 76% total rock (small and large rock and bedrock) and composed colluvium and bedrock derived from limestone. Soils are well- to rapidly drained and composed of silt loam, sandy loam, and sandy clay loam. Ground cover was sparse with bare soil ranging from 15-67% cover and of litter was low (<24% cover).

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This shrubland association is characterized by an open to moderately dense (20-50% cover) short shrub layer (0.5-2 m tall) that is codominated by *Cercocarpus intricatus* and *Glossopetalon spinescens*. Scattered *Pinus monophylla* or *Juniperus osteosperma* trees may be present but do not form a canopy (<5% cover). Serveral other shrubs are usually present with lower cover such as especially *Ephedra viridis, Symphoricarpos oreophilus, Chrysothamnus viscidiflorus,* and *Gutierrezia sarothrae* with *Peraphyllum ramosissimum, Artemisia arbuscula* and *Purshia stansburiana* less common. The herbaceous layer is usually sparse (<10% cover) with scattered forbs and grasses especially *Brickellia microphylla, Carex rossii, Castilleja* spp.,
Elymus elymoides, Erigeron spp., *Hymenopappus filifolius, Phlox* spp., *Poa fendleriana*and *Stenotus acaulis.*

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Cercocarpus intricatus, Glossopetalon spinescens Symphoricarpos oreophilus*
Herb (field)	Graminoid	*Carex rossii, Poa fendleriana*
Herb (field)	Forb	*Castilleja* spp., *Erigeron* spp., *Hymenopappus filifolius, Phlox* spp., *Stenotus acaulis*

CHARACTERISTIC SPECIES

Great Basin National Park: *Cercocarpus intricatus, Glossopetalon spinescens*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (21-Dec-2010).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Big Wash area, Shingle Canyon and Lehman Creek.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (5 plots): GRBA.130, GRBA.234, GRBA.235, GRBA.236, GRBA.702,
Local Description Authors: K. A. Schulz
References: Western Ecology Working Group n.d.

G268. Southern Rocky Mountain Montane-Subalpine Grassland

Festuca arizonica - Festuca thurberi - Muhlenbergia montana Grassland Group
Arizona Fescue - Thurber's Fescue - Mountain Muhly Grassland Group
Identifier: G268

REVISED USNVC CLASSIFICATION

Division	Western North American Grassland & Shrubland (2.C.1.Na)
Macrogroup	Southern Rocky Mountain Montane Grassland & Shrubland (M049)
Group	**Southern Rocky Mountain Montane-Subalpine Grassland (G268)**
Group (Scientific)	***Festuca arizonica - Festuca thurberi - Muhlenbergia montana* Grassland Group (G268)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Achnatherum lettermanii* Herbaceous Alliance (A2524)
Association	*Achnatherum lettermanii* Herbaceous Vegetation (CEGL005354)
Alliance	*Poa fendleriana* Herbaceous Alliance (A1336)
Association	*Poa fendleriana - Astragalus kentrophyta* Herbaceous Vegetation [Park Special] (CEPS009610)
Alliance	*Poa secunda - Arenaria congesta - Cirsium eatonii* Herbaceous Alliance [Provisional] (A2041)
Association	*Poa secunda - Arenaria congesta* Herbaceous Vegetation [Park Special] (CEPS009611)
	Poa secunda - Cirsium eatonii Post-burn Herbaceous Vegetation [Park Special] (CEPS009612)
Alliance	Post-fire Ruderal Herbacous Vegetation Alliance [Provisional] (A2043)
Association	*Balsamorhiza sagittata* Herbaceous Vegetation [Park Special] (CEPS009598)
Alliance	*Pseudoroegneria spicata* Herbaceous Alliance (A1265)
Association	*Pseudoroegneria spicata* Herbaceous Vegetation (CEGL001660)

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)
GRBA Biophysical Setting (BpS)	Montane-Subalpine Grassland (1146)
NPS-VIP Map Unit	Rocky Mountain Montane-Subalpine Grassland Complex (H_RMGC)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This Rocky Mountain grassland group typically occurs between 2200 and 3000 m elevation on flat to rolling plains and parks or on lower sideslopes that are dry, but it may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. Vegetation is characterized by an open to dense perennial graminoid layer. Larger occurrences usually consist of a mosaic of two or three plant associations with one of the following dominant bunch grasses: *Blepharoneuron tricholepis, Danthonia parryi, Festuca arizonica, Muhlenbergia montana*, or *Pseudoroegneria spicata* at lower elevation / warmer aspects, or *Danthonia intermedia, Festuca idahoensis, Festuca thurberi, Muhlenbergia filiculmis* at subalpine elevation / cooler aspects. The common subdominants include *Bouteloua gracilis, Hesperostipa comata*, or *Poa secunda*. *Bouteloua gracilis* often dominates sites with warm aspects and heavy grazing history. Forb species such as *Potentilla hippiana* may be present to codominant. These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado), they form the "matrix" of high-elevation plateaus and inter-montane valleys. Small-patch representations of this group do occur at high elevations of the Trans-Pecos where they present as occurrences of *Festuca arizonica - Blepharoneuron tricholepis* Herbaceous Vegetation (CEGL004508). These occurrences often occupy sites adjacent to Madrean Oriental Chaparral Group (G280).

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This ecological group is known from elevations ranging from 2498-3245 m (8193-10,643 feet) on low to middle slopes. Substrates are very rocky and composed of slate, limestone and dolomite. Soils are well-drained to rapidly drained and composed of silt loam and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This ecological group is characterized an open to dense (20-70% cover) layer of perennial graminoid vegetation. Shrubs may reach 10% cover in some stands. Species include *Ericameria discoidea, Eriogonum microthecum, Mahonia repens, Ribes montigenum, Symphoricarpos oreophilus*, and *Tetradymia canescens*. Dominant graminoids include *Achnatherum lettermanii, Poa fendleriana, Pseudoroegneria spicata*, and *Hesperostipa comata*. Forbs may codominate in some stands and include *Astragalus kentrophyta, Arenaria congesta, Cirsium eatonii*, and *Balsamorhiza sagittata*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Arenaria congesta*, *Astragalus kentrophyta*, *Balsamorhiza sagittata*, *Cirsium eatonii*
Herb (field)	Graminoid	*Achnatherum lettermanii*, *Hesperostipa comata*, *Poa fendleriana*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Achnatherum lettermanii*, *Arenaria congesta*, *Astragalus kentrophyta*, *Balsamorhiza sagittata*, *Cirsium eatonii*, *Hesperostipa comata*, *Poa fendleriana*, *Pseudoroegneria spicata*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Taraxacum officinale* (exotic/invasive)

CLASSIFICATION

Global Comments: Montane grasslands are very similar and intergrade with their montane and subalpine counterparts. The transition of this group to the Northern Rocky Mountain Montane Grassland Group (G267) probably occurs somewhere in central Colorado or southern Wyoming. This Southern Rockies grassland group may co-occur with patches of the more mesic Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow Group (G271), which is distinguished by dominance of mesic forb and grass species such as *Deschampsia caespitosa* and *Mertensia ciliata*.

Global Related Concepts:

- Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series - 141.41 (Brown et al. 1979) =
- Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series, *Festuca arizonica* Association - 141.412 (Brown et al. 1979) <
- Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series, *Festuca thurberi* Association - 141.411 (Brown et al. 1979) <
- Rocky Mountain Alpine and Subalpine Grassland, Bunchgrass Series, Mixed Grass-Forb Association - 141.413 (Brown et al. 1979) <
- Rocky Mountain Montane Grassland, Mixed Meadow Series - 142.41 (Brown et al. 1979) =
- Rocky Mountain Montane Grassland, Mixed Meadow Series, Mixed Forb-Grass Association - 142.411 (Brown et al. 1979) <

ELEMENT DISTRIBUTION

Great Basin National Park Range: This grassland group is scattered across the park and was sampled on a slope above Strawberry Creek basin and slopes below Bald Mountain and Wheeler Peak south to near Lincoln Peak and Mount Washington south and north of Lexington Arch.
Global Range: This grassland group occurs between 2200 and 3000 m elevation in the Southern Rocky Mountains and extends west to high plateaus and mountains in the Colorado Plateau and the Great Basin.
Nations: US
States/Provinces: AZ, CO, NM, NV, UT, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (7 plots): GRBA.301, GRBA.303, GRBA.308, GRBA.317, GRBA.329, GRBA.508, GRBA.814.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Bowns and Bagley 1986, Brown 1982, Brown et al. 1979, Hess 1981, Hess and Wasser 1982, Moir 1967, Passey et al. 1982, Shepherd 1975, Stewart 1940, Turner 1975, Turner and Dortignac 1954, Western Ecology Working Group n.d.

Pseudoroegneria spicata Herbaceous Vegetation

Bluebunch Wheatgrass Herbaceous Vegetation
Identifier: CEGL001660

REVISED USNVC CLASSIFICATION

Division	Western North American Grassland & Shrubland (2.C.1.Na)
Macrogroup	Southern Rocky Mountain Montane Grassland & Shrubland (M049)
Group	Southern Rocky Mountain Montane-Subalpine Grassland (G268)
Alliance	Southern Rocky Mountain *Pseudoroegneria spicata* Herbaceous Alliance (A2044)
Association	***Pseudoroegneria spicata*** **Herbaceous Vegetation (CEGL001660)**

OTHER CLASSIFICATIONS

Ecological System	Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)
GRBA Biophysical Setting (BpS)	Montane-Subalpine Grassland (1146)
NPS-VIP Map Unit	Rocky Mountain Montane-Subalpine Grassland Complex (H_RMGC)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This grassland association occurs on rock outcrops, talus, mesas, plateaus, windswept bluffs, ridgetops and mountains in northern Colorado, northeastern and northern Utah and western and southwestern Wyoming. It frequently occurs on moderately to steep, mid- to high-slope landforms, although gentle slopes are not uncommon. Sites are relatively xeric and are often found on southerly aspects at lower elevations or on harsh or on windswept areas at higher elevation sites. Substrates are typically shallow, often calcareous, rocky soils. Ground surface often has significant cover of bare ground, gravel and/or rock (10-90% cover). Stands are also reported east of the Continental Divide in Rocky Mountain National Park on a windward knoll and at Grand Teton National Park from a very steep northeast-facing high slope. The vegetation is characterized by an open herbaceous layer that is typically dominated by the cool-season, perennial bunchgrass *Pseudoroegneria spicata* with low to moderate cover (5-30%) and low-growing forbs. *Koeleria macrantha* is repeatedly present in low abundance. Other dry grasses may be present with low cover (less than half the cover of *Pseudoroegneria spicata*). A sparse dwarf-shrub layer (<10% cover) occurs with a variety of woody species of *Artemisia, Atriplex confertifolia, Cercocarpus, Eriogonum, Gutierrezia, Krascheninnikovia* or *Tetradymia* depending on elevation and substrate. There are several to many low-growing forbs (cushion plants) present with low cover, such as *Arenaria* spp., *Arenaria hookeri, Astragalus* spp., *Paronychia sessiliflora, Phlox* spp., *Stenotus acaulis, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Townsendia incana*. There are no clear dominants in this list, and the percent cover of each species present will vary from site to site. A diverse and abundant forb layer probably indicates a degraded occurrence.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from 2498-2755 m (8193-9036 feet) in elevation on moderate to somewhat steep slopes. Sites include mid and high slopes on colluvium on north and southeast aspects. Substrates are rapidly drained or moderately well-drained loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This herbaceous alliance is characterized by graminoid vegetation dominated by *Pseudoroegneria spicata*. Other common graminoids include *Poa secunda, Achnatherum lettermanii*, and *Poa fendleriana*. Total herbaceous cover ranges from 30-70%. A short-shrub layer may be present with up to 5% cover. Species may include *Artemisia arbuscula, Artemisia tridentata, Chrysothamnus viscidiflorus, Eriogonum microthecum, Eriogonum microthecum var. laxiflorum, Mahonia repens, Symphoricarpos oreophilus*, and *Tetradymia canescens*. Forbs are present at low covers and include *Agoseris aurantiaca, Antennaria microphylla, Calochortus nuttallii, Castilleja linariifolia, Collinsia parviflora, Comandra umbellata, Lithospermum ruderale, Lupinus argenteus, Penstemon watsonii*, and *Stephanomeria spinosa*.
exotics *Poa pratensis* and *Bromus tectorum* (on dry sites).

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Hesperostipa comata*, *Pseudoroegneria spicata*

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (30-Nov-1998).

CHARACTERISTIC SPECIES

Great Basin National Park: *Pseudoroegneria spicata*

CLASSIFICATION

Global Comments: This association needs to be compared with *Pseudoroegneria spicata* - Cushion Plants Herbaceous Vegetation (CEGL001666) of Pryor Mountains and Bighorn Canyon in south-central Montana, the Tendoy Mountains in southwest Montana and as described in Dinosaur National Monument in northwestern Colorado. It is distinguished by its lack of significant cover by cushion plants. Both associations occur on windswept ridgelines on calcareous substrates, have relatively sparse vegetation cover and contain cushion plants. The range of this association needs further review, especially disjunct stands, because the diagnostic grass in this association can be readily confused with awned *Elymus lanceolatus* (note if rhizomes are present, whereas *Pseudoroegneria spicata* has no rhizomes). Also *Pseudoroegneria spicata* ssp. *inermis* (awnless) is often confused with *Pascopyrum smithii* (note asymmetrical glume) or other wheatgrasses

Global Related Concepts:
- *Agropyron spicatum* var. *inerme* Western Slope Grassland (Baker 1982b) =
- *Pseudoroegneria spicata - Arenaria hookeri* Plant Association (Baker and Kennedy 1985) =
- *Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =
- Grassland *spicata* Grasslands (Hull and Hull 1974) B

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from hillsides south of Strawberry creek road and west of the North Fork of Lexington Arch road.
Global Range: This association occurs in Piceance Basin and Dinosaur National Park in western Colorado and the Cache Valley of northeastern Utah. Stands are reported from Fossil Butte National Monument and Grand Teton National Park in Wyoming and Rocky Mountain National Park in Colorado
Nations: US
States/Provinces: NV, CO, MT, NV, UT, WY
Federal Lands: NPS (Dinosaur, Fossil Butte, Grand Teton, Great Basin, Rocky Mountain)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2008 field data (2 plots): GRBA.303, GRBA.317.
Local Description Authors: K. Schulz
Global Description Authors: D. Zoellner
References: Baker 1982b, Baker and Kennedy 1985, Bourgeron and Engelking1994, CONPS 2003, Cogan et al. 2005. Coles et al. 2008a, Driscoll et al. 1984, Hull and Hull 1974, Jones and Ogle 2000, Peterson 2008, Rondeau personal communication, Western Ecology Working Group of NatureServe, no date.

CHARACTERISTIC SPECIES

Great Basin National Park: *Cercocarpus intricatus, Glossopetalon spinescens*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (21-Dec-2010).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Big Wash area, Shingle Canyon and Lehman Creek.
Nations: US
States/Provinces: NV, CO, MT, NV, UT, WY
Federal Lands: NPS (Great Basin)

2.B.2.Nd. Western North American Interior Sclerophyllous Chaparral Shrubland
M094. Cool Interior Chaparral
G282. Western North American Montane Sclerophyll Scrub Group [Provisional]

Arctostaphylos patula Shrubland Alliance
Greenleaf Manzanita Shrubland Alliance
Identifier: A0788

REVISED USNVC CLASSIFICATION

Division	Western North American Interior Sclerophyllous Chaparral Shrubland (2.B.2.Nd)
Macrogroup	Cool Interior Chaparral (M094)
Group	Western North American Montane Sclerophyll Scrub [Provisional] (G282)
Alliance	***Arctostaphylos patula* Shrubland Alliance (A0788)**

GRBA COMPONENT ASSOCIATIONS

Association	*Arctostaphylos patula* Shrubland (CEGL002696)
	Arctostaphylos patula / Ceanothus martinii Shrubland (CEGL005422)

OTHER CLASSIFICATIONS

Ecological Systems	Mogollon Chaparral (CES302.741)
	Great Basin Semi-Desert Chaparral (CES304.001)
GRBA Biophysical Setting (BpS)	Antelope Bitterbrush (1144)
	Montain Shrub (1126ms)
NPS-VIP Map Unit	*Arctostyphylos patula* Shrubland Alliance (S_ARPA)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: These are montane shrublands found on the eastern slope of the Sierra Nevada and into the western Great Basin and Colorado Plateau in summer-dry habitats from 800 to 3000 m elevation. Much of the precipitation comes as winter snow, but summer drought stress is characteristic. These shrublands are mostly found on steep, usually south-facing slopes, where soils are rocky and well-drained. These are typically zonal disclimax or, occasionally, edaphic climax brushfields which occur in association with dry needle-leaved evergreen forests or woodlands. These shrublands are typically established after stand-replacing fires or clearcut logging in *Pinus ponderosa* or *Pseudotsuga menziesii* forest, and are seral to forest after several decades. Excessively rocky or droughty, fire-prone sites in the forest may support relatively persistent stands of this alliance. These shrublands are strongly dominated by *Arctostaphylos patula* and may be almost monotypic. They are an important component of the Sierra Nevada/southern Cascade montane chaparral and may form large inclusions in dry pine forests following disturbance. Common shrub associates include *Ceanothus velutinus, Ceanothus cordulatus, Arctostaphylos nevadensis, Chrysolepis sempervirens (= Castanopsis sempervirens), Cercocarpus montanus*, and *Ribes* spp. Eastward, steppe species, such as *Artemisia tridentata, Purshia tridentata*, and *Cercocarpus ledifolius*, become common associates. Herbaceous vegetation is typically sparse and poorly described across the range of this alliance. Reported associates in northern California include *Elymus elymoides, Pyrola picta*, and *Stephanomeria lactucina*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This shrubland alliance is uncommon at Great Basin and found at elevations from 2550-2893 m (8362-9489 feet) on moderate to somewhat steep slopes (19-32%). Sites are limestone colluvial midslopes on all aspects with soils composed of silty and sandy clay.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by a short-shrub layer dominated by *Arctostaphylos pungens* or codominated by *Ceanothus martinii* or *Symphoricarpos oreophilus*. Trees are absent or with scattered individuals. Total shrub cover ranges from open to extremely dense (30-90% cover). No other shrubs attain significant cover, but may include *Cercocarpus ledifolius, Artemisia tridentata* ssp. *vaseyana, Amelanchier utahensis, Ribes cereum*, and *Mahonia repens*. Herbaceous cover may be absent, sparse or open. Species include *Astragalus tenellus, Cirsium neomexicanum, Elymus lanceolatus, Solidago velutina, Bromus ciliatus, Carex rossii, Machaeranthera canescens, Tragopogon dubius, Achnatherum hymenoides, Achnatherum lettermanii, Achnatherum parishii var. depauperatum, Erigeron ursinus, Hackelia patens, Lithospermum ruderale, Pascopyrum smithii, Penstemon concinnus, Petradoria pumila, Poa glauca* ssp. *rupicola, Pseudoroegneria spicata*, and *Stephanomeria spinosa*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Arctostaphylos pungens*, *Ceanothus martinii*

CHARACTERISTIC SPECIES

Great Basin National Park: *Arctostaphylos pungens*, *Ceanothus martinii*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Penstemon concinnus* (globally vulnerable, G3)

CLASSIFICATION

Global Comments: While this alliance is currently known only from the eastern slope of the Sierra Nevada, it is likely to be much more widespread. *Arctostaphylos patula* is widespread in the Great Basin. With further field inventory and classification work on successional and disturbance-dependent shrublands such as these, the alliance may prove to be similarly widespread.

ELEMENT DISTRIBUTION

Great Basin National Park Range: This manzanita alliance occurs in the southern part of the park and was sampled on hillslopes above the North Fork of Lexington Creek and on the west side of Mount Washington.

Global Range: These shrublands are reported from the eastern slope of the Sierra Nevada in Nevada and California and from the Colorado Plateau in southwestern Utah and western Colorado. *Arctostaphylos patula* is reported to form dense shrublands from southern Oregon and east across the Great Basin in montane habitats to Montana, northwestern Colorado, and northern Arizona (Mozingo 1987). The alliance likely occurs in these areas as well.

Nations: US

States/Provinces: AZ, CA, CO, NV, UT

Federal Lands: BLM (Uncompahgre Plateau); NPS (Bryce Canyon, Cedar Breaks, Colorado, Dinosaur, Grand Canyon, Great Basin, Yosemite, Zion)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2008 field data (3 plots): GRBA.310, GRBA.318, GRBA.320.
Local Description Authors: M. Hall
Global Description Authors: M.S. Reid/D. Sarr
References: Barbour and Major 1977, Conard and Radosevich 1982, Faber-Langendoen et al. 2011, Mozingo 1987, Townsend 1966

2.B.6. Temperate & Boreal Freshwater Shrubland, Wet Meadow & Marsh

2.B.6.Na. Western North American Grassland & Shrubland

M75. Western North American Montane Wet Shrubland & Wet Meadow

G504. Rocky Mountain & Great Basin Montane Alder & Birch Riparian Shrubland

Alnus incana - Betula occidentalis **Riparian/Seep Shrubland Group**
Gray Alder - Water Birch Riparian/Seep Shrubland Group
Identifier: G504

REVISED USNVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (2.B.6.Nb)
Macrogroup	Western North American Montane Wet Shrubland & Wet Meadow (M075)
Group	**Rocky Mountain & Great Basin Montane Alder & Birch Riparian Shrubland (G504)**
Group (Scientific)	***Alnus incana - Betula occidentalis*** **Riparian/Seep Shrubland Group (G504)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Acer glabrum* Mesic-Wet Shrubland Alliance (A0952)	
Association	*Acer glabrum* Drainage Bottom Shrubland	(CEGL001062)
Alliance	*Betula occidentalis* Riparian/Seep Shrubland Allince (A967)	
Association	*Betula occidentalis / Cornus sericea* Shrubland	(CEGL001161)
Association	*Betula occidentalis* / Mesic Graminoids Shrubland	(CEGL002654)

OTHER CLASSIFICATIONS

Ecol Ecological System	Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland (CES304.045)
	Rocky Mountain Subalpine-Montane Riparian Shrubland (CES306.832)
GRBA Biophysical Setting (BpS)	Montane Riparian (1154)
	Subalpine-Upper Riparian (1160)
NPS-VIP Map Unit	Montane Riparian Shrubland Complex (S_RIP)
USFWS Wetland Classification	Palustrine

ELEMENT CONCEPT

Global Summary: This group consists of tall (>1.5 m) shrubs found in riparian areas, seeps and avalanche chutes. It occurs in the mountains and lowlands throughout the western interior United States (Great Basin, Rocky Mountains) and western Canada (Rocky Mountains). This riparian group typically occurs adjacent to streams and in mountain meadows. Landforms associated with this group are stream benches, banks, alluvial bars, and floodplains in narrow to moderately wide valleys and hillside seeps in the mountains and foothills, and steep moist avalanche chutes. Sites are young, active channel shelves that lie between active and flood-stage streambanks along second-order and larger streams in moderately graded (3-5%) valleys. Soils are shallow, skeletal alluvium over water-worked cobbles and gravels. Soils may have signs of saturation (mottles). Active channel shelves have surface soil textures that are loamy sands, while older sites are silts and loam. Surface water is present for brief periods during the growing season, but the water table usually lies well below soil surface. Available water-holding capacity is low. *Alnus incana* and/or *Betula occidentalis* form a dense canopy. These shrubs can be quite tall (>1.5 m), and some regard them as trees. The diverse understory shrub layer may include *Amelanchier utahensis, Cornus sericea, Paxistima myrsinites, Sorbus scopulina* and *Sorbus sitchensis, Ribes hudsonianum, Dasiphora fruticosa* ssp. *floribunda (= Pentaphylloides floribunda), Oplopanax horridus, Prunus virginiana, Symphoricarpos albus, Salix drummondiana, Salix exigua*, and *Salix monticola*. Avalanche tracks may also have a number of tree species that never have a chance to grow much taller than the shrub layer, including *Abies lasiocarpa, Populus balsamifera* ssp. *trichocarpa*, and *Populus tremuloides*. The forb layer is sparse and may include *Canadanthus modestus (= Aster modestus), Castilleja* spp., *Erythronium grandiflorum, Galium triflorum, Heracleum sphondylium, Heracleum maximum (= Heracleum lanatum), Maianthemum stellatum, Myosotis asiatica (= Myosotis alpestris), Rudbeckia laciniata, Senecio triangularis, Symphyotrichum spathulatum (= Aster occidentalis), Thalictrum fendleri, Thalictrum occidentale, Urtica dioica, Veratrum viride*, and *Xerophyllum tenax*. The graminoid layer is usually dominated by 1 or 2 species that include *Agrostis stolonifera, Calamagrostis canadensis, Carex microptera, Carex nebrascensis, Carex pellita (= Carex lanuginosa), Carex utriculata, Glyceria* spp., and *Juncus balticus*. Fern and fern allies can be dense with at least 40% cover. The dominant species typically are *Gymnocarpium dryopteris* and *Athyrium filix-femina*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This group is known from elevations ranging from 2103-2170 m (6900-7117 feet) on gentle to somewhat steep slopes. Sites include low slopes and channel beds often where fluvium has accumulated. Soils are seasonally or semipermanently flooded but well-drained and composed of silt or sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This group occurs as a short woodland or tall shrubland characterized by open to dense stands of *Betula occidentalis* with or without *Cornus sericea* or stands dominated by *Acer glabrum*. *Pinus monophylla* and *Juniperus osteosperma* may be present in the canopy at low cover. Other shrubs associated with this group include *Artemisia tridentata* ssp. *tridentata, Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Holodiscus dumosus, Mahonia repens, Ribes aureum, Ribes cereum, Rosa woodsii, Salix exigua*, and *Symphoricarpos oreophilus*. Herbaceous cover is open to dense and may be the dominant understory component. Dominant species include *Achillea millefolium, Achnatherum* spp., *Leymus cinereus, Maianthemum stellatum*, and *Thalictrum fendleri*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula occidentalis*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer glabrum*, *Cornus sericea*
Herb (field)	Forb	*Maianthemum stellatum*
Herb (field)	Graminoid	*Achnatherum* spp., *Leymus cinereus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Acer glabrum*, *Achnatherum nelsonii*, *Betula occidentalis*, *Cornus sericea*, *Maianthemum stellatum*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

CLASSIFICATION

Global Comments: Need to review the *Alnus incana* Alliance in northern California Coast Ranges. Probably can include stands that occur in the Sierra Nevada and southern Cascades. *Alnus incana* stands in the Klamath Mountains intermix with *Alnus viridis* and are included in Vancouverian Lowland Riparian & Wet Slope Group (G322).

Global Related Concepts:

- Riparian (422) (Shiflet 1994) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This group is known from Snake Creek, Strawberry Creek, and Grey Cliffs campground.

Global Range: This group is known from throughout the Great Basin, eastern Sierra Nevada, and Rocky Mountains of the U.S. and Canada.

Nations: CA, US

States/Provinces: AB, BC, CA, CO, MT, NV, OR, WA, WY

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2008 field data (3 plots): GRBA.032, GRBA.094, GRBA.330.

Local Description Authors: M. Hall

Global Description Authors: G. Kittel

References: Butler 1979, Butler 1985, Crowe and Clausnitzer 1997, Faber-Langendoen et al. 2011, Hansen et al. 1989, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1993, MacKenzie and Moran 2004, Malanson and Butler 1984, Manning and Padgett 1995, Muldavin et al. 2000a, NCC 2002, Padgett et al. 1989, Sawyer et al. 2009, Shiflet 1994, Szaro 1989, Tuhy et al. 2002, Walford 1996, Walford et al. 2001

G527. Rocky Mountain & Great Basin Montane Riparian & Seep Shrubland

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Salix spp. Riparian & Seep Shrubland Group

Willow species Riparian & Seep Shrubland Group

Identifier: G527

REVISED USNVC CLASSIFICATION

Division	Western North American Freshwater Shrubland, Wet Meadow & Marsh (2.B.6.Nb)
Macrogroup	Western North American Montane Wet Shrubland & Wet Meadow (M075)
Group	**Rocky Mountain & Great Basin Montane Riparian & Seep Shrubland (G527)**
Group (Scientific)	***Salix* spp. Riparian & Seep Shrubland Group (G527)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Salix bebbiana* Temporarily Flooded Shrubland Alliance (A0971)
Association	*Salix bebbiana* / Mesic Graminoids Shrubland (CEGL001174)
Alliance	*Salix boothii* Temporarily Flooded Shrubland Alliance (A0972)
Association	*Salix boothii* / Mesic Forbs Shrubland (CEGL001180)
Association	*Salix boothii* / Mesic Graminoids Shrubland (CEGL001181)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Subalpine-Montane Riparian Shrubland (CES306.832)
GRBA Biophysical Setting (BpS)	Montane Riparian (1154) Subalpine-Upper Riparian (1160)
NPS-VIP Map Unit	Montane Riparian Shrubland Complex (S_RIP)
USFWS Wetland Classification	Palustrine

ELEMENT CONCEPT

Global Summary: This group is found throughout the Rocky Mountain cordillera from New Mexico north into Montana and northwestern Alberta, and also occurs in mountainous areas of the intermountain interior west and on the Colorado Plateau. These are montane to subalpine riparian shrublands occurring as narrow bands of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Generally, the group is found at higher elevations, but can be found anywhere from 1500-3475 m, and may occur at even lower elevations in the Canadian Rockies. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. Many of the plant associations found within this group are associated with beaver activity. This group often occurs as part of a mosaic of multiple communities that are shrub- and herb-dominated and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. The shrub species that can be dominant reflect the large elevational gradient of this group and include *Alnus incana, Betula glandulosa, Betula occidentalis, Cornus sericea, Salix bebbiana, Salix boothii, Salix brachycarpa, Salix drummondiana, Salix eriocephala, Salix geyeriana, Salix monticola, Salix planifolia*, and *Salix wolfii*. Generally the upland vegetation surrounding these wet shrublands is either conifer or aspen forest.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This palustrine ecological group is known from elevations ranging from 2121-2675 m (6959-8774 feet) on gentle to somewhat steep slopes. Sites include seasonally flooded or saturated valley floors, channel beds, benches on midslopes and stream terraces. Substrates consist of alluvium or fluvial deposits with poorly drained to rapidly drained soils composed of silt loam, silty clay, clay loam, and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This shrubland group is characterized by a tall-shrub layer dominated by *Salix bebbiana* or *Salix boothii*. *Prunus virginiana, Symphoricarpos oreophilus*, or *Betula occidentalis* may codominate in some stands. In some stands *Rosa woodsii* may form an open to somewhat dense short-shrub layer. Total shrub cover varies from open to very dense (15-90%). The understory is composed of various mesophytic forbs and graminoids. Dominants include *Aconitum columbianum, Carex aquatilis, Carex praegracilis, Carex scopulorum, Cirsium vulgare, Elymus trachycaulus, Equisetum arvense, Juncus balticus, Mimulus guttatus, Scirpus microcarpus, Thermopsis rhombifolia, Vicia americana*, and *Viola nephrophylla*. *Poa pratensis* has invaded some stands and may be the dominant herbaceous species.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Prunus virginiana*, *Salix bebbiana*, *Salix boothii*, *Symphoricarpos oreophilus*
Herb (field)	Graminoid	*Elymus trachycaulus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Carex aquatilis*, *Elymus trachycaulus*, *Juncus balticus*, *Mimulus guttatus*, *Prunus virginiana*, *Salix bebbiana*, *Salix boothii*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

CLASSIFICATION

Global Related Concepts:

- Riparian (422) (Shiflet 1994) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This group is known from Strawberry Creek, Lexington Creek, Lehman Creek, and Baker Creek.
Global Range: This group is found throughout the Rocky Mountain cordillera from New Mexico north into Montana and the Canadian Rockies of Alberta and British Columbia (including the isolated "island" mountain ranges of central and eastern Montana), and in mountainous areas of the Intermountain West and on the Colorado Plateau.
Nations: CA, US
States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (6 plots): GRBA.304, GRBA.305, GRBA.331, GRBA.603, GRBA.604, GRBA.608.
Local Description Authors: M. Hall
Global Description Authors: G. Kittel
References: Baker 1988, Baker 1989a, Baker 1989b, Baker 1990, Crowe and Clausnitzer 1997, Faber-Langendoen et al. 2011, Kittel 1993, Kittel 1994, Kittel et al. 1996, Kittel et al. 1999a, Kittel et al. 1999b, Kovalchik 1987, Kovalchik 1993, Kovalchik 2001, Manning and Padgett 1995, Muldavin et al. 2000a, Padgett 1982, Padgett et al. 1988a, Padgett et al. 1988b, Shiflet 1994, Steen and Coupe 1997, Szaro 1989, Walford 1996, Willoughby 2007

G521. Vancouverian & Rocky Mountain Montane Wet Meadow

Carex spp. - *Calamagrostis* spp. Montane Wet Meadow Group

Sedge species - Reedgrass species Montane Wet Meadow Group
Identifier: G521

REVISED USNVC CLASSIFICATION

Division	Western North American Freshwater Shrubland, Wet Meadow & Marsh (2.B.6.Nb)
Macrogroup	Western North American Montane Wet Shrubland & Wet Meadow (M075)
Group	**Vancouverian & Rocky Mountain Montane Wet Meadow (G521)**
Group (Scientific)	***Carex* spp. - *Calamagrostis* spp. Montane Wet Meadow Group (G521)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Carex nebrascensis* Seasonally Flooded Herbaceous Alliance (A1417)
Association	*Carex nebrascensis* Herbaceous Vegetation (CEGL001813)
Alliance	*Carex scopulorum* Seasonally Flooded Herbaceous Alliance (A1420)
Association	*Carex scopulorum* Herbaceous Vegetation (CEGL001822)
Alliance	*Dodecatheon - Mimulus - Veronica* Wet Meadow Alliance [Provisional] (A2107)

Association	*Dodecatheon alpinum* Herbaceous Vegetation [Park Special] (CEPS009590)
Alliance	*Juncus balticus* Herbaceous Alliance (A1374)
Association	*Juncus balticus* Herbaceous Vegetation (CEGL001838)
Alliance	*Juncus nevadensis* Herbaceous Alliance [Provisional] (A2037)
Association	*Juncus nevadensis - Poa secunda* Herbaceous Vegetation [Park Special] (CEPS009603)
Alliance	*Leymus cinereus* Herbaceous Alliance (A1204)
Association	*Leymus cinereus* Herbaceous Vegetation (CEGL001479)
Alliance	*Polygonum bistortoides* Herbaceous Alliance [Provisional] (A2042)
Association	*Polygonum bistortoides* Herbaceous Vegetation [Park Special] (CEPS009613)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine-Montane Wet Meadow (CES306.812)
GRBA Biophysical Setting (BpS)	Wet Meadow **(**1145wm)
NPS-VIP Map Unit	Montane Wet Meadow Complex (H_WET)
USFWS Wetland Classification	Palustrine

ELEMENT CONCEPT

Global Summary: This group contains the wet meadows found in montane and subalpine elevations, occasionally reaching into the lower edges of the alpine elevations (about 1000-3600 m) from California's Transverse and Peninsular ranges north to British Columbia's coastal mountains and from throughout the Rocky Mountains of Canada and the U.S. (including the Black Hills of South Dakota) and mountain ranges of the intermountain interior west. Wet meadows occur in open wet depressions, basins and flats with low-velocity surface and subsurface flows. They can be large meadows in montane or subalpine valleys, or occur as narrow strips bordering ponds, lakes and streams, and along toeslope seeps. They are typically found on flat areas or gentle slopes, but may also occur on subirrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches. Sites are usually seasonally wet, often drying by late summer, and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part of the year, but depths rarely exceed a few centimeters. Wet meadows can be tightly associated with snowmelt and typically are not subjected to high velocity disturbance, but can be flooded by slow-moving waters. Soils are mostly mineral and show typical hydric soil characteristics such as low chroma and redoximorphic features; some areas may have high organic content as inclusions or pockets. Vegetation of this group can manifest as a mosaic of several plant associations, or be a monotypic stand of a single association which is dominated by graminoids or forbs. Varying dominant herbaceous species include graminoids *Calamagrostis canadensis, Calamagrostis stricta, Carex bolanderi, Carex exsiccata, Carex illota, Carex microptera, Carex scopulorum, Carex utriculata, Carex vernacula, Deschampsia caespitosa, Eleocharis quinqueflora, Glyceria striata (= Glyceria elata), Juncus drummondii, Juncus nevadensis*, and *Scirpus* and/or *Schoenoplectus* spp. Forb species include *Camassia quamash, Cardamine cordifolia, Dodecatheon jeffreyi, Phippsia algida, Rorippa alpina, Senecio triangularis, Trifolium parryi*, and *Veratrum californicum*. Common but sparse shrubs may include *Salix* spp., *Vaccinium uliginosum, Betula glandulosa*, and *Vaccinium macrocarpon*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This ecological group is known from elevations ranging from 1760-3092 m (5770-10,144 feet) on flat to moderate slopes. Sites include seasonally, semipermanently, and permanently flooded seeps, mountain valley floors, stream terraces and drainages. Soils poorly to well-drained and composed of muck, silty clay, clay loam, loam, sandy clay loam, and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This ecological group is characterized by perennial graminoid and mixed herbaceous vegetation. Mesophytic shrubs may contribute low cover. Dominant species include *Carex nebrascensis, Carex scopulorum, Dodecatheon alpinum, Juncus balticus, Juncus nevadensis, Leymus cinereus*, and *Polygonum bistortoides*. Other herbaceous species include *Achillea millefolium, Agrostis stolonifera, Angelica kingii, Carex hassei, Carex microptera, Deschampsia caespitosa, Mimulus guttatus, Rorippa nasturtium-aquaticum, Stellaria longipes*, and *Trifolium longipes*. Some stands have been heavily invaded by the exotic species *Taraxacum officinale* and *Poa pratensis*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Dodecatheon alpinum*, *Polygonum bistortoides, Achillea millefolium*
Herb (field)	Graminoid	*Carex nebrascensis*, *Carex scopulorum*, *Juncus balticus*, *Juncus nevadensis, Leymus cinereus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Carex nebrascensis*, *Carex scopulorum*, *Dodecatheon alpinum*, *Juncus balticus, Juncus nevadensis, Leymus cinereus*, *Polygonum bistortoides*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

CLASSIFICATION

Global Related Concepts:

- Alpine Grassland (213) (Shiflet 1994) >
- Alpine Rangeland (410) (Shiflet 1994) ><
- Montane Meadows (216) (Shiflet 1994) >
- Tall Forb (409) (Shiflet 1994) ><
- Tufted Hairgrass - Sedge (313) (Shiflet 1994) ><

ELEMENT DISTRIBUTION

Great Basin National Park Range: This montane-subalpine wetland group occurs in seeps and wet meadows near mountain streams and was mostly sampled in Baker Creek and Snake Creek drainages with additional occurrences in a long meadow north of Strawberry Creek and below Stella Lake.

Global Range: This group occurs in the mountains in California's Transverse and Peninsular ranges north to British Columbia's coastal ranges and is found throughout the Rocky Mountains (including the Black Hills of South Dakota) of the U.S. and Canada as well as the intermountain ranges of the interior west, ranging in elevation from montane to alpine (1000-3600 m).

Nations: CA, US

States/Provinces: AB, AZ, BC, CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008, 2009, 2010 and 2011 field data (17 plots): GRBA.65, GRBA.110, GRBA.111, GRBA.112, GRBA.113, GRBA.302, GRBA.309, GRBA.332, GRBA.334, GRBA.336, GRBA.733, GRBA.735, GRBA.742, GRBA.745, GRBA.746, GRBA.748, GRBA_AA_1107.

Local Description Authors: M. Hall, mod by K. Schulz

Global Description Authors: P. Comer, mod. G. Kittel and C. Chappell

References: Banner et al. 1993, Barbour and Major 1988, Cooper 1986b, Crowe and Clausnitzer 1997, DeLong 2003, DeLong et al. 1990, DeLong et al. 1993, Faber-Langendoen et al. 2011, Holland and Keil 1995, Kittel et al. 1999b, Komarkova 1976, Komarkova 1986, Kovalchik 1987, Kovalchik 1993, Lloyd et al. 1990, MacKenzie and Moran 2004, MacKinnon et al. 1990, Manning and Padgett 1995, Meidinger and Pojar 1991, Meidinger et al. 1988, Nachlinger 1985, Padgett et al. 1988a, Reed 1988, Sanderson and Kettler 1996, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Steen and Coupe 1997

Carex scopulorum Herbaceous Vegetation

Holm's Rocky Mountain Sedge Herbaceous Vegetation
Identifier: CEGL001822

REVISED USNVC CLASSIFICATION

Division	Western North American Freshwater Shrubland, Wet Meadow & Marsh (2.B.6.Nb)
Macrogroup	Western North American Montane Wet Shrubland & Wet Meadow (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow (G521)
Alliance	*Carex scopulorum* Wet Meadow Alliance (A1420)
Association	***Carex scopulorum* Herbaceous Vegetation (CEGL001822)**

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine-Montane Wet Meadow (CES306.812)
GRBA Biophysical Setting (BpS)	Wet Meadow (1145wm)
NPS-VIP Map Unit	Montane Wet Meadow Complex (H_WET)
USFWS Wetland Classification	Palustrine

ELEMENT CONCEPT

Global Summary: From Christy (2004): Habitat is depressions and seepy alluvial fans in subalpine heath. Stands of this association occur in transitional areas between the slightly wetter *Carex nigricans* Herbaceous Vegetation (CEGL001816) and slightly drier associations of *Carex spectabilis* and upland *Phyllodoce* heath, and intergrade with both. Stands on alluvial fans occur below springs and seeps and may be laced with rivulets and or irrigated by sheetflow. Trees are absent. Shrubs are sparse, *Salix commutata* being the most abundant in 25% of the plots, but with a very low cover. *Carex scopulorum* is the primary herbaceous species with an average cover of 49% and ranging from 10-90%. Other species with significant patches include *Deschampsia caespitosa, Eleocharis quinqueflora, Muhlenbergia filiformis, Eleocharis palustris*, and *Juncus balticus*. The other 40 species occur at low constancy and cover and are mostly wetland taxa indicative of perennial saturation.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This herbaceous association is known from elevations ranging from 2860-3092 m (9380-10,141 feet) on gentle to moderate slopes. Sites include seasonally flooded midslopes, low slopes and basin floors in drainages or areas of groundwater discharge. Substrates include poorly drained muck, loam and silty loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a dense to completely closed herbaceous layer dominated by *Carex scopulorum* which has >60% cover. Other graminoids include *Carex microptera, Calamagrostis stricta*, and *Deschampsia caespitosa*. A variety of forbs may be present, and *Rorippa nasturtium-aquaticum* and *Polygonum bistortoides* may be subdominant. Other species include *Achillea millefolium, Angelica kingii, Aquilegia scopulorum, Arabis drummondii, Arnica mollis, Artemisia michauxiana, Cardamine cordifolia, Dodecatheon alpinum, Mimulus guttatus, Saxifraga odontoloma*, and *Stellaria calycantha*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum bistortoides*, *Rorippa nasturtium-aquaticum*
Herb (field)	Graminoid	*Carex scopulorum*

CHARACTERISTIC SPECIES

Great Basin National Park: *Carex microptera*, *Carex scopulorum*, *Rorippa nasturtium-aquaticum*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Aquilegia scopulorum* (endemic, G3?); **Exotic/Invasive**: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: Christy (2004) describes an *Eleocharis quinqueflora* phase: Habitat is depressions or seepy slopes in subalpine heath. It occurs at the wet end of the *Carex scopulorum* association and intergrades with the *Carex nigricans* association. Stands contain more *Eleocharis quinqueflora* than *Carex*. *Carex nigricans* and *Carex brunnescens* may form significant patches.

Global Related Concepts:

- *Carex scopulorum* var. *prionophylla* and *bracteosa* Association (Kovalchik 1993) =
- *Carex scopulorum* (Crowe and Clausnitzer 1997) =
- *Carex scopulorum* (Kovalchik 1987) =
- *Carex scopulorum* (Bourgeron and Engelking 1994) =
- *Carex scopulorum* Association (Christy 2004) =
- *Carex scopulorum* Association (Crowe et al. 2004) =
- DRISCOLL FORMATION CODE:V.C.6.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Baker Creek and Snake Creek.

Global Range: This association occurs from California to British Columbia (Christy 2004) and eastward.

Nations: CA?, US

States/Provinces: BC?, CA:S3, CO, ID:S3, MT:S4, NV, OR:S4, UT?, WA:S3S4, WY
Federal Lands: NPS (Great Basin, Great Sand Dunes); USFS (Deschutes, Fremont, Malheur, Wallowa-Whitman)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (3 plots): GRBA.309, GRBA.735, GRBA.742.
Local Description Authors: M.E. Hall
Global Description Authors: Christy (2004)
References: Bourgeron and Engelking 1994, Campbell 1973, Christy 2004, Cole 1977b, Cole 1982, Crowe and Clausnitzer 1997, Crowe et al. 2004, Driscoll et al. 1984, Evenden 1990, Hansen et al. 1991, Hansen et al. 1995, IDCDC 2005, Jankovsky-Jones et al. 1999, Kagan et al. 2004, Kovalchik 1987, Kovalchik 1993, Kovalchik 2001, MTNHP 2002b, Manning and Padgett 1989, Manning and Padgett 1991, Seyer 1981, WNHP unpubl. data, Western Ecology Working Group n.d.

Dodecatheon alpinum Herbaceous Vegetation [Park Special]
Alpine Shootingstar Herbaceous Vegetation
Identifier: CEPS009590

REVISED USNVC CLASSIFICATION

Division	Western North American Freshwater Shrubland, Wet Meadow & Marsh (2.B.6.Nb)
Macrogroup	Western North American Montane Wet Shrubland & Wet Meadow (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow (G521)
Alliance	*Dodecatheon - Mimulus - Veronica* Wet Meadow Alliance [Provisional] (A2107)
Association	***Dodecatheon alpinum* Herbaceous Vegetation [Park Special] (CEPS009590)**

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine-Montane Wet Meadow (CES306.812)
GRBA Biophysical Setting (BpS)	Wet Meadow (1145wm)
NPS-VIP Map Unit	Montane Wet Meadow Complex (H_WET)
USFWS Wetland Classification	Palustrine

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This wetland association is rare and only known from Snake and Baker creeks, ranging in elevation from 2515-2688 m (8249-8816 feet) on nearly flat to gentle slopes. Sites include seasonally flooded seeps occupying gentle slopes or basin floors. Soils are poorly drained and mucky with standing water often present.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a very dense (>90% cover) mixed graminoid and forb herbaceous layer dominated by *Dodecatheon alpinum* and often codominated by *Juncus balticus, Trifolium longipes, Elymus trachycaulus*, and/or *Polygonum bistortoides*. Herbaceous associates are highly variable. Other graminoids may include *Carex hassei, Carex nebrascensis, Carex scopulorum, Deschampsia caespitosa*, and *Juncus nevadensis*. Forb associates may include *Achillea millefolium, Epilobium ciliatum, Geum macrophyllum, Mimulus guttatus, Platanthera dilatata, Rorippa nasturtium-aquaticum, Stellaria longipes*, and *Viola nephrophylla*. The exotic species *Taraxacum officinale* and *Poa pratensis* and often present as well.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Dodecatheon alpinum*, *Polygonum bistortoides*, *Trifolium longipes*
Herb (field)	Graminoid	*Elymus trachycaulus*, *Juncus balticus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Dodecatheon alpinum*, *Juncus balticus*, *Polygonum bistortoides*, *Trifolium longipes*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Poa pratensis* (exotic/invasive, Medium), *Taraxacum officinale* (exotic/invasive)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (21-Dec-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Baker Creek and Snake Creek.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (5 plots): GRBA.110, GRBA.733, GRBA.745, GRBA.746, GRBA.748.
Local Description Authors: M. Hall
References: Western Ecology Working Group n.d.

2.B.7. Salt Marsh

2.B.7.Nd. North American Western Interior Brackish Marsh

M082. Cool Semi-Desert Alkali-Saline Wetland

G537. Intermountain Basins Alkaline-Saline Shrub Wetland

Sarcobatus vermiculatus / Artemisia tridentata Shrubland
Greasewood / Big Sagebrush Shrubland
Identifier: CEGL001359

REVISED USNVC CLASSIFICATION

Division	North American Western Interior Brackish Marsh (2.B.7.Nd)
Macrogroup	Cool Semi-Desert Alkali-Saline Wetland (M082)
Group	Intermountain Basins Alkaline-Saline Shrub Wetland (G537)
Alliance	*Sarcobatus vermiculatus* Intermittently Flooded Shrubland Alliance (A1046)
Association	**Sarcobatus vermiculatus / Artemisia tridentata Shrubland (CEGL001359)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Greasewood Flat (CES304.780)
GRBA Biophysical Setting (BpS)	NA
NPS-VIP Map Unit	*Sarcobatus vermiculatus* Shrubland Alliance (S_SAVE)
USFWS Wetland Classification	Upland/Palustrine

ELEMENT CONCEPT

Global Summary: This mixed bottomland shrubland is characteristic of stream terraces and floodplains of the Intermountain West. The presence of other shrubs in the canopy indicates less saline conditions than found in *Sarcobatus vermiculatus* Disturbed Shrubland (CEGL001357). Soils are deep and generally sandy, but a few sites are on well-drained silt loams or clays. The sagebrush element may be either *Artemisia tridentata* ssp. *tridentata* or *Artemisia tridentata* ssp. *wyomingensis*, and either the sagebrush or *Sarcobatus vermiculatus* may have the greater cover. *Atriplex canescens, Ericameria nauseosa*, and *Chrysothamnus viscidiflorus* are other common minor elements of the shrub canopy. Total shrub cover is between 5 and 30%. The understory is variable; cover by herbaceous species may be sparse to dense, or exotic species may dominate the field layer.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging 1618-1769 m (5305-5800 feet) on flat to gentle slopes. Sites include sand deposits on lower alluvial fans and valleys and a bench along a channel. Soils are well- to rapidly drained loamy sands.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by an open (15-40%) short-shrub layer codominated by *Artemisia tridentata* and *Sarcobatus vermiculatus*. Other associated shrubs include *Chrysothamnus viscidiflorus, Ephedra nevadensis, Ericameria nauseosa*, and *Atriplex confertifolia*. Cover of native grasses is sparse to absent and may include *Achnatherum hymenoides, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii*, and *Poa fendleriana*. Some stands have substantial invasion by the exotic graminoid *Bromus tectorum*. Forb cover is sparse but may include *Centaurea solstitialis, Chaenactis douglasii*, and *Astragalus kentrophyta*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Sarcobatus vermiculatus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata*, *Sarcobatus vermiculatus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Erodium cicutarium* (exotic/invasive, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Related Concepts:

- *Sarcobatus vermiculatus/Artemisia tridentata* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:III.C.2.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: Stands were sampled along Snake Creek below the hatchery and in the administration area near Baker.
Global Range: This mixed bottomland shrubland is characteristic of stream terraces and floodplains of the Intermountain West. Stands are reported from the Colorado Plateau and Great Basin from western Colorado and Utah, extending to Big Horn Basin across western Wyoming and south-central Montana.
Nations: US
States/Provinces: CO, MT:S4, NV, UT, WY
Federal Lands: NPS (Arches, Capitol Reef, Colorado, Dinosaur, Fossil Butte?, Great Basin, Hovenweep, Mesa Verde)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (3 plots): GRBA.039, GRBA.441, GRBA.443.
Local Description Authors: M.E. Hall
Global Description Authors: J. Coles, mod. K.A. Schulz
References: Bourgeron and Engelking 1994, Clark et al. 2009, Coles et al. 2008a, Coles et al. 2009a, Driscoll et al. 1984, Lesica and DeVelice 1992, MTNHP 2002b, Peterson 2008, Romme et al. 1993, Thomas et al. 2009b, Von Loh et al. 2007, Von Loh et al. 2008, Western Ecology Working Group n.d.

3. DESERT & EMI-DESERT

3.B.1. Cool Semi-Desert Scrub & Grassland

3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

M170. Great Basin & Intermountain Dwarf Sage Shrubland & Steppe

G308. Intermountain Low & Black Sagebrush Shrubland & Steppe

Artemisia arbuscula **ssp.** ***arbuscula / Pseudoroegneria spicata*** **Shrub Herbaceous Vegetation**
Low Sagebrush / Bluebunch Wheatgrass Shrub Herbaceous Vegetation
Identifier: CEGL001412

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Dwarf Sage Shrubland & Steppe (M170)
Group	Intermountain Low & Black Sagebrush Shrubland & Steppe (G308)
Alliance	*Artemisia arbuscula* ssp. *arbuscula / Pseudoroegneria spicata* Shrub Herbaceous Alliance (A1566)
Association	***Artemisia arbuscula*** **ssp.** ***arbuscula / Pseudoroegneria spicata*** **Shrub Herbaceous Vegetation (CEGL001412)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
GRBA Biophysical Setting (BpS)	Low Sagebrush Steppe (1124)
NPS-VIP Map Unit	*Artemisia arbuscula* ssp. *arbuscula* Shrub Herbaceous Alliance (S_ARAR)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This dwarf-shrubland occurs on foothills and open steep slopes from 1370 to 2930 m (4500-9600 feet) in elevation. Slopes are generally quite steep, 24% average, 37%

maximum. Soils often have a hard layer constricting drainage. The soil surface is generally gravelly with up to 50% open bare gravelly soils. This montane dwarf-shrub steppe association is dominated by *Artemisia arbuscula*. *Artemisia nova* and *Artemisia tridentata* may also be present, adding to the shrubby aspect of this type. Shrubs can be widely spaced, and there is generally equal to sometimes greater cover provided by the herbaceous cover. Shrub cover ranges from 7 to 20%. Herbaceous cover ranges from 20 to 30% cover. *Pseudoroegneria spicata* is the dominant grass. *Koeleria macrantha (= Koeleria cristata)* and *Poa secunda* are commonly also present. Forbs are less abundant but can include *Phlox hoodii, Linum perenne, Sedum lanceolatum, Eriogonum umbellatum*, and *Arenaria congesta*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from 2273-2407 m (7460-7900 feet) in elevation on moderate to somewhat steep slopes. Sites include low, mid and high slopes, boulderfields and colluvial slopes. Soils are well-drained sandy clay and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This shrub herbaceous association is characterized by an open (5-35% cover) short-shrub layer dominated by *Artemisia arbuscula* ssp. *arbuscula* with a moderately dense (25-45% cover) herbaceous layer dominated by *Pseudoroegneria spicata* and *Poa fendleriana*. Other shrub species that may be present at lower cover include *Tetradymia canescens, Purshia glandulosa, Eriogonum microthecum, Mahonia repens*, and *Cercocarpus intricatus*. A variety of forbs may be present and include *Achillea millefolium, Allium bisceptrum, Comandra umbellata* ssp. *pallida, Crepis occidentalis, Cryptantha humilis, Descurainia sophia, Eriogonum caespitosum, Hackelia patens, Lathyrus brachycalyx, Penstemon watsonii, Petradoria pumila, Phlox stansburyi*, and *Sedum lanceolatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia arbuscula* ssp. *arbuscula*
Herb (field)	Graminoid	*Poa fendleriana*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia arbuscula* ssp. *arbuscula*, *Pseudoroegneria spicata*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Descurainia sophia* (exotic/invasive, Medium/Low

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: This association includes dwarf-shrublands to grasslands and needs to be reviewed. Of the references listed below, only two (Tiedemann and Klock 1977, Schuller and Evans 1986) were not available to the Global description author. Available literature indicates this is an herbaceous shrubland, and no reference indicated these were grasslands.

Global Related Concepts:
- *Artemisia arbuscula - Agropyron - Festuca* SD-19-11 (Hall 1973) =
- *Artemisia arbuscula - Agropyron spicatum* Habitat Type (Zamora and Tueller 1973) =
- *Artemisia arbuscula / Agropyron spicatum* Community Type (Jensen et al. 1988a) =
- *Artemisia arbuscula / Agropyron spicatum* Community Type (Jensen et al. 1988b) =
- *Artemisia arbuscula / Agropyron spicatum* Habitat Type (Lewis 1975a) =
- *Artemisia arbuscula / Agropyron spicatum* Habitat Type (Mueggler and Stewart 1980) =
- *Artemisia arbuscula / Agropyron spicatum* Habitat Type (Hironaka et al. 1983) =
- *Artemisia arbuscula / Poa secunda* Community Type (Blackburn et al. 1971) =
- *Artemisia arbuscula/Pseudoroegneria spicata* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:IV.A.3.a. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This uncommon association is known from Cedar Spur and upper Ridge Creek.
Global Range: This association is known from central Oregon, southeastern Washington, northeastern Nevada, southeastern Idaho, western Wyoming and southeastern Montana. It may also occur in New Mexico.
Nations: US
States/Provinces: ID:S3, MT:S3, NM?, NV:S4S5, OR:S3, WA:S2, WY
Federal Lands: NPS (Craters of the Moon, Grand Teton, Great Basin, John Day Fossil Beds)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (3 plots): GRBA.038, GRBA.117, GRBA.612.
Local Description Authors: M. Hall
Global Description Authors: G. Kittel
References: Bell et al. 2009, Blackburn et al. 1971, Bourgeron and Engelking 1994, Cogan et al. 2005, Driscoll et al. 1984, Hall 1973, Hironaka et al. 1983, Jensen et al. 1988a, Jensen et al. 1988b, Kagan et al. 2004, Lewis 1975a, MTNHP 2002b, Mueggler and Stewart 1980, Peterson 2008, Schuller and Evans 1986, Tiedemann and Klock 1977, Western Ecology Working Group n.d., Zamora and Tueller 1973

Artemisia nova Shrubland Alliance
Black Sagebrush Shrubland Alliance
Identifier: A1105

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Dwarf Sage Shrubland & Steppe (M170)
Group	Intermountain Low & Black Sagebrush Shrubland & Steppe Group (G308)
Alliance	***Artemisia nova* Shrubland Alliance (A1105)**

GRBA COMPONENT ASSOCIATIONS

Association	*Artemisia nova / Achnatherum hymenoides* Shrubland(CEGL001422)
	Artemisia nova / Poa fendleriana Shrubland (CEGL002698)
	Artemisia nova / Pseudoroegneria spicata Shrubland (CEGL001424)

OTHER CLASSIFICATIONS

Ecological System	Great Basin Xeric Mixed Sagebrush Shrubland (CES304.774)

GRBA Biophysical Setting (BpS)	Black Sagebrush Shrubland (1079an)
NPS-VIP Map Unit	*Artemisia nova* Shrubland Alliance (S_ARNO)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: Associations within this alliance occur at intermediate elevations (1400-2500 m) in the Intermountain and Rocky Mountain West, a region of semi-arid, continental climate regime. Soils are typically young, shallow, coarse-textured, and often derived from calcareous parent materials. *Artemisia nova* associations occur on well-drained slopes and ridges and often grow with other *Artemisia* associations on deeper soils. In the Columbia River Basin, the vegetation in this alliance occupies the driest habitats of all the *Artemisia*-dominated alliances. This alliance is characterized by the dominance of the dwarf-shrub *Artemisia nova*, which must contribute at least 40% of the total shrub cover in any stand, and by cover of perennial graminoids that is typically less than 20%. Associated shrub species that occur in stands of this alliance include *Chrysothamnus viscidiflorus, Atriplex confertifolia, Artemisia tridentata, Artemisia arbuscula, Artemisia cana, Symphoricarpos oreophilus, Grayia spinosa, Purshia tridentata*, and *Gutierrezia sarothrae*. The ground layer is dominated by perennial bunch grasses which may exceed the height of the shrubs but typically have <20% total cover. Recurrent species include *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides), Achnatherum speciosum (= Stipa speciosa), Achnatherum thurberianum (= Stipa thurberiana), Hesperostipa comata (= Stipa comata), Elymus elymoides, Poa fendleriana*, *Poa secunda*, and *Koeleria macrantha*. In southern stands, *Bouteloua gracilis* and *Pleuraphis jamesii (= Hilaria jamesii)* may also be important. Common forbs include *Balsamorhiza sagittata, Senecio integerrimus, Packera multilobata (= Senecio multilobatus), Stenotus armerioides, Heterotheca villosa, Phlox hoodii, Sphaeralcea coccinea*, and *Castilleja angustifolia*. At the edges of intermountain basins, this alliance is usually contiguous with *Atriplex confertifolia* shrublands.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This shrubland alliance is known from lower elevations in the park ranging from 1854-2036 m (6085-6680 feet) on gentle to moderately steep slopes. Sites include remnant or current alluvial fans, benches, and slopes on all aspects. Substrates are typically alluvium, but less commonly colluvium. Soils are composed of moderately well-drained to rapidly drained sandy clay loam, loamy sand, silt loam, and silty clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This microphyllous dwarf-shrubland is characterized by an open to moderately dense short-shrub layer clearly dominated by *Artemisia nova*. Other shrubs, including *Artemisia tridentata, Atriplex canescens, Atriplex confertifolia, Chrysothamnus viscidiflorus, Ephedra nevadensis, Ephedra viridis, Gutierrezia sarothrae*, and *Opuntia erinacea*, may occur but are never codominant. Scattered *Pinus monophylla* and *Juniperus osteosperma* are common. The herbaceous layer is sparse to open and dominated by graminoids, including *Achnatherum hymenoides, Poa fendleriana*, or *Pseudoroegneria spicata*. Common forbs include *Arabis holboellii, Castilleja applegatei* ssp. *martinii, Cryptantha confertiflora, Cryptantha flavoculata, Cryptantha humilis, Descurainia sophia, Erigeron argentatus, Erigeron pumilus, Packera multilobata, Phacelia crenulata*, and *Streptanthus cordatus*. The exotic *Bromus tectorum* is common in stands and may codominate.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Dwarf-shrub	*Artemisia nova*
Herb (field)	Forb	*Arabis holboellii*
Herb (field)	Graminoid	*Achnatherum hymenoides*, *Poa fendleriana*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Arabis holboellii*, *Artemisia nova*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High), *Descurainia sophia* …

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (4-Jan-2011).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Mill Creek, Snake Creek, Big Wash Overlook, Shingle Creek, Pine Creek, Lincoln Canyon Creek, and Burnt Mill Canyon.
Global Range: Associations in this alliance occur in the mountains of the Mojave Desert, throughout the Great Basin, and east into western and central Wyoming, Montana, Colorado, Utah, and northwestern New Mexico. It also occurs in the upper Columbia River Basin of southeastern Idaho.
Nations: US
States/Provinces: CA, CO, ID, MT, NM, NV, OR, UT, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (15 plots): GRBA.023, GRBA.024, GRBA.026, GRBA.028, GRBA.033, GRBA.040, GRBA.069, GRBA.072, GRBA.073, GRBA.074, GRBA.114, GRBA.131, GRBA.721, GRBA.804, GRBA_AA_0318.
Local Description Authors: M.E. Hall
Global Description Authors: D. Sarr
References: Baker 1983c, Baker 1983d, Baker and Kennedy 1985, Barbour and Major 1977, Beatley 1976, Blackburn and Tueller 1970, Blackburn et al. 1968c, Blackburn et al. 1969d, Blackburn et al. 1971, Brotherson and Brotherson 1979, Caicco and Wellner 1983f, Chappell et al. 1997, Fautin 1946, Fisser 1962, Fisser 1970, Francis 1986, Heinze et al. 1962, Hironaka 1978, Hironaka et al. 1983, Hughes 1977, Jensen et al. 1988a, Johnston 1987, Leary and Peterson 1984, Lewis 1975a, Lucky McMine Application n.d., Milton and Purdy 1983, ORNHP unpubl. data, Peterson 1984, Rickard and Beatley 1965, Roberts et al. 1992, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Soil Conservation Service 1978, Tweit and Houston 1980, Western Ecology Working Group n.d., Zamora and Tueller 1973

M169. Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe

G303. Intermountain Dry Tall Sagebrush Shrubland

Artemisia tridentata **ssp.** ***tridentata / Agropyron cristatum*** **Semi-natural Shrubland [Park Special]**

Basin Big Sagebrush / Crested Wheatgrass Semi-natural Shrubland
Identifier: CEPS009566

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe (M169)
Group	Intermountain Dry Tall Sagebrush Shrubland Group (G303)
Alliance	Artemisia tridentata / Ruderal Understory Shrubland Alliance (A2039)
Association	***Artemisia tridentata*** **ssp.** ***tridentata /*** **Ruderal Understory Shrubland [Park Special] (CEPS009566)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
	Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)
GRBA Biophysical Setting (BpS)	Montane Sagebrush Steppe – upland (1126u)
NPS-VIP Map Unit	*Artemisia tridentata* ssp. *tridentata* Shrubland Complex (S_ARTR)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This shrubland association is known from elevations ranging from 1645-2298 m (5400-7540 feet) on flat to moderate slopes. Sites are typically disturbed and include alluvial benches, valley floors, midslopes and high slopes on substrates of alluvial deposits with some areas being seasonally flooded. Soils are well-drained and composed of sandy loam and sandy clay loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This microphyllous shrubland association is characterized by a sparse to open (5-30% cover) short-shrub layer of *Artemisia tridentata* ssp. *tridentata* with a sparse to moderately dense (5-40% cover) herbaceous layer dominated by the exotic grass *Agropyron cristatum*. Other shrub associates include *Ericameria nauseosa, Grayia spinosa, Gutierrezia sarothrae, Mahonia repens, Purshia glandulosa*, and *Rosa woodsii*. Herbaceous diversity is low and species may include *Achnatherum hymenoides, Elymus elymoides, Mentzelia albicaulis, Salsola paulsenii, Sisymbrium altissimum*, and *Streptanthus cordatus*. The exotic grass *Bromus tectorum* may occasionally be subdominant.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *tridentata*
Herb (field)	Graminoid	*Agropyron cristatum*

CHARACTERISTIC SPECIES

Great Basin National Park: *Agropyron cristatum*, *Artemisia tridentata* ssp. *tridentata*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Agropyron cristatum* (exotic/invasive, Medium/Low), *Bromus tectorum* (exotic/invasive, High), *Salsola paulsenii* (exotic/invasive, Low), *Sisymbrium altissimum* (exotic/invasive)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (15-Nov-2010).

CLASSIFICATION

Status: Nonstandard

ELEMENT DISTRIBUTION

Great Basin National Park Range: This shrubland is known from Mount Washington, Bald Mountain, Lincoln Peak, Baker Ridge, Wheeler Peak, and Pyramid Peak.
Global Range: This shrubland is known from Colorado Plateau and Great Basin and is likely more widespread in the intermountain western U.S.
Nations: US
States/Provinces: NV, UT
Federal Lands: NPS (Bryce Canyon, Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2009, and 2010 field data (4 plots): GRBA.017, GRBA.132, GRBA.430, GRBA.440.
Local Description Authors: M. Hall
Global Description Authors: K. A. Schulz
References: Western Ecology Working Group n.d.

Artemisia tridentata Dry Shrubland Alliance [Provisional]
Big Sagebrush Dry Shrubland Alliance
Identifier: A2113

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe (M169)
Group	Intermountain Dry Tall Sagebrush Shrubland (G303)
Alliance	***Artemisia tridentata* Dry Shrubland Alliance [Provisional] (A2113)**

GRBA COMPONENT ASSOCIATIONS

Association	*Artemisia tridentata / Elymus elymoides* Shrubland (CEGL001001)
	Artemisia tridentata ssp. *tridentata / Pleuraphis jamesii* Shrubland (CEGL001015)
	Peraphyllum ramosissimum - Artemisia tridentata Shrubland(CEGL005430)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)
	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
GRBA Biophysical Setting (BpS)	Montane Sagebrush Steppe – upland (1126u)
NPS-VIP Map Unit	*Artemisia tridentata* ssp. *tridentata* Shrubland Complex (S_ARTR)
	Cercocarpus intricatus – (*Peraphyllum ramosissimum*) Shrubland Complex (S_CIPR)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from elevations ranging from 2165-2023 m (6640-7101 feet) on gentle to very steep slopes. Sites include channel beds, stream terraces and talus slopes. Parent materials may be colluvial or alluvial with soils that are well- to rapidly drained silt loam, sandy clay loam, and loamy sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by a sparse to open (10-40% cover) shrub layer dominated by *Artemisia tridentata* or codominated by *Peraphyllum ramosissimum*. Scattered *Juniperus osteosperma* and *Pinus monophylla* individuals are common. Other common shrub species include *Artemisia nova, Cercocarpus ledifolius, Ephedra viridis, Ericameria nauseosa, Gutierrezia sarothrae*, and *Opuntia polyacantha*. The herbaceous layer is grassy with bunch grasses *Achnatherum hymenoides, Elymus elymoides, Elymus lanceolatus*, and *Poa fendleriana* dominating. *Bromus tectorum* is a frequent invader and dominates some stands. No forbs have significant cover or high frequency.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Peraphyllum ramosissimum*
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata*
Herb (field)	Graminoid	*Elymus elymoides*, *Elymus lanceolatus*, *Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata*, *Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Chinese Wall, Mount Washington, between Snake Creek and Big Wash, south of Brown Lake, Baker Lake, Pole Canyon, and Highland Ridge.
Nations: CA?, US
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (4 plots): GRBA.261, GRBA.407, GRBA.409, GRBA.801.
Local Description Authors: M. Hall
References: Faber-Langendoen et al. 2011

G302. Intermountain Mesic Tall Sagebrush Shrubland & Steppe Group

Artemisia tridentata ssp. *tridentata / Leymus cinereus* Shrubland
Basin Big Sagebrush / Great Basin Wildrye Shrubland
Identifier: CEGL001016

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe (M169)
Group	Intermountain Mesic Tall Sagebrush Shrubland & Steppe Group (G302)
Alliance	*Artemisia tridentata* ssp. *tridentata* Mesic Shrubland (A1992)
Association	***Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Shrubland (CEGL001016)**

OTHER CLASSIFICATIONS

Ecological Systems	Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)
	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

GRBA Biophysical Setting (BpS)	Montane Sagebrush Steppe – upland (1126u) Basin wildrye (1126bw), Class C
NPS-VIP Map Unit	*Artemisia tridentata* ssp. *tridentata* Shrubland Complex (S_ARTR)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This widely distributed sagebrush shrubland is a transitional community found on floodplains, terraces of perennial streams and along the edges of seasonally flooded washes and gullies of the high desert steppe of the western United States or associated relatively mesic upland sites (swales) with high water tables. Elevations range from 1600 to 2170 m (5250-7120 feet). On terraces, slopes are level to gentle, and the substrate is alluvium or loess. Mesic upland site are gentle to steep, with substrates derived from shale and sandstone. Soils generally have silty or clay loam textures and are moderately well-drained. Stands of this association are characterized by a shrub layer dominated by *Artemisia tridentata* ssp. *tridentata* standing 1-3 m tall and an herbaceous layer dominated by *Leymus cinereus* 0.5-1.5 m tall. Some stands may take the form of a *Leymus cinereus* grassland with *Artemisia tridentata* ssp. *tridentata* on the margins, but more often stands are shrublands with grass growing in openings between shrub canopies. Total vegetation cover ranges from 20 to 90%. *Sarcobatus vermiculatus* and *Ericameria nauseosa (= Chrysothamnus nauseosus)* may also be present in the shrub stratum. *Leymus cinereus* dominates the understory with 15 to 90% cover. Various other grasses are likely to be present, including *Bromus tectorum, Distichlis spicata*, and other grasses associated with more mesic or riparian environments. Forbs species vary among sites.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging from 2203-2670 m (7230-8757 feet) on flat and somewhat steep slopes usually on relatively mesic sites. Topographic positions include high slopes on east and southeast aspects and low-level flat areas. Substrates include well- to rapidly drained sandy loam derived of quartzite and alluvium.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to moderately dense (10-40% cover) short-shrub layer of *Artemisia tridentata* ssp. *tridentata* and *Artemisia tridentata* ssp. *wyomingensis*. Scattered individuals of *Juniperus osteosperma* may be present. Other common shrubs include *Chrysothamnus viscidiflorus, Ephedra viridis, Eriogonum microthecum, Gutierrezia sarothrae, Mahonia repens, Rosa woodsii*, and *Symphoricarpos oreophilus*. The herbaceous layer is open to dense and dominated by *Leymus cinereus*, although *Comandra umbellata* codominates in one stand. Other graminoids include *Poa fendleriana, Poa glauca*, and *Bromus carinatus (=Bromus marginatus)*. Forb diversity is high and species include *Agoseris glauca, Allium bisceptrum, Arabis holboellii, Artemisia ludoviciana, Astragalus piutensis, Calochortus nuttallii, Castilleja linariifolia, Collinsia linearis, Crepis acuminata, Crepis intermedia, Melica bulbosa*, and *Polygonum douglasii* ssp. *johnstonii*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	Forb	*Comandra umbellata*
Herb (field)	Graminoid	*Leymus cinereus*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata* ssp. *tridentata*, *Artemisia tridentata* ssp. *wyomingensis*, *Leymus cinereus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Collinsia linearis* (endemic, G3?); **Exotic/Invasive**: *Poa pratensis* (exotic/invasive, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (7-Apr-1998). This plant association was formerly widespread in the western United States but is now rare due to habitat loss and degradation of stands. The association is believed to be extirpated in Washington. In other western states, high-quality examples are of rare occurrence, and most stands are small and fragmented. Livestock use has reduced the quality of stands and continues to threaten remaining occurrences. Agricultural conversion has also eliminated habitat previously occupied by the association. Exotic species, including *Poa pratensis* or *Bromus tectorum*, may become locally dominant, nearly replacing the diagnostic graminoid. Incision of smaller streams and intermittent drainages throughout the West also has affected this association by dropping the water table and causing stands to dry out to the point that they will no longer support *Leymus cinereus*.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Related Concepts:
- *Artemisia tridentata / Elymus cinereus* Plant Association (Johnston 1987) >
- *Artemisia tridentata* ssp. *tridentata/Leymus cinereus* (Bourgeron and Engelking 1994) =
- *Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Habitat Type (Hess 1981) =
- *Artemisia tridentata* ssp. *tridentata / Leymus cinereus* Habitat Type (Wasser and Hess 1982) =
- DRISCOLL FORMATION CODE:III.A.2.b. (Driscoll et al. 1984) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This shrubland association is know from mesic areas north of Baker Creek and below Horse Heaven, and a stream terrace along North Fork Big Wash.
Global Range: This was formerly a widespread association in the western United States. Today it is known from California to Washington and east to Montana and Colorado.
Nations: US
States/Provinces: CA:S1, CO:S1, ID:S1, MT:S1, NV, OR:S2, WA:S1, WY:S1S2
Federal Lands: NPS (Craters of the Moon, Dinosaur, Fossil Butte, Great Basin, John Day Fossil Beds); USFS (Arapaho-Roosevelt, Shoshone)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003and 2009 field data (3 plots): GRBA.403, GRBA.731, GRBA.811.
Local Description Authors: M. Hall
Global Description Authors: M. Jankovsky-Jones, mod. J. Coles and K.A. Schulz
References: Baker 1982b, Baker 1983b, Bell et al. 2009, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Coles et al. 2008a, Driscoll et al. 1984, Hess 1981, IDCDC 2005, Johnston 1987, Jones and Fertig 1996, Jones and Ogle 2000, Kagan et al. 2004, Kittel et al. 1994, Kittel et al. 1999a, MTNHP 2002b, Peterson 2008, Walford 1996, Wasser and Hess 1982, Western Ecology Working Group n.d.

G304. Intermountain Mountain Big Sagebrush Shrubland & Steppe Group

Artemisia tridentata ssp. *vaseyana* Shrubland Alliance
Mountain Big Sagebrush Shrubland Alliance
Identifier: A0831

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe (M169)
Group	Intermountain Mountain Big Sagebrush Shrubland & Steppe Group (G304)
Alliance	***Artemisia tridentata*** **ssp.** ***vaseyana*** **Shrubland Alliance (A0831)**

GRBA COMPONENT ASSOCIATIONS

Association	*Artemisia tridentata* ssp. *vaseyana - Symphoricarpos oreophilus / Elymus trachycaulus* ssp. *trachycaulus* Shrubland (CEGL001034)
	Artemisia tridentata ssp. *vaseyana - Symphoricarpos oreophilus / Pseudoroegneria spicata* Shrubland (CEGL001038)
	Artemisia tridentata ssp. *vaseyana / Poa (glauca, secunda)* Shrubland (CEGL005423)
	Artemisia tridentata ssp. *vaseyana / Poa fendleriana* Shrubland (CEGL002812)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
GRBA Biophysical Setting (BpS)	Montane Sagebrush Steppe – upland (1126u)
	Montane Sagebrush Steppe-mountain (>9500’) (1126m)
NPS-VIP Map Unit	*Artemisia tridentata* ssp. *vaseyana* / Grass Understory Shrubland Complex (S_ARTRV)
	Artemisia tridentata ssp. *vaseyana* - *Symphoricarpos oreophilus* Shrubland Alliance (S_ARTSY)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This alliance is widespread in mountainous areas across the western U.S. The alliance forms large, continuous stands on mid-elevation mountain slopes and foothills, and can extend above the lower treeline as patches within montane or subalpine coniferous forests. Sites are variable and range from flats to steep slopes to ridgetops with deep to shallow rocky soil. The vegetation included in this alliance is characterized by a moderate to dense shrub layer in which *Artemisia tridentata* ssp. *vaseyana* is either dominant or contributes >40% to the total sagebrush shrub cover. Other shrub species present may include *Artemisia rigida, Artemisia arbuscula, Chrysothamnus* spp., *Symphoricarpos oreophilus, Purshia tridentata, Ribes cereum, Rosa woodsii, Ceanothus velutinus*, and *Amelanchier alnifolia*. Perennial graminoids typically dominate the herbaceous layer, but their total cover is generally <20%. Total herbaceous cover can be higher, depending on the density of the shrub layer and environmental factors. The most widespread species are *Pseudoroegneria spicata* and *Festuca idahoensis*, which occur from the Columbia Basin to the northern Rockies, although they may not be the most abundant species in individual stands. Other locally important species may include *Leymus cinereus, Leucopoa kingii (= Festuca kingii), Festuca thurberi, Festuca viridula, Pascopyrum smithii, Bromus carinatus (=Bromus marginatus), Elymus trachycaulus, Koeleria macrantha, Achnatherum occidentale (= Stipa occidentalis), Poa fendleriana, Poa secunda*, and *Bouteloua gracilis*. The forb layer is variable and can be very diverse. Species of *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus*, and *Eriogonum* are characteristic. Other common forbs include *Balsamorhiza* *sagittata, Achillea millefolium, Antennaria rosea*, and *Eriogonum umbellatum*. Diagnostic of this shrubland alliance is the *Artemisia tridentata* ssp. *vaseyana* dominating the shrub layer or with >40% relative cover, and total perennial graminoid cover typically less than 20%.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from elevations ranging from 2292-3014 m (7520-9885 feet) on gentle to steep slopes. Sites are variable from upland to palustrine and include basin floor, low to high slopes, valley floors, channel beds, saddles, stream benches, ridges and summits. Parent materials may consist of colluvium, alluvium or glacial deposits. Soils are moderately well-drained to rapidly drained sandy loam, silty clay, clay loam, silt loam, silty clay loam, and loamy sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by an open to dense (15-60% cover) short-shrub layer dominated by *Artemisia tridentata* ssp. *vaseyana* often codominant with *Symphoricarpos oreophilus*. Scattered individuals of *Abies concolor, Picea engelmannii, Pinus flexilis*, and *Pinus monophylla* are common. Other common shrub associates include *Amelanchier utahensis, Artemisia frigida, Artemisia tridentata* ssp. *tridentata, Artemisia tridentata* ssp. *wyomingensis, Chrysothamnus viscidiflorus, Eriogonum microthecum, Gutierrezia sarothrae, Mahonia repens*, and *Opuntia erinacea*. Understories are characteristically dominated by bunch grasses and may form a sparse to dense (up to 70% cover) herbaceous layer. Dominant grasses include *Elymus trachycaulus* ssp. *trachycaulus, Pseudoroegneria spicata, Poa secunda, Poa glauca*, and *Poa fendleriana*. Common forbs include *Arabis holboellii, Castilleja linariifolia, Collinsia parviflora, Comandra umbellata, Crepis occidentalis, Erigeron jonesii, Eriogonum racemosum, Fritillaria atropurpurea, Hackelia patens, Lomatium foeniculaceum, Lupinus argenteus, Penstemon watsonii*, and *Senecio integerrimus*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos oreophilus*
Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	Graminoid	*Elymus trachycaulus* ssp. *trachycaulus*, *Poa fendleriana*, *Poa glauca*, *Poa secunda*, *Pseudoroegneria spicata*

CHARACTERISTIC SPECIES

Great Basin National Park: *Artemisia tridentata* ssp. *vaseyana*, *Elymus trachycaulus* ssp. *trachycaulus*, *Poa fendleriana*, *Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CLASSIFICATION

Global Related Concepts:

- Big Sagebrush Series (Sawyer and Keeler-Wolf 1995) ><
- SRM Cover Type #402 - Mountain Big Sagebrush (Shiflet 1994) =
- Western Shrub and Grasslands Combinations: 55: Sagebrush-Steppe (*Artemisia-Agropyron*) (Kuchler 1964) ><
- Western Shrub: 38: Great Basin Sagebrush (*Artemisia*) (Kuchler 1964) ><

ELEMENT DISTRIBUTION

Great Basin National Park Range: This shrubland alliance is widespread at middle and upper elevations and is known from the Strawberry Creek area south to Pole Canyon, Baker Creek, Snake Creek, Horse Heaven, Lexington Arch, and Decathon Road.
Global Range: This shrubland alliance occurs in mountainous regions from eastern California, Oregon, and Washington, across the Great Basin in Nevada, the northern Rocky Mountain foothills of Idaho, and in Colorado, Wyoming, and Montana. It has not been reported from Utah, Arizona, or New Mexico, but it is very likely to occur in these states at high elevations. In addition, the alliance probably extends north into Alberta, Canada.
Nations: CA?, US
Federal Lands: NPS (Black Canyon of the Gunnison, Bryce Canyon, Capitol Reef, Craters of the Moon, Curecanti, Dinosaur, Fossil Butte, Grand Teton, Great Basin, Rocky Mountain, Yosemite, Zion); USFS (Arapaho-Roosevelt, Bighorn, Bridger-Teton, Deschutes, Gunnison, Medicine Bow, Routt, Shoshone, White River NF)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (23 plots): GRBA.050, GRBA.051, GRBA.098, GRBA.099, GRBA.100, GRBA.127, GRBA.246, GRBA.247, GRBA.248, GRBA.251, GRBA.420, GRBA.510, GRBA.515, GRBA.516, GRBA.706, GRBA.716, GRBA.718, GRBA.725, GRBA.726, GRBA.727, GRBA.728, GRBA.737, GRBA.749
Local Description Authors: M. Hall
Global Description Authors: D. Sarr, mod. M.S. Reid
References: Baker 1983c, Baker and Kennedy 1985, Boyce 1977, Bramble-Brodahl 1978, Caicco and Wellner 1983a, Chappell et al. 1997, Cooper et al. 1999, Current 1984, Faber-Langendoen et al. 2011, Francis 1983, Giese 1975, Hess 1981, Hess and Wasser 1982, Hironaka et al. 1983, Jensen et al. 1988a, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Komarkova 1986, Kuchler 1964, Lewis 1971, Lewis 1975a, McArthur and Welch 1986, Mooney 1985, Nelson and Jensen 1987, ORNHP unpubl. data, Rzedowski 1981, Sawyer and Keeler-Wolf 1995, Shiflet 1994, Smith 1966, Tart 1996, Terwilliger and Smith 1978, Terwilliger and Tiedemann 1978, Tiedemann et al. 1987, Tueller and Eckert 1987, West 1983c, Winward 1970

***Amelanchier utahensis* - *Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland**

Utah Serviceberry - (Mountain Big Sagebrush, Wyoming Big Sagebrush) Shrubland
Identifier: CEGL002820

REVISED USNVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Tall Sagebrush Shrubland & Steppe (M169)
Group	Intermountain Mountain Big Sagebrush Shrubland & Steppe Group (G304)
Alliance	*Artemisia tridentata* ssp. *vaseyana* – Mixed Shrubland Alliance (A0831)
Association	***Amelanchier utahensis* - *Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland (CEGL002820)**

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
GRBA Biophysical Setting (BpS)	Montane Steppe (1126ms)
NPS-VIP Map Unit	*Amelanchier utahensis - (Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland (S_AMARTV)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This association has been described from Dinosaur National Monument, the Roan Plateau and the Piceance Basin in northwestern Colorado and adjacent Utah. It also occurs in southwestern Wyoming and Nevada. Sites are on level to moderately sloping hills, valleys and benches. Elevation ranges from 2165 to 2600 m, and stands may be oriented to any aspect. The deep, well-drained soils are derived from sandstone, shale, loess or limestone and range in texture from clay loam and silt loam to loamy sand. Organic litter is typically a significant component of the ground surface cover. The vegetation is characterized by the codominance in the canopy of *Artemisia tridentata* (ssp. *vaseyana* or ssp. *wyomingensis*, or sometimes a hybrid of the two) and *Amelanchier utahensis* with 15 to 55% total cover. It often takes the appearance of a tall shrubland type in which clumps of serviceberry grow in a matrix of sagebrush. Although serviceberry and sagebrush are visually dominant, in some stands *Symphoricarpos oreophilus* may have the highest cover of the three shrub species. *Chrysothamnus viscidiflorus, Mahonia repens*, and *Purshia tridentata* may be minor components of the shrub canopy. *Quercus gambelii*, if present, has less than 1% cover. Graminoids tend to dominate the well-developed herbaceous layer; typical species are *Pascopyrum smithii (= Agropyron smithii), Melica spectabilis (= Bromelica spectabilis), Carex geyeri, Koeleria macrantha, Poa fendleriana, Achnatherum nelsonii* ssp. *dorei (= Stipa columbiana), Hesperostipa comata (= Stipa comata)*, and *Achnatherum lettermanii (= Stipa lettermanii)*. The forb component of the understory is usually diverse and may contribute significant cover, especially in stands that have been grazed. *Achillea millefolium, Balsamorhiza sagittata, Comandra umbellata, Crepis acuminata, Eriogonum umbellatum, Lathyrus lanszwertii var. leucanthus (= Lathyrus leucanthus), Lupinus argenteus, Penstemon caespitosus, Sphaeralcea coccinea*, and *Viola nuttallii* are common species. *Poa pratensis* may be the dominant grass in areas that have a history of grazing.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This association is known from elevations ranging from 2390-2506 m (7839-8219 feet) on moderate to steep slopes. Sites include south- and southeast-facing mid and lower slopes on rocky substrates such as colluvium, bedrock and till. Soils are well-drained and composed of sandy loam, silty loam, and loamy sand.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by an open to dense tall-shrub layer dominated by *Amelanchier arborea* and a open short-shrub layer of *Artemisia tridentata* ssp. *tridentata*. Other common shrubs include *Chrysothamnus viscidiflorus, Eriogonum microthecum, Mahonia repens, Opuntia polyacantha, Rosa woodsii*, and *Symphoricarpos oreophilus*. The herbaceous layer is dominated by graminoids including *Poa fendleriana, Poa secunda*, and on more disturbed sites, the exotic *Bromus tectorum* may invade stands. Forb diversity may be high and include *Hackelia patens, Packera multilobata, Arabis holboellii, Astragalus tenellus, Calochortus nuttallii, Chaenactis douglasii, Collinsia parviflora, Comandra umbellata, Crepis occidentalis, Cryptantha confertiflora, Cryptantha humilis, Descurainia pinnata, Erigeron divergens, Eriogonum racemosum, Linum lewisii, Lithospermum ruderale, Lupinus argenteus, Lupinus caudatus, Mentzelia albicaulis, Penstemon eatonii, Penstemon speciosus*, and *Penstemon watsonii*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Amelanchier arborea*

Short shrub/sapling	Broad-leaved evergreen shrub	*Artemisia tridentata* ssp. *tridentata*
Herb (field)	Graminoid	*Poa fendleriana*, *Poa secunda*

CHARACTERISTIC SPECIES

Great Basin National Park: *Amelanchier arborea*, *Artemisia tridentata* ssp. *tridentata*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Bromus tectorum* (exotic/invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (12-Jul-2005).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: There is some overlap between this community and the various sagebrush - snowberry associations in the IVC, but the codominance of *Artemisia tridentata* and *Amelanchier utahensis* distinguishes it from them. This association is not ecotonal between sagebrush shrublands and mixed mountain shrublands; instead, it appears to occupy its own habitat and can cover extensive areas.

Global Related Concepts:

- Mixed Montane Shrublands (Keammerer and Stoecker 1975) >
- Serviceberry - Sagebrush Shrubland (Keammerer and Peterson 1981) =
- Upland Sagebrush Community (Keammerer and Stoecker 1975) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This shrubland is known from Snake Creek and Big Wash.

Global Range: This association is currently known from the highlands of Dinosaur National Monument and Black Canyon of the Gunnison National Park, as well as the Roan Plateau and Piceance Basin in northwestern Colorado and northeastern Utah. It also occurs at Fossil Butte National Monument in southwestern Wyoming and is likely more widespread.

Nations: US

States/Provinces: CO, NV, UT, WY

Federal Lands: NPS (Black Canyon of the Gunnison, Curecanti, Dinosaur, Fossil Butte, Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (3 plots): GRBA.044, GRBA.313, GRBA.703.

Local Description Authors: M. Hall

Global Description Authors: J. Coles, mod. K.A. Schulz

References: Coles et al. 2008a, Coles et al. 2010, Keammerer and Peterson 1981, Keammerer and Stoecker 1975, Western Ecology Working Group n.d.

4. POLAR & HIGH MONTANE SCRUB& GRASSLAND

4.B.1. Alpine Scrub, Forb Meadow & Grassland

4.B.1.Nb. Western North American Alpine Scrub, Forb Meadow & Grassland

M099. Rocky Mountain Alpine Scrub, Forb Meadow & Grassland

G316. Rocky Mountain Alpine Dwarf-Shrubland Group

Ribes (cereum, montigenum) - Ericameria discoidea Shrubland [Provisional]

(Wax Currant, Western Prickly Gooseberry) - White-stem Goldenbush Shrubland
Identifier: CEGL005445

REVISED USNVC CLASSIFICATION

Division	Western North American Alpine Scrub, Forb Meadow & Grassland (4.B.1.Nb)
Macrogroup	Rocky Mountain Alpine Scrub, Forb Meadow & Grassland (M099)
Group	Rocky Mountain Alpine Dwarf-Shrubland (G316)
Alliance	*Ribes montigenum* Shrubland Alliance (A0926)
Association	***Ribes (cereum, montigenum) - Ericameria discoidea* Shrubland [Provisional] (**CEGL005445)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine Turf (CES306.816)
GRBA Biophysical Setting (BpS)	Limber-Bristlecone Pine Woodland – mesic (1020m), Class A Spruce (1056), Class A Alpine (1144), Class B
NPS-VIP Map Unit	*Ribes montigenum* (*Juniperus communis*) Shrubland Complex (S_RMJC)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This high-elevation shrubland association is known from 3107-3462 m (10,190-11,355 feet) on moderate to somewhat steep slopes. Sites include high slopes and avalanche chutes on rocky substrates that include colluvium, bedrock and till. Soils are well-drained to rapidly drained soils composed of loamy sand and silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This association is characterized by a sparse to open short- or dwarf-shrub layer dominated by *Ribes montigenum, Ribes cereum*, and *Ericameria discoidea*. Scattered trees, including *Picea engelmannii* and *Pinus flexilis*, may be present. The only other shrubs documented include *Juniperus communis* and *Ceanothus martinii*. The herbaceous layer is sparse to open and diverse. Common species include *Arenaria congesta, Artemisia michauxiana, Astragalus kentrophyta var. tegetarius, Elymus elymoides, Erigeron tener, Eriogonum umbellatum, Monardella odoratissima, Phlox pulvinata, Poa fendleriana, Poa secunda, Trifolium gymnocarpon*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Ericameria discoidea*, *Ribes cereum*, *Ribes montigenum*
Herb (field)	Graminoid	*Poa fendleriana*

CHARACTERISTIC SPECIES

Great Basin National Park: *Ericameria discoidea*, *Ribes cereum*, *Ribes montigenum*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Exotic/Invasive: *Taraxacum officinale* (exotic/invasive)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Dec-2010).

CLASSIFICATION

Status: Provisional

ELEMENT DISTRIBUTION

Great Basin National Park Range: This association is known from Wheeler Peak, Bald Mountain and Lincoln Peak.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (4 plots): GRBA.208, GRBA.231, GRBA.325, GRBA.503.
Local Description Authors: M.E. Hall
References: Western Ecology Working Group n.d.

G314. Rocky Mountain Alpine Turf & Fell-Field

***Carex elynoides - Kobresia myosuroides - Phlox pulvinata* Alpine Turf & Fell-Field Group**
Blackroot Sedge - Pacific Bog Sedge - Cushion Phlox Alpine Turf & Fell-Field Group
Identifier: G314

REVISED USNVC CLASSIFICATION

Division	Western North American Alpine Scrub, Forb Meadow & Grassland (4.B.1.Nb)
Macrogroup	Rocky Mountain Alpine Scrub, Forb Meadow & Grassland (M099)
Group	**Rocky Mountain Alpine Turf & Fell-Field (G314)**
Group (Scientific)	***Carex elynoides - Kobresia myosuroides - Phlox pulvinata* Alpine Turf & Fell-Field Group (G314)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	*Aquilegia scopulorum - Eriogonum holmgrenii - Geum rossii* Alpine Fell-field Herbaceous Alliance (A2702)
Association	*Aquilegia scopulorum - Eriogonum holmgrenii* Fell-field Herbaceous Vegetation (CEGL005421)
	Astragalus kentrophyta - Eriogonum holmgrenii Fell-field Herbaceous Vegetation [Park Special] (CEPS009597)
	Cymopterus nivalis - Erigeron leiomerus - Poa secunda Herbaceous Vegetation [Park Special] (CEPS009600)
	Geum rossii - Phlox pulvinata Fell-field Herbaceous Vegetation (CEGL005428)
Alliance	*Carex elynoides* Herbaceous Alliance (A1303)
Association	*Carex elynoides - Geum rossii* Herbaceous Vegetation (CEGL001853)
	Carex elynoides - Phlox pulvinata - Poa secunda Herbaceous Vegetation (CEGL005424)
Alliance	*Geum rossii* Herbaceous Alliance (A1645)
Associatin	*Geum rossii - Calamagrostis purpurascens* Herbaceous Vegetation [Park Special] (CEPS009602)
	Geum rossii Herbaceous Vegetation (CEGL001964)
Alliance	*Lomatium graveolens* var. *alpinum* Herbaceous Alliance [Placeholder] (A2045)
Association	*Lomatium graveolens* var. *alpinum* Herbaceous Vegetation [Park Special] (CEGL002740)
Alliance	*Phlox pulvinata* Herbaceous Alliance (A1651)

Association *Phlox pulvinata* Herbaceous Vegetation [Provisional] (CEGL002740)

OTHER CLASSIFICATIONS

Ecological Systems	Rocky Mountain Alpine Fell-Field (CES306.811) Rocky Mountain Alpine Turf (CES306.816)
GRBA Biophysical Setting (BpS)	Alpine (1144)
NPS-VIP Map Units	Alpine Cushion Plant Fell-field Complex (SV_FELL) Alpine Turf Complex (H_TURF)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This widespread group occurs at and above upper treeline throughout the Rocky Mountain cordillera and alpine areas of mountain ranges in Utah and Nevada, and isolated alpine sites in the northeastern Cascades. It includes both wind-scoured fell-fields and dry turf. Fell-fields are typically free of snow during the winter as they are found on ridgetops, upper slopes and exposed saddles, whereas dry turf is found on gentle to moderate slopes, flat ridges, valleys, and basins where the soil has become relatively stabilized and the water supply is more-or-less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. Fell-field substrates are generally shallow, stony, low in organic matter, and poorly developed with wind deflation often resulting in a gravelly pavement. Alpine turf sites have deeper, more developed soils, although there may be moderately high cover of cobbles and boulders present.

The vegetation is generally composed of low-growing perennial forbs and graminoids. On fell-field sites, total vegetation cover ranges from sparse to moderate cover dominated by cushion plants, whereas on turf sites, it ranges from open to moderately dense or dense cover dominated by graminoids or a mixture of graminoids and forbs (especially cushion plants). The graminoids are typically rhizomatous, sod-forming sedges such as *Carex elynoides, Carex scirpoidea, Carex siccata, Carex nardina, Carex rupestris*, and *Kobresia myosuroides*. Most fell-field plants are cushioned or matted, frequently succulent, flat to the ground in rosettes, and often densely haired and thickly cutinized. Common species include *Arenaria capillaris, Geum rossii, Minuartia obtusiloba, Myosotis asiatica, Paronychia pulvinata, Phlox pulvinata, Silene acaulis, Trifolium dasyphyllum*, and *Trifolium parryi*. Many other graminoids, forbs, and prostrate shrubs can also be found, including *Calamagrostis purpurascens, Deschampsia caespitosa, Dryas octopetala, Festuca brachyphylla, Festuca idahoensis, Leucopoa kingii, Poa arctica, Poa glauca, Poa secunda* (Great Basin), *Saxifraga* spp., *Selaginella densa, Solidago* spp., and *Polygonum bistortoides*. Fell-fields are usually found within or adjacent to alpine dry turf with many of the same prostrate and mat-forming plants found in both, frequently with broad transition zones.

Although alpine dry turf may form the matrix or large patches of the alpine zone, it typically intermingles with alpine bedrock and scree, ice field, fell-field, alpine dwarf-shrubland, and alpine/subalpine wet meadow systems. Great Basin alpine areas tend to be drier with smaller turf patches and include some species common in desert scrub such as *Poa secunda*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This group is known from elevations ranging from 3043-3981 m (9981-13,057 feet) on gentle to steep slopes. Sites include exposed and windswept midslopes, high slopes, swales, benches, ridges and summits on rocky substrates including colluvium, glacial deposits and bedrock. The system may be classified as upland or palustrine. Soils are

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This group is represented by forb, graminoid or mixed forb/graminoid herbaceous associations which may be very sparse to dense with up to 80% herbaceous cover. Woody species are almost nonexistent, but an occasional tree or shrub may be present. Dominant species include *Aquilegia scopulorum, Astragalus platytropis, Calamagrostis purpurascens, Carex elynoides, Castilleja nana, Cymopterus nivalis, Erigeron leiomerus, Eriogonum holmgrenii, Festuca brachyphylla, Geum rossii, Packera werneriifolia, Phlox pulvinata, Poa secunda, Potentilla rubricaulis, Selaginella watsonii*, and *Silene acaulis*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Aquilegia scopulorum*, *Astragalus platytropis*, *Eriogonum holmgrenii*, *Geum rossii*, *Monardella odoratissima*, *Phlox pulvinata*
Herb (field)	Graminoid	*Calamagrostis purpurascens*, *Carex elynoides*, *Poa secunda*

CHARACTERISTIC SPECIES

Great Basin National Park: *Aquilegia scopulorum*, *Astragalus platytropis*, *Calamagrostis purpurascens*, *Eriogonum holmgrenii*, *Geum rossii*, *Monardella odoratissima*, *Phlox pulvinata*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Aquilegia scopulorum* (endemic, G3?), *Eriogonum holmgrenii* (endemic, G1)

CLASSIFICATION

Classification Confidence: 2 - Moderate

Global Comments: Alpine turf and fell-field are included together for several reasons. Although these types can be quite different and can have relatively abrupt boundaries in saddles, there is often a long transition on broad alpine slopes.

Global Related Concepts:

- AT Alpine Tundra (mesic to dry sites) (Ecosystems Working Group 1998) >
- Alpine Rangeland (410) (Shiflet 1994) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alpine group is known from high-elevation sites on Bald Mountain, Baker Ridge, Pyramid Peak, Mount Washington, Lincoln Peak, and Highland Ridge.

Global Range: This group occurs above upper treeline throughout the North American Rocky Mountain cordillera, including alpine areas of ranges in the Great Basin, and isolated alpine sites in the northeastern Cascades.

Nations: CA, US

Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (17 plots): GRBA.196, GRBA.197, GRBA.198, GRBA.306, GRBA.307, GRBA.322,

GRBA.323, GRBA.324, GRBA.326, GRBA.327, GRBA.422, GRBA.424, GRBA.426, GRBA.428, GRBA.817, GRBA.901, GRBA.903.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Baker 1980a, Bamberg 1961, Bamberg and Major 1968, Billings 2000, Cooper et al. 1997, Ecosystems Working Group 1998, Faber-Langendoen et al. 2011, Komarkova 1976, Komarkova 1980, Shiflet 1994, Willard 1963, Zwinger and Willard 1996

Aquilegia scopulorum - Eriogonum holmgrenii - Geum rossii Alpine Fell-field Herbaceous Alliance

Utah Columbine - Snake Range Buckwheat - Ross' Avens Alpine Fell-field Herbaceous Alliance
Identifier: A2702

REVISED USNVC CLASSIFICATION

Division	Western North American Alpine Scrub, Forb Meadow & Grassland (4.B.1.Nb)
Macrogroup	Rocky Mountain Alpine Scrub, Forb Meadow & Grassland (M099)
Group	Rocky Mountain Alpine Turf & Fell-Field (G314)
Alliance	***Aquilegia scopulorum - Eriogonum holmgrenii - Geum rossii* Alpine Fell-field Herbaceous Alliance (A2702)**

GRBA COMPONENT ASSOCIATIONS

Association	*Aquilegia scopulorum - Eriogonum holmgrenii* Fell-field Herbaceous Vegetation (CEGL005421)
	Astragalus kentrophyta - Eriogonum holmgrenii Fell-field Herbaceous Vegetation [Park Special] (CEPS009597)
	Cymopterus nivalis - Erigeron leiomerus - Poa secunda Herbaceous Vegetation [Park Special] (CEPS009600)
	Geum rossii - Phlox pulvinata Fell-field Herbaceous Vegetation (CEGL005428)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine Fell-Field (CES306.811)
GRBA Biophysical Setting (BpS)	Alpine (1144)
NPS-VIP Map Unit	Alpine Cushion Plant Fell-field Complex (SV_FELL)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This herbaceous alliance is known from alpine zones at elevations ranging from 3422-3535 m (11224-1160 feet) on moderate to somewhat steep slopes. Sites include high slopes, ridges and summits on all aspects. Substrates are very rocky and include bedrock, till and talus derived from quartzite sandstone, schist and limestone. Soils are thin and include moderately well-drained to rapidly drained sandy loam, silty clay, clay loam, and silt loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This alliance is characterized by a sparse to open herbaceous layer dominated mostly by forbs, including *Aquilegia scopulorum, Eriogonum holmgrenii, Geum rossii, Phlox pulvinata, Erigeron leiomerus, Astragalus kentrophyta, Cymopterus nivalis*, or in some cases the graminoid *Poa secunda*. Occasional stunted *Picea engelmannii* and *Pinus longaeva* may be present but scattered. The shrub layer is essentially absent. Other herbaceous species that may be present include *Castilleja nana, Carex elynoides, Cerastium beeringianum, Elymus scribneri, Erigeron compositus, Erigeron simplex, Festuca brachyphylla, Packera werneriifolia, Potentilla diversifolia, Potentilla rubricaulis, Primula nevadensis, Symphyotrichum foliaceum*, and *Trifolium gymnocarpon*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Aquilegia scopulorum*, *Astragalus kentrophyta*, *Cymopterus nivalis*, *Erigeron leiomerus*, *Eriogonum holmgrenii*, *Geum rossii*, *Phlox pulvinata*
Herb (field)	Graminoid	*Poa secunda*

CHARACTERISTIC SPECIES

Great Basin National Park: *Aquilegia scopulorum*, *Astragalus kentrophyta*, *Cymopterus nivalis*, *Erigeron leiomerus*, *Eriogonum holmgrenii*, *Geum rossii*, *Phlox pulvinata*, *Poa secunda*

OTHER NOTEWORTHY SPECIES

Great Basin National Park: Vulnerable: *Aquilegia scopulorum* (endemic, G3?), *Eriogonum holmgrenii* (endemic, G1), *Primula nevadensis* (endemic, G2)

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Mount Washington, Lincoln Peak, Baldy Point, and Pyramid Peak.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003, 2008 and 2009 field data (7 plots): GRBA.196, GRBA.197, GRBA.198, GRBA.306, GRBA.324, GRBA.422, GRBA.817.
Local Description Authors: M.E. Hall
References: Western Ecology Working Group n.d.

Carex elynoides Herbaceous Alliance

Blackroot Sedge Herbaceous Alliance
Identifier: A1303

REVISED USNVC CLASSIFICATION

Division	Western North American Alpine Scrub, Forb Meadow & Grassland (4.B.1.Nb)
Macrogroup	Rocky Mountain Alpine Scrub, Forb Meadow & Grassland (M099)
Group	Rocky Mountain Alpine Turf & Fell-Field (G314)
Alliance	***Carex elynoides* Herbaceous Alliance (A1303)**

GRBA COMPONENT ASSOCIATIONS

Association	*Carex elynoides - Geum rossii* Herbaceous Vegetation (CEGL001853)
	Carex elynoides - Phlox pulvinata - Poa secunda Herbaceous Vegetation (CEGL005424)

OTHER CLASSIFICATIONS

Ecological Systems	Rocky Mountain Alpine Turf (CES306.816)
GRBA Biophysical Setting (BpS)	Alpine (1144)
NPS-VIP Map Unit	Alpine Turf Complex (H_TURF)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: Vegetation types within this short alpine or subalpine sod grassland alliance occur on open, dry, windswept slopes at high elevations in the Rocky Mountains. Sites occupy gentle to moderately sloping (3-26%) upland terrain of southerly to easterly exposures at elevations ranging from 2400 to 4200 m. Stands are found on granitic or metamorphic colluvium. Soils are skeletal and loamy. Coarse fragments are abundant, and pH varies from 5.4 to 6.6. They are found on well-drained sites which receive little or no snow cover. Stands on Trail Ridge, Colorado, are free of snow and frost very early; plants were observed blooming in mid May. Most moisture is received from summer rains. *Carex elynoides* dominates the graminoid layer with at least 60% cover, forming an extensive turf. *Kobresia myosuroides* commonly occurs with *Carex elynoides* in the graminoid stratum. Typically the forb layer is conspicuous with at least 20% cover. Forb species include *Geum rossii, Trifolium dasyphyllum, Arenaria fendleri, Oreoxis alpina* (*Oreoxis bakeri* in New Mexico stands), *Potentilla diversifolia*, and *Phlox caespitosa*. *Selaginella densa* is commonly found in the fern layer.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known at Great Basin from elevations ranging from 3435-3520 m (11,226-11,545 feet) on gentle to steep slopes (9-70%). Topographic positions include high slopes, high levels and summits on southwest and north aspects. Substrates include loam and silt loam soils derived of quartzite and limestone.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This herbaceous alliance is characterized by open stands of *Carex elynoides* ranging from 20-40% cover. Trace cover of short shrubs *Ericameria discoidea* and *Ribes montigenum* may be present. Many other herbaceous species may be present but are never codominant. Graminoids may include *Poa secunda, Festuca brachyphylla, Poa glauca* spp. *rupicola, Elymus elymoides*, and *Elymus scribneri*. Forb diversity is high with the only constant species being *Phlox pulvinata*. Other forbs include *Geum rossii, Arenaria congesta, Potentilla glandulosa* spp. *nevadensis, Astragalus platytropis, Cymopterus nivalis, Erigeron leiomerus, Trifolium gymnocarpon, Androsace septentrionalis, Antennaria corymbosa, Antennaria microphylla, Antennaria rosea, Arabis drummondii*, and *Astragalus kentrophyta*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex elynoides*

CHARACTERISTIC SPECIES

Great Basin National Park: *Carex elynoides*, *Phlox pulvinata*

CLASSIFICATION

Global Related Concepts:

- *Carex* spp. Series (Johnston 1987) B

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alpine turf alliance occurs on several of the major peaks and was sampled on Bald Mountain and Lincoln Peak including Highland Ridge.
Global Range: This alliance has been described from mountains of Idaho, Montana, Colorado, Nevada, and New Mexico. It likely occurs in Utah and Wyoming.
Nations: US
States/Provinces: CO, ID, NV, MT, NM,
Federal Lands: NPS (Great Basin, Great Sand Dunes, Rocky Mountain); USFS (Arapaho-Roosevelt, Beaverhead, Challis, Lolo, Salmon)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2008 and 2009 field data (5 plots): GRBA.307, GRBA.323, GRBA.326, GRBA.327, GRBA.903.

Local Description Authors: M. Hall
Global Description Authors: D. Culver
References: Baker 1980a, Baker 1983a, Bamberg 1961, Benedict 1977b, Braun 1969, Caicco 1983, Cooper and Lesica 1992, Eddleman 1963, Eddleman 1967, Faber-Langendoen et al. 2011, Hermann 1970, Hess 1981, Johnson 1970a, Johnston 1987, Komarkova 1976, Komarkova and Webber 1978, Langenheim 1962, Loder 1964, Marr and Willard 1970, Moir and Smith 1970, Moseley 1985, Olmsted and Taylor 1977a, Paulsen 1960, Ramaley 1919a, Scott-Williams 1965, Starr 1983, Welden 1981, Welden 1985, Willard 1963, Willard 1979

6. ROCK VEGETATION

6.B.2. Temperate & Boreal Cliff, Scree & Rock Vegetation

6.B.2.Nb. Western North American Temperate Cliff, Scree & Rock Vegetation

M113. Rocky Mountain Cliff, Scree & Rock Vegetation

G565. Rocky Mountain Cliff, Scree & Rock Vegetation

Nonvascular Rocky Mountain Cliff, Scree & Rock Group

Nonvascular Rocky Mountain Cliff, Scree & Rock Group
Identifier: G565

REVISED USNVC CLASSIFICATION

Division	Western North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Nb)
Macrogroup	Rocky Mountain Cliff, Scree & Rock Vegetation (M113)
Group	**Rocky Mountain Cliff, Scree & Rock Vegetation (G565)**
Group (Scientific)	**Nonvascular Rocky Mountain Cliff, Scree & Rock Group (G565)**

GRBA COMPONENT ALLIANCES AND ASSOCIATIONS

Alliance	Hulsea algida Herbaceous Alliance (A2615)
Association	*Hulsea algida - Selaginella watsonii* Herbaceous Vegetation [Provisional] (CEGL005429)
Alliance	Polemonium - Castilleja - Ribes - Trisetum Alpine Rock Sparse Vegetation [Provisional] (A2711)
Association	*Petrophyton caespitosum* Sparse Vegetation [Park Special] (CEPS009605)
	Polemonium viscosum - Castilleja nana Alpine Rock Sparse Vegetation [Provisional] (CEGL005443)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine Bedrock and Scree (CES306.809)
GRBA Biophysical Setting (BpS)	NA
NPS-VIP Map Unit	Bare Talus, Scree and Fell-fields (G_TALS)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This group consists of barren and sparsely vegetated rock outcrops and cliff faces located throughout the Rocky Mountains west into Great Basin and northeastern Cascade Ranges. These sparsely vegetated surfaces (generally <10% plant cover) are found from foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. It also occurs on unstable scree and talus slopes that can occur below cliff faces. In general these are the dry, sparsely vegetated places. The biota reflects what is surrounding them, unless it is an extreme parent material. There is often very high cover of nonvascular lichens and, in wetter places, mosses. There may be small patches of dense vascular vegetation and can include scattered trees and/or shrubs. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii, Pinus ponderosa, Pinus flexilis, Populus tremuloides, Abies concolor, Abies lasiocarpa*, or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus, Ribes, Physocarpus, Rosa, Juniperus*, and *Jamesia americana, Mahonia repens, Rhus trilobata*, or *Amelanchier alnifolia*. Soil development is limited, as is herbaceous cover. Characteristic nonvascular species information is not available

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This ecological group is known from elevations ranging from 3155-3635(10,348-11,933 feet) on flat to steep slopes. Sites include low to high slopes, ridges and summits on moraines with substrates composed of talus, scree, bedrock and glacial till. Soils are extremely thin and rapidly drained.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This sparsely vegetated group is characterized by herbaceous or dwarf-shrub physiognomy. Total cover does not exceed 10% and may be as little as 1%. The characteristic dwarf-shrub is *Petrophyton caespitosum*. Dominant herbaceous species include *Hulsea algida, Polemonium viscosum, Castilleja nana*, and *Selaginella watsonii*. *Ribes montigenum, Ericameria discoidea*, and *Juniperus communis* are common shrub associates. Other herbaceous species may include *Androsace septentrionalis, Arenaria congesta, Astragalus kentrophyta, Astragalus kentrophyta var. tegetarius, Erigeron tener, Eriogonum holmgrenii, Phlox pulvinata, Poa secunda, Potentilla nivea*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Dwarf-shrub	*Petrophyton caespitosum*
Herb (field)	Forb	*Castilleja nana*, *Hulsea algida*, *Polemonium viscosum*, *Selaginella watsonii*

CHARACTERISTIC SPECIES

Great Basin National Park: *Castilleja nana*, *Hulsea algida*, *Petrophyton caespitosum*, *Polemonium viscosum*, *Selaginella watsonii*

CLASSIFICATION

Global Comments: Need moss and other nonvascular species information.

Global Related Concepts:

- CL Cliff (Ecosystems Working Group 1998) >
- RO Rock (Ecosystems Working Group 1998) >
- TA Talus (Ecosystems Working Group 1998) >

ELEMENT DISTRIBUTION

Great Basin National Park Range: This group is known from Chinese Wall, the Glacier Trail and Pyramid Peak.

Global Range: This group is located throughout the Rocky Mountain, including the isolated island ranges of central Montana, Great Basin and northeastern Cascade Ranges in western North America.

Nations: CA, US

States/Provinces: AB, AZ, BC, CO, ID, MT, NM, NV, OR, TX, UT, WA, WY

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (6 plots): GRBA.228, GRBA.229, GRBA.230, GRBA.232, GRBA.506, GRBA.902.
Local Description Authors: M. Hall
Global Description Authors: G. Kittel and M.S. Reid
References: Andrews and Righter 1992, Comer et al. 2003, Ecosystems Working Group 1998, Faber-Langendoen et al. 2011, Hess and Wasser 1982, Larson et al. 2000a, NCC 2002, Neely et al. 2001, Peet 1981

***Polemonium* spp. - *Castilleja* spp. - *Ribes* spp. - *Trisetum* spp. Alpine Rock Sparsely Vegetated Alliance [Provisional]**

Jacob's-ladder species - Indian-paintbrush species - Currant species - Oatgrass species Alpine Rock Sparsely Vegetated Alliance
Identifier: A2711

REVISED USNVC CLASSIFICATION

Division	Western North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Nb)
Macrogroup	Rocky Mountain Cliff, Scree & Rock Vegetation (M113)
Group	Rocky Mountain Cliff, Scree & Rock Vegetation Group (G565)
Alliance	***Polemonium* spp. - *Castilleja* spp. - *Ribes* spp. - *Trisetum* spp. Alpine Rock Sparsely Vegetated Alliance [Provisional] (A2711)**

GRBA COMPONENT ASSOCIATIONS

Association	*Petrophyton caespitosum* Sparse Vegetation [Park Special] (CEPS009605)
Association	*Polemonium viscosum - Castilleja nana* Alpine Rock Sparse Vegetation [Provisional] (CEGL005443)

OTHER CLASSIFICATIONS

Ecological System	Rocky Mountain Alpine Bedrock and Scree (CES306.809)
GRBA Biophysical Setting (BpS)	NA
NPS-VIP Map Unit	Bare Talus, Scree and Fell-fields (G_TALS)
USFWS Wetland Classification	Upland

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This alliance is known from elevations ranging from 3155-3635(10,348-11,933 feet) on flat to steep slopes. Sites include low to high slopes, ridges and summits on moraines with substrates composed of talus, scree, bedrock and glacial till. Soils are extremely thin and rapidly drained.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This sparsely vegetated group is characterized by herbaceous or dwarf-shrub physiognomy. Total cover does not exceed 10% and may be as little as 1%. The characteristic dwarf-shrub is *Petrophyton caespitosum*. Dominant herbaceous species include *Polemonium viscosum, Castilleja nana*, and *Selaginella watsonii*. *Ribes montigenum, Ericameria discoidea*, and *Juniperus communis* are common shrub associates. Other herbaceous species may include *Androsace septentrionalis, Arenaria congesta, Astragalus kentrophyta, Astragalus kentrophyta var. tegetarius, Erigeron tener, Eriogonum holmgrenii, Phlox pulvinata, Poa secunda, Potentilla nivea*, and *Trisetum spicatum*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Herb (field)	Dwarf-shrub	*Petrophyton caespitosum*

Herb (field)	Forb	*Castilleja nana*, *Polemonium viscosum*, *Selaginella watsonii*

CHARACTERISTIC SPECIES

Great Basin National Park: *Castilleja nana*, *Petrophyton caespitosum*, *Polemonium viscosum*, *Selaginella watsonii*

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (24-Jan-2011).

CLASSIFICATION

Status: Provisional

ELEMENT DISTRIBUTION

Great Basin National Park Range: This alliance is known from Chinese Wall, the Glacier Trail and Pyramid Peak.
Nations: US
States/Provinces: NV
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2003 and 2009 field data (5 plots): GRBA.228, GRBA.229, GRBA.230, GRBA.506, GRBA.902.
Local Description Authors: M. Hall
Global Description Authors:
References: Western Ecology Working Group n.d.

6.C.2. Cool Semi-Desert Cliff, Scree & Rock Vegetation

6.C.2.Nb. North American Cool Semi-Desert Cliff, Scree & Rock Vegetation

M118. Intermountain Basin Cliff, Scree & Badland Sparse Vegetation

G570. Intermountain Basins Cliff, Scree & Badland Sparse Vegetation

Atriplex spp. - *Cercocarpus* spp. - *Ephedra* spp. Intermountain Basins Sparse Vegetation Group

Saltbush species - Mountain-mahogany species - Joint-fir species Intermountain Basins Sparse Vegetation Group
Identifier: G570

REVISED USNVC CLASSIFICATION

Division	North American Cool Semi-Desert Cliff, Scree & Rock Vegetation (6.C.2.Nb)
Macrogroup	Rocky Mountain Cliff, Scree & Rock Vegetation (M118)
Group	**Intermountain Cliff, Scree & Badland SparseVegetation (G570)**
Group (Scientific)	***Atriplex* spp. - *Cercocarpus* spp. - *Ephedra* spp. Intermountain Basins Sparse Vegetation Group (G570)**

GRBA COMPONENT ALLIANCE AND ASSOCIATIONS

Alliance	Sparse Wooded Vegetation Alliance (A2705)
Association	*Abies concolor* Rock Outcrop Sparse Vegetation [Park Special] (CEPS009594)
Association	*Cercocarpus ledifolius* Rock Outcrop Sparse Vegetation [Park Special] (CEPS009599)
Association	*Pinus flexilis* Bedrock Sparse Vegetation [Park Special] (CEPS009606)

OTHER CLASSIFICATIONS

Ecological System	Inter-Mountain Basins Cliff and Canyon (CES304.779)
GRBA Biophysical Setting (BpS)	NA
NPS-VIP Map Unit	Bare Talus, Scree and Fell-fields (G_TALS)
USFWS Wetland Classification	Upland

ELEMENT CONCEPT

Global Summary: This group consists of barren and sparsely vegetated substrates from a variety of landscapes in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains. Landforms include cliffs and canyon sides, mesas and plateaus, and mountains. Sparse vegetation also occurs on special substrates such as shale outcrops, active sand dunes, badlands and volcanic deposits such as lava, cinder, ash, tuff and basalt dikes. Rock substrates include bedrock and unstable talus and scree slopes. Some substrates, such as marine shales, are strongly alkaline and/or saline which chemically limits plant growth. Active substrates such as scree slopes are difficult sites for plants to grow. Physical properties of substrates may also limit plant growth. Some massive rock substrates lack cracks where vascular plants can root. Badland sites often have heavy clay soils that reduce water infiltration increasing erosion rates and reducing soil moisture for plants. Vegetation is variable depending on environmental variables of the sites, which range from relatively low-elevation semi-desert to subalpine cliffs and rock outcrops. Lower elevation sites often have herbaceous or shrub species present, whereas foothill, montane and subalpine sites may also include trees. Most of the species also occur in non-sparse vegetation groups. However, some of the sites with harsh soil properties have a high number of endemic perennial species. Characteristic shrub species in lower elevation semi-desert, lava field, and badland areas include *Artemisia tridentata, Atriplex canescens, Atriplex corrugata, Atriplex gardneri, Artemisia pedatifida, Atriplex confertifolia, Ephedra* spp., *Eriogonum corymbosum, Eriogonum ovalifolium, Fallugia paradoxa, Grayia spinosa, Purshia tridentata, Salvia dorrii*, and *Sarcobatus vermiculatus*. Characteristic herbs include species of *Achnatherum, Camissonia, Cleome, Eriogonum*, and *Mentzelia*. Foothill sites include *Pinus edulis* and *Pinus ponderosa* (Colorado Plateau), *Pinus monophylla, Pinus longaeva* (Great Basin), *Juniperus osteosperma, Cercocarpus intricatus, Cercocarpus ledifolius*, and *Ephedra* spp. At montane and subalpine elevations, scattered trees may be present, such as *Pinus ponderosa, Pinus flexilis, Abies concolor, Pseudotsuga menziesii*, and *Picea engelmannii*. Shrubs may include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus ledifolius, Ephedra* spp., *Holodiscus* spp., and *Purshia tridentata*.

ENVIRONMENTAL DESCRIPTION

Great Basin National Park Environment: This sparsely vegetated or wooded group is known from elevations ranging from 2632-2975 m on gentle to very steep slopes. Sites include exposed low slopes, high slopes, outcrops and cliffs with substrates composed of limestone. Soils are composed of moderately well-drained to rapidly drained silt loam and sandy loam.

VEGETATION DESCRIPTION

Great Basin National Park Vegetation: This group is characterized by sparse wooded vegetation not exceeding 5% cover. Dominant species may include short-statured *Abies concolor, Cercocarpus ledifolius*, or *Pinus flexilis*. Numerous shrubs may be present at low or trace cover, the most common of which are *Symphoricarpos oreophilus, Cercocarpus ledifolius*, and *Juniperus communis*. The only notable herbaceous species are *Hesperostipa comata* and *Penstemon watsonii*.

MOST ABUNDANT SPECIES

Great Basin National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies concolor*, *Pinus flexilis*
Tree canopy	Broad-leaved evergreen tree	*Cercocarpus ledifolius*

CHARACTERISTIC SPECIES

Great Basin National Park: *Abies concolor*, *Cercocarpus ledifolius*, *Pinus flexilis*
Classification Confidence: 2 - Moderate
Global Comments: This group is very diverse floristically and so it is difficult to determine indicator species. More diagnostic is the sparse cover of vascular plants and/or presence and sometimes dominance of nonvascular (lichen) species. This broadly defined lithomorphic group was developed by NatureServe.
Global Related Concepts:

- Littleleaf Mountain-Mahogany (417) (Shiflet 1994) ><
- Pinyon - Juniper: 239 (Eyre 1980) ><

ELEMENT DISTRIBUTION

Great Basin National Park Range: Although widespread in the park, stands in this group were only sampled from below Mount Washington and near Granite Peak.
Global Range: This barren and sparsely vegetated group occurs in the interior western U.S. from the Columbia Plateau south to the Great Basin and Colorado Plateau, east into Wyoming basins and plains.
Nations: US
States/Provinces: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Federal Lands: NPS (Great Basin)

ELEMENT SOURCES

Great Basin National Park Plots: This description is based on 2008 and 2009 field data (3 plots): GRBA.319, GRBA.507, GRBA.513.
Local Description Authors: M. Hall
Global Description Authors: K.A. Schulz
References: Barbour and Billings 2000, Brodo et al. 2001, Day and Wright 1985, Eyre 1980, Faber-Langendoen et al. 2011, Graybosch and Buchanan 1983, Hansen et al. 2004c, Shiflet 1994, Tisdale et al. 1965, Welsh 1979, Welsh and Chatterly 1985

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FIELD DEFINITIONS FOR LOCAL AND GLOBAL DESCRIPTIONS

Local descriptions describe vegetation associations as they occur at specific National Parks. Data from field observation points and quantitative plots were used to write the local, park-specific descriptions. These descriptions were entered into NatureServe Central Databases and reports with local and global descriptions for each association were generated for each Park. The following section lists the content of those reports with definitions of each field in the report.

- **rUSNVC Scientific Name (local and global)**

The standard Association, Alliance or Group name from rUSNVC databases, based on Latin names of dominant and diagnostic plant species. The Association is the finest level of the Revised USNVC. Species occurring in the same stratum are separated by a hyphen (-), and those occurring in different strata are separated by a slash (/). Species occurring in the uppermost strata are listed first, followed successively by those in lower strata. Within the same stratum, the order of species names generally reflects decreasing levels of dominance, constancy, or indicator value. In physiognomic types where there is a dominant herbaceous layer with a scattered woody layer, Association names can be based on species found in either the herbaceous layer or the woody layer, whichever is more diagnostic of the type. If both layers are used, then the uppermost layer is always listed first, regardless of which may be more diagnostic.

Species less consistently found in all occurrences of the Association are placed in parentheses (). In cases where a particular genus is dominant or diagnostic, but individual species of the genus may vary among occurrences, only the specific epithets are placed in parentheses. Association names conclude with the Class Name in which they are classified.

In cases where diagnostic species are unknown or in question, a more general term may be used as a species placeholder (e.g., *Sphagnum* spp., Mixed Herbs, Mesic Graminoids). An environmental or geographic term, or one that is descriptive of the height of the vegetation (e.g., Dwarf Forest, Northern Shrubland), can also be used as a modifier when such a term is necessary to adequately characterize the Association. For reasons of standardization and brevity, however, this is kept to a minimum. For Provisional Associations, [Provisional] is added at the end of the name (ex. *Salix wolfii* Shrubland [Provisional]).

Vascular plant species nomenclature for Association and Alliance names follows the nationally standardized list of Kartesz (1999), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/hornworts.

- SYNONYMS

- **rUSNVC English Name (local and global)**

The standard Association, Alliance or Group name from Revised USNVC databases, but with a translation of the scientific names using standard NatureServe Central Ecology-accepted common names for the plant taxa used in the name.

- **Revised USNVC Identifier (local and global)**

A unique identifier code for the Association from Revised USNVC databases. Associations have a code that begins with the string "CEGL" (Community Element GLobal) followed by a unique 6-digit number. Units that are not defined in the Revised USNVC are listed as “nonstandard” in this field.

- **LOCAL INFORMATION**

- **Environmental Description**

A summary of available information on the environmental conditions associated with the Association and any other important aspects of the environment which affect this particular type within the park, including elevation ranges and, where relevant, information on large landscape context, geology and soils.

- **Vegetation Description**

A summary of available information on the vegetation, species composition (including dominant and diagnostic taxa, as well as problematic exotic species), structure (defining strata and their heights and percent cover), and variability of the vegetation of this Association as it occurs on the park.

- **Most Abundant Species**

Component plant species that are dominant (i.e., most abundant in terms of percent cover) for the Association as it occurs in the park.

- **Stratum**

For each component plant species, the stratum (or strata) in which it occurs in the Association within the park.
<u>Values for Stratum are</u>

Tree (canopy & subcanopy)
Tree canopy
Tree subcanopy
Shrub/sapling (tall & short)
Tall shrub/sapling
Short shrub/sapling
Herb (field)
Nonvascular
Floating aquatic
Submerged aquatic

- **Lifeform**

The lifeform of each component plant species that is present within each designated stratum of the community as it occurs within the park. Lifeform definitions are from Table 3.1, page 37, of Whittaker, R. H. 1975. Communities and ecosystems. Second edition. Macmillan Publishing Co., New York. 387 pp.
<u>Values for Lifeforms are</u>

Needle-leaved tree
Broad-leaved deciduous tree
Broad-leaved evergreen tree
Thorn tree
Evergreen schlerophyllous tree
Succulent tree
Palm tree
Tree fern
Bamboo
Needle-leaved shrub
Broad-leaved deciduous shrub
Broad-leaved evergreen shrub
Thorn shrub
Evergreen schlerophyllous shrub
Palm shrub
Dwarf-shrub
Semi-shrub
Succulent shrub
Ephiphyte
Vine/Liana
Forb
Graminoid
Succulent forb
Aquatic herb (floating & submergent)
Moss
Alga
Lichen
Fern or fern ally
Other/unknown
Other shrub
Other herbaceous
Liverwort/hornwort

- **Species Name**

Global scientific name (and common name) for each floristic component species of the Association as it occurs within the park.

- **Characteristic Species**

Component plant species that are characteristic for the Association as it occurs within the park.

- **Other Noteworthy Species**

Other noteworthy species (i.e., species that are not necessarily diagnostic of the Association, but that are worth noting for some other reasons, such as those that are rare species or exotic invasives) that are found within the Association in the park.

- **Classification Comments**

Comments about classification criteria used to define the Association or description of any remaining issues associated with its classification on the park.

- **Other Comments**

Additional comments about the Association within the park.

- **Local Range**

A description of the total range (including present and historic, if known) of the Association within the park.

- **Plots**

List of plot codes for plots used in the identification and classification of the Association on the park.

- **Local Description Authors**

Name(s) of the person(s) primarily responsible for authorship of the current description of this Association on the park.

Global Information

Revised USNVC Below the Association, Alliance, or Group name being described the Revised USNVC is listed from Division to Association with of the classification unit being described Bolded. If higher level units (Alliance or Group) are being described then component classification units are listed. The hierarchy code follows the Division Name, the Macrogroup code follows the Macrogroup name, the Group code follows the Group name, the Alliance key follows the Alliance name, and the element code follows the Association name.

- **Summary of the Revised USNVCS Hierarchy Levels and Criteria for Natural Vegetation.**

• Hierarchy Level	• Criteria
• Upper:	• Physiognomy plays a predominant role.
• L1 - Formation Class	• Broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and substrate/aquatic conditions.
• L2 - Formation Subclass	• Combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate/aquatic conditions.
• L3 – Formation	• Combinations of dominant and diagnostic growth forms that reflect global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.
• Mid:	• Floristics and physiognomy play predominant roles
• L4 – Division	• Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant species that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
• L5 – Macrogroup	• Combinations of moderate sets of diagnostic plant species and diagnostic growth forms, that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
• L6 – Group	• Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect regional mesoclimate, geology, substrates, hydrology and

	disturbance regimes.
• Lower:	• Floristics plays a predominant role
• L7 – Alliance	• Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
• L8 – Association	• Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.

- **OTHER CLASSIFICATION**

- **Ecological System(s)**

A list of the Ecological Systems of which the Association is a member (NatureServe 2003). Ecological Systems are groups of plant associations unified by similar ecological conditions and processes (e.g., fire, riverine flooding), underlying environmental features (e.g., shallow soils, serpentine geology), and/or environmental gradients (e.g., elevation, hydrology in coastal zones). They should form relatively robust, cohesive, and distinguishable units on the ground. In most landscapes, the Ecological System will manifest itself on the ground as a spatial aggregation at an intermediate scale (e.g., between the IVC Alliance and Formation scales).

GRBA Biophysical Setting (BpS)
Name and codes of Biophysical Setting x-walked to the classification units.

NPS-VIP Map Unit
Map Class name and code for current NPS VIP mapping project at GRBA

USFWS Wetland Classification System
Systems developed for the classification of wetlands by the U.S. Fish and Wildlife Service to classify. System refers to a complex of wetlands and deepwater habitats that share the influence of similar hydrologic, geomorphic, chemical, or biological factors. As defined in Cowardin et al. (1979), the values are:

Marine - consists of open ocean overlying the continental shelf and its associated high-energy coastline.
Estuarine - consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.
Riverine - includes all wetlands and deepwater habitats contained with a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5%.
Lacustrine - includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres).
Palustrine - includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%.

- **GLOBAL DESCRIPTION**

- **Concept Summary**

A description of the range, structure, composition, environmental setting and dynamics associated with the community. Information includes a general understanding of the type, often with some concept of its distribution; environmental setting in which the type occurs and a summary of the important disturbance regimes, successional status, and temporal dynamics for this community rangewide; community structure/physiognomy; species by strata (dominant and diagnostic taxa); and key diagnostic characteristics that distinguishes it from similar types.

- **Environmental Description**

A summary of available information on the environmental conditions of the Association rangewide and any other important aspects of the environment which affect this particular type, including elevation ranges and, where relevant, information on large landscape context, geology and soils.

- **Vegetation Description**

A summary of available information on the leaf type and phenology, species composition (including dominant and diagnostic taxa, as well as problematic exotic species), structure (defining strata and their heights and percent cover), and variability of the vegetation of this Association rangewide and any additional comments relating to the vegetation.

- **Most Abundant Species**

Component plant species that are dominant (i.e., most abundant in terms of percent cover) for the Association as it occurs rangewide.

- **Stratum**

For each component plant species, the stratum (or strata) in which it occurs in the Association rangewide. <u>Values for Stratum are</u>

Tree (canopy & subcanopy)
Tree canopy
Tree subcanopy
Shrub/sapling (tall & short)
Tall shrub/sapling
Short shrub/sapling
Herb (field)
Nonvascular
Floating aquatic
Submerged aquatic

- **Lifeform**

The lifeform of each component plant species that is present within each designated stratum of the community as it occurs rangewide. Lifeform definitions are from Table 3.1, page 37, of Whittaker, R. H. 1975. Communities and ecosystems. Second edition. Macmillan Publishing Co., New York. 387 pp. <u>Values for Lifeforms are</u>

Needle-leaved tree
Broad-leaved deciduous tree
Broad-leaved evergreen tree
Thorn tree
Evergreen schlerophyllous tree
Succulent tree
Palm tree
Tree fern
Bamboo
Needle-leaved shrub
Broad-leaved deciduous shrub
Broad-leaved evergreen shrub
Thorn shrub
Evergreen schlerophyllous shrub
Palm shrub
Dwarf-shrub
Semi-shrub
Succulent shrub
Ephiphyte
Vine/Liana
Forb
Graminoid
Succulent forb
Aquatic herb (floating & submergent)
Moss
Alga
Lichen
Fern or fern ally
Other/unknown
Other shrub
Other herbaceous
Liverwort/hornwort

- **Species Name**

Global scientific name (and common name) for each floristic component species of the Association as it occurs rangewide.

- **Characteristic Species**

Component plant species that are characteristic for the Association as it occurs rangewide.

- **Other Noteworthy Species**

Other noteworthy species (i.e., species that are not necessarily diagnostic of the Association, but that are worth noting for some other reasons, such as those that are rare species or exotic invasives) that are found within the Association rangewide.

- **DISTRIBUTION**

- **Range**

A description of the total range (present and historic, if known) of the Association rangewide, using names of nations, subnations or states, ecoregions, etc.

- **States/Provinces**

The two-letter postal codes for U.S. states and Canadian provinces in which the Association occurs. Mexican two-letter state abbreviations are preceded by "MX". When the occurrence of the Association in a state/province is uncertain, a ? is appended. The state code may be followed by the State Rank when known.

- **Federal Lands**

List of federal lands where the Association occurs or is believed to occur. Names used are shortened versions of the official name of the Federal land unit with "National Park, National Forest," etc. dropped from the name. A ? indicates that presence is uncertain. Federal Agency Abbreviations are:

BIA = Bureau of Indian Affairs
BLM = Bureau of Land Management
COE = U.S. Army Corps of Engineers
DOD = Department of Defense
DOE = Department of Energy
NPS = National Park Service
PC = Parks Canada
TVA = Tennessee Valley Authority
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service

CONSERVATION STATUS

- **Global Rank**

The Heritage Conservation Status Global Rank which best characterizes the relative rarity or endangerment of the Association worldwide. Values for Global Rank are:

G1 = Critically imperiled globally = Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s)
G2 = Imperiled globally = Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s)
G3 = Rare or uncommon = Generally 21-100 occurrences; either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factor(s)
G4 = Widespread, abundant, and apparently secure, but with cause for long-term concern = Uncommon but not rare (although it may be quite rare in parts of its range, especially at the periphery); apparently not vulnerable in most of its range
G5 = Demonstrably widespread, abundant and secure = Common, widespread, and abundant (although it may be quite rare in parts of its range, especially at the periphery); not vulnerable in most of its range

G#G# = Numeric range rank (range no greater than 2) = Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate; for example, a G1G3 rank indicates the rank could be G1, G2, or G3
GNR = Not yet ranked = Status has not yet been assessed
GNA = Rank not applicable
GH = Historical = Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with potential for restoration (e.g., *Castanea dentata* Forest)
GX = Extirpated = Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species
GU = Unrankable = Status cannot be determined at this time
Qualifiers:
? = Inexact numeric rank = A question mark added to a rank expresses an uncertainty about the rank in the range of 1 in either way on the 1-5 scale; for example, a G2? rank indicates that the rank is thought to be G2, but could be G1 or G3 (Note: G1? and G5? are both valid ranks)
Q = Questionable taxonomy = A "Q" added to a rank denotes questionable taxonomy; it modifies the degree of imperilment and is only used in cases where the type would have a less imperiled rank if it were not recognized as a valid type (i.e., if it were combined with a more common type); a GUQ rank often indicates that the type is unrankable because of daunting taxonomic questions

For non-natural types, a **Global Rank** of **GNA** = **Rank not applicable** is assigned. They are further identified as one from the following:
Cultural - indicates that the Association is cultivated. Planted/cultivated areas are defined as being dominated by vegetation that has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. The majority of these areas are planted and/or maintained for the production of food, feed, fiber, or seed.
Ruderal - indicates that the Association is considered ruderal. Ruderal communities are vegetation resulting from succession following anthropogenic disturbance of an area. They are generally characterized by unnatural combinations of species (primarily native species, though they often contain slight to substantial numbers and amounts of species alien to the region as well). In many landscapes, ruderal communities occupy large areas - sometimes more than any other category of communities - and can provide important biodiversity functions.
Modified/Managed - indicates that the Association is modified or managed. Modified/managed communities are vegetation resulting from the management or modification of natural/near-natural vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue. Modified vegetation may be easily restorable by either management, time, or restoration of ecological processes. It is not yet clear how to deal with these communities in the IVC.
Invasive - indicates that the Association is weedy and invasive. Invasive communities are dominated by invasive alien species. Although these communities are often casually considered as "planted/cultivated," they are spontaneous, self-perpetuating, and not the (immediate) result of planting, cultivation, or human maintenance. Land occupied by invasive communities is generally permanently altered (converted) unless restoration efforts are undertaken. It is also important to recognize that these communities are novel; they are not merely a community "transplanted" from the native range of the dominant species. *Melaleuca* in south Florida, kudzu in the southeastern United States, tamarisk in the western United States, and red mangrove in Hawaii all form communities which have no equivalent in the native range of the dominant species (associated species, processes, landscape context, fauna, etc. are all significantly different).

- **Global Rank Date**

The date the Global Rank was last ***reviewed*** (regardless of whether the rank was changed).

- **Global Rank Reasons**

Reasons that the Heritage Conservation Status Global Rank for the Association was assigned, including key ranking variables and other considerations used.

- **CLASSIFICATION INFORMATION**

- **Status**

The status of the Association in relation to the standard IVC. <u>Values for Classification Status are</u>:

Standard – the Association has been formally recognized, described, and accepted by NatureServe Central Ecology as a standard Association in the IVC.
Nonstandard – the Association has not been accepted by NatureServe Central Ecology as a standard Association (i.e., it does not follow the standard classification).
Provisional* – the Association is a candidate for acceptance into the standard classification but has not yet been comprehensively reviewed by NatureServe Central Ecology.

- **Confidence**

The degree of confidence associated with the classification of the Association. This confidence is based on the quality and type of data used in the analysis, as well as the extent to which the entire (or potential) range of the Association was considered. <u>Values for Circumscription Confidence are</u>:

1 – Strong: Classification is based on quantitative analysis of verifiable, high-quality field data (species lists and associated environmental information) from plots that are published in full or are archived in a publicly accessible database. A sufficient number of high-quality plots covering the expected geographic distribution and habitat variability of the vegetation type, as well as plots from related types across the region, have been used in the analysis.

2 – Moderate: Classification is based either on quantitative analysis of a limited data set of high-quality, published/accessible plots and/or plots from only part of the geographic range, or on a more qualitative assessment of published/accessible field data of sufficient quantity and quality.

3 – Weak: Classification is based on limited, or unpublished/inaccessible plot data or insufficient analysis, anecdotal information, or community descriptions that are not accompanied by plot data. These types have often been identified by local experts. Although there is a high level of confidence that these types represent recognized vegetation entities, it is not known whether they would meet national standards for floristic types in concept or in classification approach if sufficient data were available.

- **Comments**

Comments about classification criteria used to define the Association, or to describe any remaining issues associated with the classification. Any potentially confusing relationships with other existing Associations should be indicated if there is a potential that further scrutiny may result in a change in the classification of the Association. Discussion of any atypical occurrences and why they are included in this Association concept may also be addressed. In addition, rationale for choosing nominal species that are not dominant and other comments about nominal species pertaining to the classification of the Association should be included. Comments may explain confusion about the similarity between types that may not be distinguishable.

- **Similar Associations**

The Global Name and Elcode of any closely related or apparently similar IVC association(s) which may be mistaken for this Association. They may be in the same or different Formation or Alliance. This includes only types whose classification is not at issue (e.g., two types have similar sounding names but are differentiated by the degree of canopy closure and lower frequency of associated light-requiring species). Notes regarding the relationship and/or distinction of each particular Similar Association may follow.

- **Related Concepts**

Name used by agencies or other published or unpublished classification systems to describe Associations that may be related to this Association. These might include Society of American Foresters (SAF) cover types, Kuchler PNV types, U.S. Fish and Wildlife Service (USFWS) wetland types, or other local or regional vegetation classifications. The Other Community Name is followed by the associated Reference and Relationship. The Related Concept Reference is the source reference for the Related Concept. Relationship indicates whether the type designated in Other Community Name is more, less, or equally inclusive of the IVC Association concept. <u>Values for Relationship are</u>:

B – Broader: the concept of the Other Community is broader than the Association concept
F – Finer: the concept of the Other Community is finer (more narrow) than the Association concept
I – Intersects: the concepts of the Other Community and the Association overlap (i.e., neither fully includes the other) and are related in a way that is more complex than a simple "broader/finer" relationship
= - Equivalent: concept designated in Other Community Name is equivalent to the Association concept
? – Unknown: the relationship of the Other Community to the Association has not been determined

Note: Names used by Heritage Programs/CDCs are listed in the section entitled Subnational Distribution with Crosswalk data.

- **SOURCES**

- **Description Authors**

Name(s) of the person(s) primarily responsible for authorship of the current version of the Association's *description* and *characterization* including descriptions in Environment, Vegetation, and Dynamics. The abbreviation mod. before a name indicates that modifications were subsequently made to the original description by the person(s) listed.

- **References**

Short citations of all references used in documenting the classification/concept and characterization of this Association.

Citation for Field Definitions for Local and Global Descriptions

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APPENDIX H: FIELD KEY TO THE MAP CLASSES OF GREAT BASIN NATIONAL PARK, NEVADA

Note: Before using key please review information from the Introduction in **Appendix F**: Field Key to the Vegetation of Great Basin National Park, Nevada. Map Class complexes are defined as groups of related alliances.

Table of Contents

KEY I: THE MAJOR PHYSIOGNOMIC GROUPS OF GREAT BASIN NP

1a) Site vegetated with $\geq$ 10% total vascular vegetation cover. **(2)**
1b) Site barren to sparsely vegetated generally with < 10% total vascular vegetation cover. Non-vascular (lichen and mosses) may exceed 10% cover. Scattered plants are present such as a *Pinus, Cercocarpus, Petrophyton, Hulsea*, and *Polemonium*, but do not form a layer.
Go to: **Key V (p 13)**

2a) Vegetation woody or appearing woody; the tallest stratum dominated by trees, shrubs, or dwarf-shrubs and is typically > 10% cover. Total vegetation cover may range from near sparse to dense. Cover of tree or shrub strata may extend down to 5% when that stratum dominates or characterized an open stand, especially. **(3)**
2b) Vegetation herbaceous; the tallest stratum dominated by grasses, grass-like herbs (graminoids), and broad-leaf herbs (forbs) usually w. Scattered trees or shrubs may be present with low cover <10% cover, but do not form a stratum and herbaceous cover is greater than woody cover. Total vegetation cover may range from near sparse to dense; comprised primarily of graminoid species; wetland to upland habitats; characteristic genera include *Achnatherum*, *Agropyron, Aquilegia*, *Astragalus, Balsamorhiza, Bromus*, *Calamagrostis, Carex*, *Distichlis, Dodecatheon*, *Eleocharis*, *Eriogonum, Elymus, Geum, Hesperostipa*, *Leymus*, *Mimulus*, *Muhlenbergia*, *Phlox, Phragmites*, *Pleuraphis*, *Poa, Polemonium, Polygonum, Pseudoroegneria, Sporobolus*, and *Typha.*
Go to: **Key IV (p 12)**

3a) Tree-dominated forests (overlapping tree canopies), woodlands (open tree canopies), or tree species forming shrublands or dwarf woodlands (avalanche chute, krummholz).Characteristic genera include *Abies, Acer*, *Cercocarpus, Juniperus*, *Picea*, *Pinus*, *Populus*, *Pseudotsuga*, and *Salix.* The tree canopy layer has 10% or more cover generally, but may be as low 5% cover when trees characterize the otherwise borderline sparse vegetation stand (total vegetation cover <20%).

Go to: **Key II (p 2)**

3b) Shrub-dominated vegetation, including shrub-like herbs (*Eriogonum* spp.); canopies may interlock, but are more commonly less dense. Characteristic genera include *Acer, Amelanchier*, *Arctostaphylos*, *Artemisia*, *Atriplex*, *Betula*, *Cercocarpus*, *Chrysothamnus*, *Dasiphora*, *Ephedra*, *Ericameria*, *Eriogonum*, *Gutierrezia*, *Peraphyllum, Picrothamnus*, *Purshia*, *Rhus*, *Ribes, Rosa*, *Salix*, *Sarcobatus,* and *Symphoricarpos.* Scattered tall trees may be present in shrublands, especially in transitional stands, but do not form a tree canopy (<10% cover) or characterize otherwise borderline sparse vegetation stand.

Go to: **Key III (p 8)**

KEY II: THE FOREST AND WOODLAND MAP CLASSES OF GREAT BASIN NP

1a) Deciduous forests or woodlands that occupy a variety of habitats from riparian areas to high elevation slopes. Conifer trees may be present, but generally do not codominate or only do so as occasional small clumps within the larger deciduous tree dominated stand. **(2)**

1b) Evergreen and mixed evergreen – deciduous (aspen) forests and woodlands; or shrublands (dwarfed trees in avalanche chutes or krummholz) occupying a variety of habitats, typically upland or high elevation sites, but includes riparian sites. Includes both needle-leaved and sclerophyllous evergreen tree species. **(4)**

2a) Forests or woodlands characterized by *Populus angustifolia* occurring within drainage bottoms or on mesic alluvial deposits. Other trees such as *Abies concolor, Juniperus scopulorum, Populus tremuloides* or *Pinus monophylla* are often present and may codominate, however *Populus angustifolia* is diagnostic. Understory is variable and may be dominated by *Artemisia tridentata* ssp*. tridentata, Cornus sericea, Prunus virginiana,* or *Rosa woodsii.*

***Populus angustifolia* Riparian Forest & Woodland Alliance (F_POAN)**

2b) Forests or woodlands dominated by *Populus tremuloides* typically occupying stream banks, mesic areas, or occurring on higher elevation slopes. Non-deciduous trees such as *Abies concolor, Juniperus scopulorum* or *Pinus flexilis* may be present, but total <25% relative cover of total tree canopy. If *Populus angustifolia* is present then it has low cover and does not codominate with *Populus tremuloides.* **(3)**

3a) Stand is found along a stream channel or seep. The understory is dominated by riparian shrubs and/or herbaceous species. Characteristic species include *Betula occidentalis, Salix boothii, S. exigua, Carex nebrascensis, C. scopulorum* and *Mimulus guttatus,* or other wet to mesic herbaceous species such as *Aquilegia formosa, Cardamine breweri, Berula erecta, Equisetum laevigatum, Glyceria striata, Juncus balticus, Ligusticum porteri, Maianthemum stellatum, Mertensia franciscana,* and *Scirpus microcarpus.* Shrubs *Amelanchier utahensis, Rosa woodsii, Prunus virginiana,* and *Symphoricarpos oreophilus* may be present to dominant, but are not always riparian.

Rocky Mountain *Populus tremuloides* Riparian Forest & Woodland Alliance (F_POTR2)

3b) Stand is in mesic to dry uplands. The understory is usually dominated by shrubs and/or herbaceous species, but occasionally understory is sparse with high cover of leaf litter. Characteristic shrub species may include *Artemisia tridentata, Juniperus communis, Prunus virginiana, Ribes* spp. *Symphoricarpos oreophilus.* The herbaceous layer lacks the wetland species and is dominated by mesic and dry species such as *Achillea millefolium, Bromus carinatus, Elymus glaucus, Elymus trachycaulus, Lathyrus* spp., *Juncus balticus, Poa pratensis* (introduced species), *Poa secunda, Poa wheeleri,* or *Vicia americana*. Occasionally there is low cover of shrubs and herbaceous species and

Rocky Mountain *Populus tremuloides* Forest & Woodland Alliance (F_POTR1)

4a) Forests or woodlands dominated by sclerophyllous evergreen tree/tall shrub *Cercocarpus ledifolius*. Other trees such as *Abies concolor, Juniperus scopulorum* or *Pinus monophylla* may be present to codominant especially in transitional stands; however dominance by *Cercocarpus ledifolius* is diagnostic. Understory is variable depending on site and may have short shrub or herbaceous layers or be sparse.

***Cercocarpus ledifolius* Shrubland & Woodland Complex (W_CELE)**

4b) Forests or woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) with *Cercocarpus ledifolius* absent or with low cover in tree canopy, but may form an understory layer. **(5)**

5a) Forests or woodlands dominated or codominated by *Pinus ponderosa* occurring along drainages on mesic alluvial deposits or upland sites. Other trees such as *Abies concolor, Juniperus scopulorum, Pinus monophylla, Pseudotsuga menziesii*, or *Populus tremuloides* are often present and may codominate, however *Pinus ponderosa* is diagnostic. **(6)**

5b) Forests or woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) not characterized by *Pinus ponderosa* trees. *Pinus ponderosa* is absent or with low (accidental) cover (<5%). **(7)**

6a) Mixed canopy forests occurring along drainages with *Pinus ponderosa* codominant or conspicuously present as large emergent trees over a subcanopy of *Abies concolor, Juniperus scopulorum, Pinus monophylla, Pseudotsuga menziesii* and/or *Populus tremuloides.* Characteristic riparian and mesic site understory species are typically present such as *Betula occidentalis* and *Salix* spp. mixed with upland species. *Pinus ponderosa* is diagnostic.

***Pinus ponderosa* – (*Pseudotsuga menziesii*) Riparian Woodland Alliance (W_PPPM2)**

6b) Forests or woodlands dominated or codominated by *Pinus ponderosa* occurring on upland sites. Other trees such as *Abies concolor, Pseudotsuga menziesii,* or *Pinus monophylla* are often present and may codominate, however large, visually dominant (often emergent) *Pinus ponderosa* in tree canopy is diagnostic even if not the most abundant tree.

***Pinus ponderosa* – (*Pseudotsuga menziesii*) Woodland Complex (W_PPPM1)**

7a) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma*. Stands often have an open tree canopy (generally 10-30% cover) with a denser shrub understory, but include very open woodland stands (down to 5% tree cover)when these trees dominate the vegetation and total vegetation cover is low (<20% cover), as well as denser canopied stands with >30% tree cover. **(8)**

7b) Forests or woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) not dominated by *Pinus monophylla* and *Juniperus osteosperma* trees. *Pinus monophylla* or *Juniperus osteosperma* trees may be present with low cover (not codominant). **(13)**

8a) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma* trees that lack a developed understory. Neither herbaceous nor shrub species have 5% or more cover, and most stands have less than 2% total understory cover. Stands may have sparse understories because they have nearly closed canopy that shades out understory or occur on substrates that limit understory growth (shale substrates with poor water-holding capacity, very high cover of surface rock or sand, sometimes with high cover biological soil crusts).

***Pinus monophylla - (Juniperus osteosperma) /* Grass & Sparse Understory Woodland Complex (W_PJSP)**

8b) Woodlands dominated by *Pinus monophylla* and/or *Juniperus osteosperma* trees with a developed understory (5% or more cover of shrubs or herbaceous species). **(9)**

9a) Understory is characterized by an herbaceous layer typically dominated or codominated by grasses, especially *Poa fendleriana* and/or *Poa secunda*. If shrubs present with 5-10% cover then herbaceous cover exceeds shrub cover.

***Pinus monophylla - (Juniperus osteosperma) /* Grass & Sparse Understory Woodland Complex (W_PJSP)**

9b) Understory characterized by a shrub layer (generally >10% cover). If shrubs present with 5-10% cover then shrub cover exceeds herbaceous cover. **(10)**

10a) Stand occurs along a stream or below a seep. Understory is characterized by mesic shrubs such as *Betula occidentalis, Prunus virginiana,* and *Rosa woodsii.* Wet to mesic graminoids and forbs such as *Juncus balticus, Leymus cinereus,* and *Maianthemum stellatum* may be present to abundant in the herbaceous layer, but upland species are often also abundant when the riparian zone is narrow.
***Pinus monophylla - Juniperus osteosperma /* Mixed Riparian ShrubWoodland Complex (W_PJRP)**

10b) Shrub layer is dominated by upland shrub species. **(11)**

11a) Understory is characterized by the tree layer codominated by *Cercocarpus ledifolius* or a shrub layer dominated or codominated by *Cercocarpus ledifolius*. Other shrubs may be present such as *Amelanchier utahensis* and *Artemisia tridentata*. In a mixed shrub understory layer, *Cercocarpus ledifolius* has 10% or more cover, or is most abundant shrub species if shrub layer is 5-10% cover. At GRBA, *Cercocarpus ledifolius* can have both a tree and shrub form.
***Pinus monophylla - Juniperus osteosperma / Cercocarpus ledifolius* Woodland (W_PJCL)**

11b) Shrub layer is characterized by other species. **(12)**

12a) Understory is dominated by shrub species from the genus *Artemisia*, including *A. arbuscula, A. nova, A. tridentata* ssp. *tridentata, A. tridentata* ssp. *vaseyana, Artemisia tridentata* ssp. *wyomingensis* and/or the big sagebrush associate *Purshia tridentata.*
***Pinus monophylla - (Juniperus osteosperma) / Artemisia* spp. Woodland Complex (W_PJSG)**

12b) Understory is dominated or codominated by shrub species *Cercocarpus intricatus, Chrysothamnus viscidiflorus, Ephedra viridis, Glossopetalon spinescens, Peraphyllum ramosissimum, Purshia stansburiana,* and *Rhus trilobata* may be present to codominant. Other shrubs may include *Arctostaphylos patula* and *Symphoricarpos longiflorus*. *Artemisia* spp. may be present to codominant.
***Pinus monophylla - (Juniperus osteosperma*) / Mixed Shrub Woodland Complex (W_PJMX)**

13a) Woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) dominated or codominated by *Pinus longaeva* and/or *P. flexilis*. Other trees such as *Abies concolor, Picea engelmannii*, and *Pseudotsuga menziesii* may be present to codominant. *Populus tremuloides* may also be present to co-dominant in mixed stands; however >50% relative cover of conifer canopy cover of *Pinus flexilis* trees and/or presence of *Pinus longaeva* is diagnostic. **(14)**

13b) Forests, woodlands or shrublands (dwarfed trees in avalanche chutes or krummholz) that are not characterized by *Pinus longaeva* and/or *Pinus flexilis* trees. *Pinus longaeva* is absent and/or *Pinus flexilis* is absent or has <50% relative canopy cover of conifer trees. **(18)**

14a) Stand is krummholz (shrubland) dominated or codominated by wind-stunted *Pinus flexilis* < 5 m tall occurring near upper tree line. *Picea engelmannii* is often present to codominant.
***Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz Alliance (S_PIEN)**
14b) Stand is a forest or woodland dominated or codominated by *Pinus longaeva* and/or *P. flexilis* trees 5-35 m tall. **(15)**

15a) Open to moderately dense woodlands dominated or codominated by *Pinus longaeva*. *Pinus flexilis* is often present to codominant. Tree canopy ranges from 5-45%. Other trees such as *Abies concolor, Picea engelmannii* and *Pseudotsuga menziesii* may be present, and *Populus tremuloides* may codominate, however the presence of *Pinus longaeva* trees is diagnostic. **(16)**
15b) Woodlands dominated by *Pinus flexilis* (>50% relative cover of conifer canopy). *Pinus longaeva* is absent or has very low cover (accidental <2%). Other trees such as *Abies concolor, Picea engelmannii* and *Pseudotsuga menziesii* may be present and *Populus tremuloides* may codominate, however the dominance of *Pinus flexilis* trees and absence of *P. longaeva* trees is diagnostic. Tree canopy is variable, but generally >10% cover. **(17)**

16a) If present, shrubs in understory include *Ericameria discoidea* and *Ribes montigenum*, although *Juniperus communis* may dominate. Subalpine and alpine herbaceous species are typically present as this is a high elevation type (generally >9700ft).
***Pinus longaeva* Subalpine Woodland (W_PILO1)**
16b) If present, shrubs in understory include *Arctostaphylos patula, Artemisia tridentata, Ceanothus martinii,* or *Symphoricarpos oreophilus.* Montane herbaceous species are typically present as this type occurs at lower elevation than the *Pinus longaeva* subalpine woodlands (generally <9700ft).
***Pinus longaeva* Montane Woodland (W_PILO2)**

17a) Tree canopy is codominated by *Populus tremuloides* and *Pinus flexilis. Picea engelmannii* may be present to codominate with less canopy cover than *Pinus flexilis*. This association is broadly defined and includes stands with understories dominated by shrubs and/or herbaceous species.
***Populus tremuloides - Pinus flexilis* Forest (F_PTPF)**
17b) Tree canopy is dominated by *Pinus flexilis* trees. *Populus tremuloides* may be present but not codominant. Shrubs in understory are dominated or codominated by *Artemisia tridentata* ssp. *vaseyana* or *Symphoricarpos oreophilus.* Other shrubs may be present to codominant. Also the understory may be composed of only an herbaceous layer or be sparse.
Great Basin *Pinus flexilis* Woodland Alliance (W_PIFL)

18a) Subalpine forests, woodlands or shrublands (stunted and broken trees in avalanche chutes or krummholz) dominated or codominated by *Picea engelmannii*. Other trees species may be present with equal or less cover than *Picea engelmannii* including *Abies concolor, Pseudotsuga menziesii,* and *Pinus flexilis* especially in transition zones with montane forests. *Populus tremuloides* may be present to codominate (in mixed conifer-deciduous forests and woodlands); however *Picea engelmannii* is diagnostic when it is one of the most abundant conifer trees. **(19)**

18b) Montane forests and woodlands or shrublands (stunted and broken trees in avalanche chutes) dominated or codominated by *Abies concolor* and/or *Pseudotsuga menziesii.* Other trees may be present with lower cover especially in transition zones with foothill (*Pinus monophylla*) and subalpine forests *Pinus flexilis, Picea engelmannii)*, however *Abies concolor* and/or *Pseudotsuga menziesii* are diagnostic species and combined generally dominate the conifer tree canopy. **(23)**

19a) Stand is a shrubland or stunted/broken woodland dominated or codominated by *Picea engelmannii* < 5 m tall. **(20)**

19b) Stand is a forest or woodland dominated or codominated by *Picea engelmannii* trees 5-35 m tall. **(21)**

20a) Stand is composed of short and broken *Picea engelmannii* and *Populus tremuloides* damaged by reoccurring avalanche. *Abies concolor* may be present to codominant.
Southern Rocky Mountain Avalanche Chute Shrubland Complex (S_AVAL)

20b) Stand is a krummholz shrubland dominated by wind-stunted *Picea engelmannii* occurring near upper tree line.
***Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz Shrubland Alliance (S_PIEN)**

21a) Stand occurs along a stream or below a seep or spring (wetland). *Populus tremuloides* is often present to codominant in the tree canopy. Understory is characterized by an herbaceous layer dominated or codominated by *Carex scopulorum* or presence of other wetland indicator species such as *Aconitum columbianum, Angelica kingii, Carex microptera, C. phaeocephala, Juncus balticus, Mertensia ciliata,* and *Mimulus guttatus*. *Salix boothii* and mesic shrubs may be present to abundant. Mesic graminoids and forbs may be present to codominant. If other conifers are present in tree canopy, then *Picea engelmannii* is the most abundant conifer.
***Picea engelmannii* Riparian Forest & Woodland Alliance (F_PIEN2)**

21b) Stand is not riparian or wetland, but occurs in uplands from mesic valley bottoms to drier slopes and ridges. **(22)**

22a) Upland forests and woodlands codominated by *Picea engelmannii* and *Populus tremuloides*. *Populus tremuloides* trees codominate with conifers with 25-75% relative canopy cover. *Picea engelmannii* is the most abundant conifer tree in mixed conifer stands. Other conifer trees such as *Abies concolor*, *Pseudotsuga menziesii* and/or *Pinus flexilis* may be present with lower or equal individual canopy cover to *Picea engelmannii*. Understory is variable.

***Picea engelmannii - Populus tremuloides* Forest (F_PIEN3)**

22b) Upland forests and woodlands dominated by *Picea engelmannii*. *Populus tremuloides* trees are absent or have low cover (<25% relative cover of tree canopy). *Picea engelmannii* is the most abundant tree in mixed conifer stands. Other conifer trees such as *Abies concolor*, *Pseudotsuga menziesii* and/or *Pinus flexilis* may be present with lower or equal individual canopy cover to *Picea engelmannii*. Understory is variable.

***Picea engelmannii* Forest Complex (F_PIEN1)**

23a) Stand is composed of short and broken *Abies concolor* and/or *Pseudotsuga menziesii* and *Populus tremuloides* trees < 5 m tall damaged by reoccurring avalanche.

Southern Rocky Mountain Avalanche Chute Shrubland Complex (S_AVAL)

23b) Stand is a forest or woodland dominated or codominated by *Abies concolor* and/or *Pseudotsuga menziesii* trees 5-30 m tall. **(24)**

24a) Stand occurs along a stream or below a seep or spring (wetland). *Populus tremuloides* is often present to codominant in the tree canopy. Understory is characterized by wetland indicator species such as shrubs *Betula occidentalis, Salix bebbiana* or *S. boothii* and/or an herbaceous layer dominated or codominated by *Carex scopulorum* or presence of other wetland indicator species such as*, Angelica kingii, Cardamine breweri, Glyceria striata, Mertensia franciscana,* or *Mimulus guttatus,* . Other mesic graminoids may be present to codominant. *Symphoricarpos oreophilus* may form a shrub layer.

***Abies concolor* Riparian Forest & Woodland Alliance (W_ACRIP)**

24b) Stand is not riparian or wetland, but occurs in uplands from mesic valley bottoms to drier slopes and ridges. **(25)**

25a) Upland montane forests and woodlands codominated by *Abies concolor* and/or *Pseudotsuga menziesii*. *Populus tremuloides* trees codominate with conifers with 25-75% relative canopy cover. Other conifer trees such as *Picea engelmannii* and *Pinus flexilis* may be present; however *Abies concolor* and/or *Pseudotsuga menziesii* are the most abundant conifer trees.

***Abies concolor - Populus tremuloides* Forest Complex (F_ABPO)**

25b) Upland montane forests and woodlands dominated or codominated by *Abies concolor* and/or *Pseudotsuga menziesii*. *Populus tremuloides* trees are absent or have low cover (<25% relative cover of tree canopy). Other conifer trees such as *Picea engelmannii* and *Pinus flexilis* may be present; however the combined canopy cover of *Abies concolor* and *Pseudotsuga menziesii* exceeds that of other individual conifer trees.

***Abies concolor* - Pseudotsuga menziesii Forest & Woodland Complex (W_ACPM)**

KEY III: THE SHRUBLAND AND SHRUB STEPPE MAP CLASSES OF GREAT BASIN NP

1a) Shrubland stand composed of short and broken aspen and conifer trees < 5 m tall **(2)**
1b) Shrubland stand composed of a variety of broadleaf and microphyllus shrubs **(3)**

2a) Stand occurs in an avalanche chute is composed of short and broken trees generally < 5 m tall damaged by reoccurring avalanche and shrubs such as *Symphoricarpos* spp., *Chrysothmnus viscidiflorus,* and *Juniperus communis*. Tree species include *Abies concolor, Pseudotsuga menziesii* and *Populus tremuloides* trees in Montane Zone and *Picea engelmannii* and *Populus tremuloides* in Subalpine Zone.
Southern Rocky Mountain Avalanche Chute Shrubland Complex (S_AVAL)
2b) Stand is a krummholz shrubland dominated by wind-stunted trees < 5 m tall occurring near upper tree line. Tree species include *Picea engelmannii and Pinus flexilis.*
***Picea engelmannii - (Pinus flexilis)* Great Basin Krummholz ShrublandAlliance (S_PIEN)**

3a) Stand occurs in an avalanche chute is composed of shrubs such as *Symphoricarpos* spp., *Chrysothmnus viscidiflorus,* and *Juniperus communis*. Avalanche damaged tree species may be present with low cover.
Southern Rocky Mountain Avalanche Chute Shrubland Complex (S_AVAL)
3b) Stand does not occur in an avalanche chute. **(4)**

4a) Shrubland occurs in a previously burned area and may be dominated by by a variety shrubs such as *Prunus virginiana, Chrysothamnus viscidiflorus, Ribes spp.,*or *Symphoricarpos oreophilus* that are typical of seral stages of post-fire forest regeneration. *Penstemon rostriflorus* and *Cirsium eatonii* are characteristic of the post-burn conditions and are often present. This type is not well described and may include other shrubs or may be herbaceous dominated by as long as there is good evidence of recent fire.
Post-fire Shrubland Complex (S_FIRE)
4b) Shrubland is not in a previously burned area or was not recent enough to have clear evidence of fire. **(5)**

5a) Tall and short shrublands occurring within drainage bottoms or on mesic alluvial deposits (benches and terraces) that are dominated or codominated by species of *Acer, Betula, Prunus, Rosa* or *Salix*.
Montane Riparian Shrubland Complex (S_RIP)
5b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Arctostaphylos*, *Atriplex, Artemisia, Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Gutierrezia, Juniperus, Peraphyllum, Prunus, Purshia, Ribes, Sarcobatus,* or *Symphoricarpos.* **(6)**

6a) Desert scrub occurring on lower elevation sites around Baker Visitor Center that are dominated or codominated by species of *Atriplex, Gutierrezia, Artemisia* or *Sarcobatus.* **(7)**
6b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Arctostaphylos*, *Artemisia, Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Juniperus, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(8)**

7a) Open low shrubland dominated or codominated by *Gutierrezia sarothrae* with other disturbance species such as *Tetradymia.* It typically occurs on highly disturbed sites and was not sampled within park boundaries.
***Gutierrezia sarothrae* Dwarf-shrubland Alliance (DS_GUSA)**
7b) Open shrublands dominated or codominated by *Sarcobatus vermiculatus* with *Artemisia tridentata* and/or *Atriplex confertifolia.* Stands often occur on sandy upland sites near Baker Visitor Center and saline bottomlands along washes.
***Sarcobatus vermiculatus* Shrubland Alliance (S_SAVE)**

8a) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Artemisia. Amelanchier utahensis, Chamaebatiarria millefolium,* or *Peraphyllum ramosissimum* may be presen to codominant. **(9)**
8b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Amelanchier, Arctostaphylos*, *Ceanothus, Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Juniperus, Gutierrezia, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* *Artemisia* spp. may be present, but do not codominate. **(14)**

9a) Shrubland or shrub steppe with open to dense shrub layer dominated or codominated by dwarf-shrub, *Artemisia arbuscula* ssp. *arbuscula* with 50% or more relative shrub cover or is the most abundant shrub species. Cover of herbaceous layer often exceeds the cover of shrubs. Common grasses are *Poa fendleriana* and *Pseudoroegneria spicata.*
***Artemisia arbuscula* ssp. *arbuscula* Shrub Herbaceous Alliance (S_ARAR)**
9b) Shrublands or shrub steppe dominated or codominated by *Artemisia nova* or *Artemisia tridentata.* **(10)**

10a) Shrubland or shrub steppe with open to dense shrub layer dominated or codominated by dwarf-shrub by *Artemisia nova* with 50% or more relative shrub cover or is the most abundant shrub species.
***Artemisia nova* Shrubland Alliance (S_ARNO)**
10b) Shrublands or shrub steppe dominated or codominated by *Artemisia tridentata.* **(11)**

11a) Shrub layer is codominated by *Amelanchier utahensis* and *Artemisia tridentata,* usually *A. t.* ssp. *vaseyana. Amelanchier utahensis* will typically have >25% relative cover in short shrub layer or form a tall shrub layer over an *Artemisia tridentata* dominated short shrub layer.
***Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland (S_AMARTV)**
11b) Shrub layer is not codominated by *Amelanchier utahensis.* **(12)**

12a) Shrub layer is dominated or codominated by *Artemisia tridentata* ssp. *vaseyana.* Sampled stands are generally above 2290 m (7500 feet). **(13)**

12b) Shrub layer is dominated or codominated by *Artemisia tridentata* ssp. *tridentata.* Sampled upland stands are generally below 2350 m (7700 feet), except for bottomland associations which extend up to 2685 m (8800 feet). Other shrubs that may be present to codominant include *Chamaebatiarria millefolium, Ericameria nauseousa,* and *Peraphyllum ramosissimum.* Common grasses include *Elymus elymoides, Leymus cinereus, Pleuraphis jamesii,* and introduced species *Agropyron cristatum* and *Bromu tectorum.*
***Artemisia tridentata* ssp. *tridentata* Shrubland Complex (S_ARTR)**

13a) Shrub layer is dominated by *Artemisia tridentata* ssp. *vaseyana* with herbaceous layer dominated by grasses such as *Poa fendleriana, P. glauca, Poa secunda* and introduced annual, *Bromus tectorum. Symphoricarpos oreophilus* is typically absent or has low cover.
***Artemisia tridentata* ssp. *vaseyana* / Grass Understory Shrubland Complex (S_ARTRV)**

13b) Shrub layer is codominated by *Artemisia tridentata* ssp. *vaseyana* and *Symphoricarpos oreophilus.* Grasses such as *Elymus trachycaulis* and *Pseudoroegneria spicata* may be present and sometimes form an herbaceous layer
***Artemisia tridentata* ssp. *vaseyana – Symphoricarpos oreophilus* Shrubland Alliance (S_ARTSY)**

14a) Short shrublands (generally < 2m tall), occurring dry uplands that are dominated or codominated by *Arctostaphylos patula,* often with *Ceanothus martinii.*
***Arctostaphylos patula* Shrubland Alliance (S_ARPA)**

14b) Tall and short shrublands occurring in mesic or dry uplands that are dominated or codominated by species of *Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Juniperus, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(15)**

15a) Shrub layer is dominated or codominated by *Peraphyllum ramosissimum* typically with *Artemisia tridentata* present to sometimes nearly codominant. Many other shrubs may be present with less cover than *Peraphyllum ramosissimum* including *Cercocarpus intricatus, Glossopetalon spinescens,* and *Ephedra viridis.* Scattered *Pinus monophylla, Juniperus osteosperma, and Cercocarpus ledifolius* trees may be present. This type is known from Big Wash area.
***Cercocarpus intricatus* – (*Peraphyllum ramosissimum*) Shrubland Complex (S_CIPR)**

15b) Shrub layer is not dominated or codominated by *Peraphyllum ramosissimum.* **(16)**

16a) Shrub layer is dominated or codominated by *Amelanchier utahensis* and *Artemisia tridentata,* usually *A. t.* ssp. *vaseyana. Amelanchier utahensis* will typically have >25% relative cover in short shrub layer or form a tall shrub layer over an *Artemisia tridentata* dominated short shrub layer.
***Amelanchier utahensis - Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis)* Shrubland (S_AMARTV)**

16b) Shrub layer is not codominated by *Amelanchier utahensis.* **(17)**

17a) Tall shrublands occurring in dry uplands that are dominated or codominated by *Cercocarpus ledifolius*.
Cercocarpus ledifolius **Shrubland and Woodland Complex (W_CELE)**
17b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Cercocarpus, Chrysothamnus, Dasiphora, Ericameria, Ephedra*, *Juniperus, Peraphyllum, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(18)**

18a) Short shrublands (generally < 2m tall), occurring on dry uplands that are dominated or codominated by *Cercocarpus intricatus* and/or *Glossopetalon spinescens. Ephedra viridis, Purshia tridentata, Peraphyllum ramosissimum,* and *Artemisia tridentata* may be present, but not codominant.
***Cercocarpus intricatus* – (*Peraphyllum ramosissimum*) Shrubland Complex (S_CIPR)**
18b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Chrysothamnus, Dasiphora, Ephedra, Ericameria, Juniperus, Prunus, Purshia, Ribes,* or *Symphoricarpos.* **(19)**

19a) Short shrublands or shrub steppe (generally < 2m tall) occurring dry uplands that are dominated by *Purshia tridentata* with *Artemisia tridentata* usually present to sometimes nearly codominant.
Purshia tridentata **Shrubland Complex (S_PUTR)**
19b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Chrysothamnus, Dasiphora, Ephedra, Juniperus, Ericameria, Prunus, Ribes,* or *Symphoricarpos.* **(20)**

20a) Short shrublands or shrub steppe (generally < 2m tall) occurring on dry uplands that are dominated by *Chrysothamnus viscidiflorus* sometimes with *Eriogonum microthecum* codominant. The herbaceous layer is dominated by *Pseudoroegneria spicata.*
Chrysothamnus viscidiflorus **Shrub Herbaceous Alliance (S_CHVI)**
20b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ericameria, Ephedra, Juniperus, Prunus, Ribes,* or *Symphoricarpos.* **(21)**

21a) Short shrublands or shrub steppe (generally < 2m tall), occurring in dry valleys and uplands that are dominated by *Ericameria nauseosa*. If present, the herbaceous layer is typically dominated by *Bromus tectorum,* an introduced annual grass. Sites have been disturbed in past and may have scattered *Artemisia tridentata* in some stands.
Ericameria nauseosa **Shrubland Alliance (S_ERNA)**
21b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ericameria, Ephedra, Juniperus, Prunus, Ribes,* or *Symphoricarpos.* **(22)**

22a) Short shrublands (generally < 2m tall) occurring in somewhat mesic, higher elevation uplands that are dominated or codominated by *Ribes cereum* and/or *R. montigenum* often with *Ericameria discoidea* present to codominant. This map class also includes stands dominated by *Juniperus communis* with or without *Ribes* spp. Sites frequently occur near upper tree line in lower alpine – upper subalpine zones.

***Ribes montigenum* – (*Juniperus communis*) Shrubland Complex (S_RMJC)**

22b) Tall and short shrublands occurring on mesic or dry uplands that are dominated or codominated by species of *Dasiphora, Ephedra, Prunus,* or *Symphoricarpos.* **(23)**

23a) Stand is a mesic meadow. Mesic species such as *Elymus trachycaulus,* sometimes with an open shrub canopy of *Dasiphora fruticosa* ssp. *floribunda* dominate with other mesic herbaceous species, forming a mixture of mesic forbs and graminoids including *Achillea millefolium, Juncus parryi,* and *Potentilla pulcherrima,* sometimes with wet meadow species present such as *Polygonum bistortoides* or *Ranunculus alismifolius.* The mesic introduced grass, *Poa pratensis* is abundant on some sites.

Montane Mesic Meadow Complex (H_MESC)

23b) Stand not dominated by *Dasiphora fruticosa* ssp. *floribunda.* **(24)**

24a) Stands are patchy and near sparse (10-15% cover), mixed vegetation occurring on a variety of rocky sites such as bedrock outcrops and steep talus slopes. Vegetation ranges from mat-forming plants such as *Petrophyton caespitosum* and *Selaginella watsonii;* mixed cold deciduous shrubs with scattered seedlings of *Pinus flexilis, Abies concolor,* or *Cercocarpus ledifolius;* and various rock loving herbaceous species *Castilleja nana, Hulsea algida, Polemonium viscosum* and cushion plants at higher elevations.

Mixed Rock & Talus Shrubland Complex (S_RT)

24a) Stands are relatively mesic, tall mixed shrublands (generally > 2m tall) occurring at the somewhat mesic sites at such as the base of rock outcrops and below seep areas on steep talus slopes. Stands are dominated by *Prunus virginiana* with *Acer glabrum, Artemisia tridentata, Holodiscus dumosus, Rosa woodsii,* and/or *Symphoricarpos oreophilus* present to codominant.

Montane Talus & Rock Outcrop Shrubland Complex (S_MOTA)

KEY IV: THE HERBACEOUS MAP CLASSES OF GREAT BASIN NP

1a) Herbaceous vegetation occurring in avalanche chutes.
Southern Rocky Mountain Avalanche Chute Herbaceous Vegetation Complex (H_AVAL)
1b) Herbaceous vegetation occurring outside avalanche chutes **(2)**

2a) Recently burn site dominated by herbaceous vegetation (Also key vegetation to non-post fire types below).
Post-fire Shrubland (S_FIRE)
2b) Recently burn sites not dominated by herbaceous vegetation. **(3)**

3a) Herbaceous vegetation dominated by introduced herbaceous species. **(4)**
3b) Herbaceous vegetation dominated by native herbaceous species. **(5)**

4a) Herbaceous vegetation dominated by annual introduced herbaceous species, *Bromus tectorum* or other introduced annual grass or forb species.
Annual Invasive Complex (H_AINV)
4b) Herbaceous vegetation dominated by perennial introduced herbaceous species such as *Agropyron cristatum, Bromus inermis,* and/or *Poa pratensis*.
Perennial Invasive Grassland Complex (H_PINV)

5a) Herbaceous vegetation occurring above upper tree line and dominated by alpine species. **(6)**
5b) Herbaceous vegetation dominated by foothill, montane and subalpine herbaceous species. **(7)**

6a) Herbaceous vegetation is dominated or codominated by *Carex elynoides, Carex subnigricans, Calamagrostis purpurascens, Trisetum spicatum,* and *Geum rossii* forming alpine turf. *Phlox pulvinata* and *Poa secunda* may be present to codominant. Total plant cover ranges from 10-90%.
Alpine Turf Complex (SV_TURF)
6b) Herbaceous vegetation is dominated by cushion plants forming, windswept alpine fell-field. Characteristic species are *Aquilegia scopulorum, Astragalus kentrophyta, Eriogonum holmgrenii, Cymopterus nivalis, Erigeron leiomerus, Geum rossii* and *Phlox pulvinata.* Total plant cover typically ranges form 5-35% and there is often more than 50% ground cover of gravel and rock.
Alpine Cushion Plant Fell-field Complex (SV_FELL)

7a) Herbaceous vegetation occupies relatively xeric upland sites, including valley bottoms, terraces, slopes and benches; community not controlled by mesic conditions. Herbaceous layer is dominated or co-dominated by *Achnatherum lettermanii*, *Arenaria congesta, Astragalus kentrophyta, Balsamorhiza sagittata, Cirsium eatonii, Elymus scribneri, Erigeron simplex, Hesperostipa comata, Lomatium graveolens* var. *alpinum, Monardella odoratissima, Penstemon pachyphyllus, Phacelia hastata, Poa fendleriana, Poa secunda, Pseudoroegneria spicata* and *Symphyotrichum spathulatum.*
However, if shrubs form a consistent open layer (≥5% cover), go to Key III Shrubland and Shrub Steppe Map Classes, to verify stand is not a shrub steppe type.
Rocky Mountain Montane-Subalpine Grassland Complex (H_RMGC)

7b) Herbaceous vegetation occupies mesic sites and wetlands including seeps, and springs, along perennial drainages, mesic meadows and depressions. Dominated or codominated by species of *Carex*, *Dodecatheon, Elymus, Juncus, Leymus, Poa* and *Polygonum.* Mesic shrubs *Dasiphora fruticosa* ssp. *floribunda* and *Symphoricarpos oreophilus* may be present to abundant. **(8)**

8a) Stand is a mesic meadow. Mesic species such as *Elymus trachycaulus,* sometimes with an open shrub canopy of *Dasiphora fruticosa* ssp. *floribunda* often dominate with other mesic herbaceous species forming a mixture of mesic forbs and graminoids including *Achillea millefolium, Juncus parryi,* and *Potentilla pulcherrima,* sometimes with wet meadow species present such as *Polygonum bistortoides* or *Ranunculus alismifolius.* The mesic introduced grass *Poa pratensis* is abundant on some sites.
Montane Mesic Meadow Complex (H_MESC)

8b) Stand is a wet meadow. Wetland species such as *Carex nebrascensis, Carex scopulorum*, *Dodecatheon alpinum, Juncus balticus, Juncus nevadensis, Leymus cinereus* and *Polygonum bistortoides* dominate or codominate stands. Some stands have low cover of shrubs *(Artemisia tridentata, Salix boothii,* and *Rosa woodsii)* or mesic upland species
Montane Wet Meadow Complex (H_WET)

KEY V: THE SPARSE MAP CLASSES OF GREAT BASIN NP

1a) Barren sites (<2% vascular plant cover) or sparse vegetation (<10% vascular plant cover) occurring in avalanche chutes.
Unvegetated Avalanche Chute Talus & Rock (G_AVAL)
1b) Barren sites or sparse vegetation occurring outside avalanche chutes **(2)**

2a) Sparsely vegetated site. **(3)**
2b) Barren rock. **(4)**

3a) Sparse vascular herbaceous vegetation is dominated by cushion plants forming alpine fell-field. Characteristic species are *Aquilegia scopulorum, Astragalus kentrophyta, Eriogonum holmgrenii, Cymopterus nivalis, Erigeron leiomerus,* and *Phlox pulvinata.* Total vascular plant cover typically ranges form 5-35%. Sites often have over 50% ground cover of gravel and rock.
Alpine Cushion Plant Fell-field Complex (SV_FELL)
3b) Foothill to alpine sparsely vegetated rock outcrop sites with less than 10% total vascular plant cover. Sites are characterized by either woody species such as *Abies concolor, Cercocarpus ledifolius,* and *Pinus flexilis* or by herbaceous species such as *Castilleja nana, Hulsea algida, Juniperus communis, Petrophyton caespitosum, Ribes* spp. or *Polemonium viscosum.*
Mixed Rock &Talus Shrubland Complex (S_RT)

4a) Barren Talus and Scree fields with <2% total vascular plant cover.
Bare Talus, Scree & Fell-field Complex (G_TALS)
4b) Barren Rock Outcrop and Scree fields with <2% total vascular plant cover.
Unvegetated Rock Cliff & Outcrop (G_ROCK)

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