

TECHNICAL NOTE

Selecting the Appropriate Native Plants for Revegetation and Restoration Purposes in the Southwest

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One of the most common questions confronting natural resources conservation specialists and land managers is what native plant species are appropriate for a particular revegetation or restoration project. Such projects typically aim to rehabilitate wildlands that have been disturbed by natural forces or human activities.

This document describes the following approaches for determining the selection of appropriate species:

- Using native plant lists or floras from nearby or similar sites.
- Using the NRCS Ecological Site Information System (ESIS) website to access Ecological Site Descriptions (ESDs) and Major Resource Land Areas (MLRAs).
- Using an NRCS State Website to access the Ecological Site Descriptions.
- Using the USDA-NRCS Web Soil Survey Website to access Ecological Site Descriptions
- Using the NRCS PLANTS Database to find the dominant species within an ecoregion having characteristics suitable for the revegetation site.
- Using the NatureServe Explorer website to find plant association information.

Using Native Plant Lists or Floras

There are numerous sources of native plant lists or floras. These sources often concentrate on a single location or area which would be useful if a project is located near one of these areas. Some of these types of sources are listed as well as examples:

Sources	For Example . . .
National parks	Grand Canyon National Park Vascular Plant List Link: http://www.nps.gov/crca/naturescience/upload/GRCAVascular_Flora20051001.xls
National monuments	White Sands National Monument Checklist of Plants Link: http://www.nps.gov/whsa/naturescience/checklist-of-plants.htm
Native plant societies	Native Plant Society of New Mexico Link: http://npsnm.unm.edu/native_plant.html
State parks and preserves	Native Plant Revegetation Guide for Colorado Link: http://parks.state.co.us/NR/rdonlyres/00A97125-2219-4E68-A28F-6CC62300D43A/0/revegetation.pdf
National forests	Plant Associations of Arizona and New Mexico Volume 1: Forests Edition 3, USDA Forest Service, Southwestern Region, Habitat Typing Guides

Sources**For Example . . .**

Link: http://www.nm.nrcs.usda.gov/technical/tech-notes/range/range99-publication-forests.pdf	Plant Associations of Arizona and New Mexico Volume 2: Woodlands Edition 3, USDA Forest Service, Southwestern Region, Habitat Typing Guides
Link: http://www.nm.nrcs.usda.gov/technical/tech-notes/range/range99-publication-woodland.pdf	
Universities	Natural Heritage New Mexico - Floristic Survey of Cannon Air Force Base and Melrose Air Force Range New Mexico
Link: http://nhnm.unm.edu/vlibrary/pubs_archive/nhnm/nonsensitive/U95DEB01NMUS.pdf	
Herbariums	Herbarium University of New Mexico – Checklist of Vascular Plants in the Sandia and Manzano Mountains of Central New Mexico
Link: http://www.msb.unm.edu/publications/documents/OccPap-MSB-N10-Sivinski2007.pdf	

Using the NRCS Ecological Site Information System

When an adjacent flora is not available, another approach to determine appropriate species is the NRCS Ecological Site Information System (ESIS) to access the NRCS Ecological Site Descriptions (ESDs). These descriptions can be useful to help identify the dominant native plant species as well as other site factors that can influence species selection.

You can access the NRCS Ecological Site Information System (ESIS) from the webpage <http://esis.sc.egov.usda.gov/> or from the NRCS PLANTS database <http://plants.usda.gov/>.

Once you have accessed the ESIS website, follow these steps:

Step	User Action
1	Click the Ecological Site Description box.
2	Click the Approved ESD Reports; the first input requirement is to determine the Major Land Resource Area (MLRA) of the project. The webpage has a button to access MLRA Explorer which will determine the desired Resource Area, and if needed output an MLRA Report.
3	Click MRLA Explorer.
4	Click the region (Continental U.S.)
5	Check the boxes next to areas of interest (for example, Check “Check/Clear all” for all ecological information.
6	Click “Click Select” to create a report for a single MRLA.
7	Click the area of the map for which you want to create a report.
8	Click “Create Report.” Figure 1 shows an example map created for MLRA 35 –Colorado Plateau.

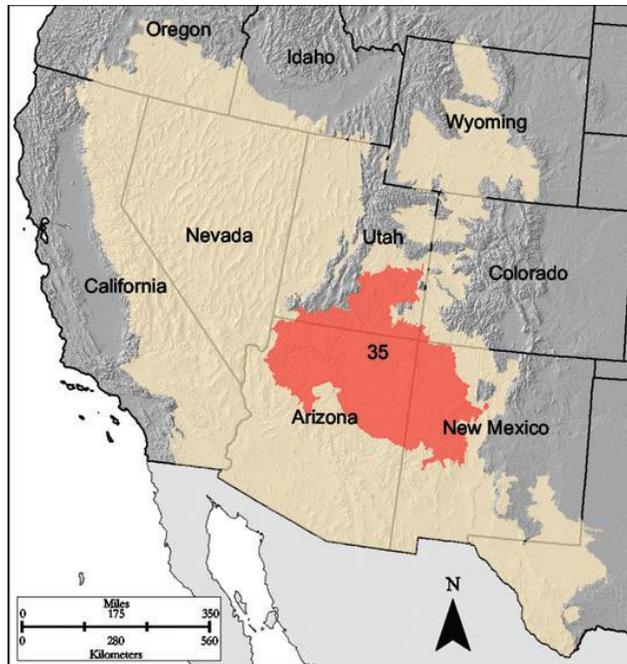


Figure 1: MLRA 35 – Colorado Plateau

When the appropriate MLRA is entered without a State designation, ESIS lists all the site descriptions for all states having this Resource Area (for MLRA 35, ESDs for New Mexico, Arizona, and Utah are listed). These site descriptions will be categorized by features including:

- Topography (e.g., bottomland)
- Slope (e.g., steep)
- Soil texture (e.g., clay)
- Soil chemistry (e.g., saline)
- Soil depth (e.g., shallow)
- Dominant vegetation (e.g., Pinyon – Utah Juniper)
- Geological features (e.g., malpais)

Using an NRCS State Website to Access Ecological Site Descriptions

Within each NRCS State website, it is possible to access ESDs, but the procedure varies by state:

Examples: Accessing Ecological Site Descriptions from an NRCS State Website

State	Link
New Mexico	http://www.nm.nrcs.usda.gov/technical/fotg/section-2/esd.html)
Arizona	http://efotg.nrcs.usda.gov/references/public/AZ/ArizonaEcologicalSiteKeyMLRA35.doc Ecological Site Key (for example, MLRA 35)
Utah	http://www.ut.nrcs.usda.gov/technical/technology/range/ecosites.html
Colorado	http://www.co.nrcs.usda.gov/technical/ecs/ecs-index.html Electronic Field Office Technical Guide (eFOTG) Section II D. Ecological Site

Examples: Accessing Ecological Site Descriptions from an NRCS State Website

State	Link
	Descriptions for MLRA's 67B and 69 only

For the New Mexico website, the procedure is as follows:

Step	User Action	Result
1	Click the MLRA number on the map of the area for which you wish to create a report.	The MLRA Characteristics with associated MLRA numbers are listed.
2	Click the desired MLRA number	The MLRA Land Resource Units with associated numbers are listed.
3	Click the Land Resource Unit for the area you are investigating.	A Site Description list for the MLRA is displayed.
4	Select the Site Description best describing the project site and click the associated site number.	The Ecological Site Description webpage is displayed.
5	Click the type of information desired (located along the left side of the webpage). If you want a complete report, click "Complete Report."	The selected characteristics of the ESD are displayed.

After deciding on an appropriate ESD Site Description that matches the project site characteristics, you can create a report for the specified ESD with Physiographic Features, Climate Features, Water Features, Soil Features, Plant Communities, Site Interpretations, and Supporting Information.

Within the Plant Communities selection, a listing of the Historic Climax Plant Community Plant Species Composition is very useful in determining key plant species for the site (see Table 1 for an example). In addition, this selection often reports the Ecological Dynamics of the Site. In some cases, the site may have undergone such severe disturbance that the plant species listed in the Historic Plant Community cannot be successfully established. The Ecological Dynamics section can give some insight on what species might be appropriate for such a disturbed site.

Table 1: Ecological Site Description Historic Climax Plant Community Plant Species Composition

Example - Site Type: Rangeland, **Site Name:** Loamy, **Site ID:** R035XB001NM, **Major Land Resource Area:** 035 - Colorado Plateau

Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	Annual Production in Pounds Per Acre High
Grasses:			
James' galleta	<i>Pleuraphis jamesii</i>	55	83
Indian ricegrass	<i>Achnatherum hymenoides</i>	55	110
needleandthread	<i>Hesperostipa comata</i>	28	55
New Mexico feathergrass	<i>Hesperostipa neomexicana</i>	28	55
western wheatgrass	<i>Pascopyrum smithii</i>	17	28
squirreltail	<i>Elymus elymoides</i>	28	55
blue grama	<i>Bouteloua gracilis</i>	55	110
sand dropseed	<i>Sporobolus cryptandrus</i>	28	55
sideoats grama	<i>Bouteloua curtipendula</i>	11	38
threeawn	<i>Aristida</i>	17	28

Table 1: Ecological Site Description Historic Climax Plant Community Plant Species Composition

Example - Site Type: Rangeland, **Site Name:** Loamy, **Site ID:** R035XB001NM, **Major Land Resource Area:** 035 - Colorado Plateau

Common Name	Scientific Name	Annual Production in Pounds Per Acre Low	Annual Production in Pounds Per Acre High
alkali sacaton	<i>Sporobolus airoides</i>	17	44
Forbs:			
threadleaf ragwort	<i>Senecio flaccidus var. flaccidus</i>	17	28
scarlet globemallow	<i>Sphaeralcea coccinea</i>	17	28
fleabane	<i>Erigeron</i>	17	28
woolly plantain	<i>Plantago patagonica</i>	17	28
Cuman ragweed	<i>Ambrosia psilostachya</i>	17	28
milkweed	<i>Asclepias</i>	17	28
aster	<i>Aster</i>	17	28
locoweed	<i>Oxytropis</i>	17	28
Shrubs:			
beardtongue	<i>Penstemon</i>	17	28
big sagebrush	<i>Artemisia tridentata</i>	28	83
fourwing saltbush	<i>Atriplex canescens</i>	28	55
Cutler's jointfir	<i>Ephedra cutleri</i>	17	28
winterfat	<i>Krascheninnikovia lanata</i>	17	28
yellow rabbitbrush	<i>Chrysothamnus viscidiflorus</i>	17	28
pale desert-thorn	<i>Lycium pallidum</i>	17	28
camphor tansy	<i>Tanacetum camphoratum</i>	17	28
spineless horsebrush	<i>Tetradymia canescens</i>	17	28

Using the USDA-NRCS Web Soil Survey Website

This USDA-NRCS website enables you to access soil data for the desired area and then select various reports including Suitabilities and Limitations for Use, Soil Properties and Qualities, and Ecological Site Assessment. One key benefit of using Web Soil Survey is its ability to generate an ESD using aerial photo maps without having to determine the appropriate MLRA. From this soil data you can generate an Ecological Site Description Report.

Use the following steps generate an ESD report for the area of interest:

Step	User Action	Result
1	Enter the following URL: http://WebSoilSurvey.nrcs.usda.gov/app/	Displays the Web Soil Survey Web page.
2	Click Start WSS 	Displays the Area of Interest (AOI) page that contains the Area of Interest (AOI) Interactive Map.
3	For the purpose of this exercise, select “State and County” from the Quick Navigation list located on the left-hand side. A. Click State and select New Mexico from the drop-	Displays the state and county region on the AOI Interactive Map.

Step	User Action	Result
	<p>down list; select San Juan County from the drop-down list.</p> <p>B. Click View.</p>	
4	<p>A. Click AOI Zoom In icon on the AOI Interactive Map. Place the cursor on desired area of the AOI map (the cursor becomes a crosshair).</p> <p>B. Click the left mouse button to zoom in on the area.</p> <p>C. Repeat clicking until the area of interest is more identifiable (3 or 4 times).</p>	Displays a close-up view on the AOI Interactive Map.
5	<p>A. Click the AOI Rectangle  icon.</p> <p>B. Place the cursor over the desired area and hold down the left mouse button and drag to select the area of interest on the AOI Interactive Map.</p>	Displays “Creating AOP” and “Clipping soils layer to AOI extent...” and outlines the area on the AOI Interactive Map. The Area of Interest Properties is displayed on the left-hand side of the page.
6	<p>Click the “Soil Map” tab.</p> <p>Optional: Enter a project name in the Name box.</p>	Displays the Soil Map on the right and the Map Unit Legend on the left-hand side of the page.
7	<p>A. Click the “Soil Data Explorer” tab.</p> <p>B. Click “Ecological Site Assessment” tab.</p>	<p>Displays the Ecological Site Assessment on the top middle area of the page.</p> <p>Displays the Ecological Sites for the area of interest.</p>
9	Select the appropriate Ecological Site type (such as loamy, sandy, etc.) for the site, then click “Historic Climax Plant Community.:	Displays plant community information.
8	<p>A. Click “Add to Shopping Cart Options” at the top right-hand side of the page to include in the soils report.</p> <p>B. Click “Add to Shopping Cart.”</p> <p>Optional: Enter a subtitle if desired.</p> <p>C. Click OK.</p> <p>D. Click Shopping Cart (Free) tab</p> <p>Optional: Enter a Subtitle in the Subtitle box.</p>	Displays “Adding soil properties to the report...” and lists the “Report Properties” on the left-hand side of the page.
9	<p>A. Click Checkout.</p> <p>B. Select Get Now and click OK in the “Checkout Options.”</p>	Displays “Generating custom soil resource report...” and displays the report in PDF format. You can now print or save the report.

Alternative Approach: An alternative approach provides the Ecological Site ID but does not directly access the ESD report as described above. Within Soil Data Explorer, select the Suitabilities and Limitations for Use tab. Click the Land Classification selection and then click the Ecological Site ID selection. This procedure will provide the Ecological Site ID as a Rating for each Map Unit identified in the Area of Interest.

Using the NRCS PLANTS Database - VEGSPEC

Another approach to selecting appropriate native species for a revegetation or restoration project involves the use of the NRCS PLANTS database. The PLANTS database delineates species characteristics for many of the dominant plant species in each ecoregion. Many of these characteristics are crucial in determining the suitability of a particular species for a certain site.

Within the PLANTS database, VEGSPEC allows a conservation specialist or land manager to use soil, plant, and climate data to select plant species that are:

1. Adapted to a specific site
2. Suitable for the selected practice (treatment)
3. Appropriate for the purposes and sub-purposes for which the planting is intended

Note for NRCS Users

Do not use VEGSPEC in place of the eFOTG recommendations. This tool is more applicable for use by state specialists who have the responsibility of evaluating output appropriate to site conditions for augmenting species in the Field Office Technical Guide.

Use the Site Specific selection to narrow down plant choices by state, MLRA, soil, and climate options:

Step	User Action...	and VEGSPEC...
1	Enter the NRCS PLANTS Database URL: http://www.plants.usda.gov/ and clicks VEGSPEC at the bottom of the left column.	Displays the VEGSPEC webpage.
2	Click Start VEGSPEC and specify the site information and the Soil Survey Area ID (usually designated by county) and Soil Map Unit (often available in the Ecological Site Description)	Lists soils information such as pH, texture, and salinity.
3	Specify the most appropriate climate station	Reports summary precipitation and temperatures data for that station.
4	Specify the conservation practice (such as critical area planting), purpose (for example erosion control and native plant community restoration), and plant type (such as grass).	Supplies a listing of potential plant species and cultivars
5	Select the most suitable candidates or add additional species to become the Selected Plant List.	The Selected Plants are listed.

Example 1 shows an abbreviated VEGSPEC report for a hypothetical, critical area revegetation project for a natural gas well pad site in northwest New Mexico having an ESD the same as in Table 1. VEGSPEC also allows the user to perform seeding mix calculations based on a 40 Pure Live Seed (PLS) per square foot or user-defined specifications. If the user has germination and purity data on their seedlots, VEGSPEC will calculate the bulk seed requirements. A Conservation Practice Job Sheet 342

(located on the New Mexico NRCS website) also provides an interactive spreadsheet which provides seed mix calculations: <http://efotg.nrcs.usda.gov/references/public/NM/js342.xls>

VEGSPEC will respond with attributes of the selected species that indicate the mix might require some revision based on attributes such as seedling vigor, season of growth, vegetative rate of spread, or moisture use. The highlighted sentences in Example 1 present the species with attributes that are not consistent with the rest of the species mix.

Example 1: VEGSPEC Critical Area Planting Report

User Name: Land Manager **Site Name:** Natural Gas Development -Well Pad Example
Project Location: San Juan County **State:** NM

Landscape Information

Site Aspect:

Water Receiving: N
Irrigation: None
Exposure: Full Sun

Soil Information

Soil Survey Area ID: SAN JUAN COUNTY, EASTERN PART, NEW MEXICO: 618
Soil Map Unit: Doak loam, 1 to 3 percent slopes: Db
Soil Component: Doak:90%

Soil Attributes

Slope Percent:	1	3	2.0	
Salinity (mmhos) most saline layer in 12 inches:	0	0	0	L
pH (lowest and highest):	7.4	9.0		

MLRA:	0037:San Juan River Valley Mesas and Plateaus
Hydric Soil:	N
Surface Texture:	L
Surface Texture Class:	M
Tax Class:	NON-AQUIC
Average Water Capacity (avg. layer, top 40 inches, perm; .06 inches/hr)	6.58
Soil Classification:	NON-UDIC

Climate Information

Climate Station: **Id:** NM0692 **Name:** AZTEC RUINS NATL MONUME
Last Frost Date: 5/ 8
First Frost Date: 10/14
Growing season length (days): 159

Climate Attributes

Avg. Annual Precipitation: 10.31
Estimated Annual Average Precipitation (EAAP) inches: 7.72 **Average derived from:** 2IN10
Minimum temperature -10.0

Average Temperature and Precipitation by Month												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temperature	28.0	35.0	41.6	49.4	58.4	67.9	74.4	72.1	64.1	52.9	40.1	30.0
Precipitation	0.87	0.79	0.89	0.68	0.6	0.36	0.99	1.17	1.03	1.17	0.89	0.87

Planting Objectives

Practice: 342-Critical area planting

Purposes(s) Selected
Native Plant Community Restoration
Water Erosion Control
Wind Erosion Control

Plant Type: Grass

Plant Selection

Potential Plants

Common Name	Scientific Name	Release Name
alkali sacaton	Sporobolus airoides	Salado
Arizona cottontop	Digitaria californica	n.a.
beardless wheatgrass	Pseudoroegneria spicata ssp. inermis	Whitmar
beardless wildrye	Leymus triticoides	Rio
black grama	Bouteloua eriopoda	n.a.
bluebunch wheatgrass	Pseudoroegneria spicata ssp. spicata	Goldar
bluebunch wheatgrass	Pseudoroegneria spicata ssp. spicata	n.a.
bluebunch wheatgrass	Pseudoroegneria spicata ssp. spicata	Secar
Indian ricegrass	Achnatherum hymenoides	n.a.
Indian ricegrass	Achnatherum hymenoides	Paloma
sideoats grama	Bouteloua curtipendula	n.a.
squirreltail	Elymus elymoides	n.a.
streambank wheatgrass	Elymus lanceolatus ssp. lanceolatus	n.a.

Selected Plants

alkali sacaton: Sporobolus airoides: Salado: SPAI
beardless wildrye: Leymus triticoides: Rio: LETR5
black grama: Bouteloua eriopoda: n.a.: BOER4
bluebunch wheatgrass: Pseudoroegneria spicata ssp. spicata: Secar: PSSPS
Indian ricegrass: Achnatherum hymenoides: Paloma: ACHY
sideoats grama: Bouteloua curtipendula: n.a.: BOCU
squirreltail: Elymus elymoides: n.a.: ELEL5
streambank wheatgrass: Elymus lanceolatus ssp. Lanceolatus: n.a.: ELLAL

Seeding Rate Calculations

Seeding Method:	Drill
Row spacing:	12.0
Acres to seed:	1.0
Rate Calculation method:	Vegspec Seed Rate Rules

Species	Release	Mix %	Standard Seeding Rate(lb/acre)	Standard Seeds/ft2	Actual Seeding Rate(lb/acre)	Actual Seeds/ft2	Total lb PLS	Germ %	Purity %	Total lb. Bulk
alkali sacaton	Salado	10	0.99	40.0	0.09	4.0	0.09	÷	÷	=
beardless wildrye	Rio	5	10.23	40.0	0.51	2.0	0.51	÷	÷	=
black grama	n.a.	10	1.3	40.0	0.13	4.0	0.13	÷	÷	=
bluebunch wheatgrass	Secar	5	13.86	40.0	0.69	2.0	0.69	÷	÷	=
Indian ricegrass	Paloma	20	10.76	40.0	2.15	8.0	2.15	÷	÷	=
sideoats grama	n.a.	20	10.94	40.0	2.18	8.0	2.18	÷	÷	=
squirreltail	n.a.	20	9.07	40.0	1.81	8.0	1.81	÷	÷	=
streambank wheatgrass	n.a.	10	11.38	40.0	1.13	4.0	1.13	÷	÷	=

Total Mix:	100
Total Seeds/ft2:	40.0
Total Seed (required(lb):	8.69
Total Seeds per linear ft:	40.0

The seeding mixture contains species with both low and high vigor ratings. This may cause difficulty in the successful establishment of the low vigor species. (Indian ricegrass and streambank wheatgrass have high vigor)

The seeding mixture contains grasses and/or forbs that have different active growth periods. The mixture may not be compatible or may require specialized management. (e.g., squirreltail actively grows in spring only)

The seeding mixture contains species that have different rates of vegetative spread. This may cause difficulty in the successful establishment of the slow spreading species due to competition for water and nutrients. (beardless wildrye and streambank wheatgrass have rapid vegetative spread)

The seeding mixture contains species that are comparatively high users of available moisture. This may cause difficulty in the long-term maintenance of these species on sites with less than adequate available moisture or they may cause difficulty in the establishment other species in the mixture that have lower moisture use characteristics. (e.g., beardless wildrye is a high moisture user)

Using the NRCS PLANTS Database – Advanced Search Download

Another approach to using the NRCS PLANTS database involves the Advanced Search Download feature. This feature allows the user to select criteria in the PLANTS Core Data Fields including **Distribution, Taxonomy, Ecology** (such as Duration, Growth Habit, Native Status), and **Legal Status**. About 2,500 important species have Conservation Plant Characteristics Data which allows the user to select among the following characteristics:

- **Morphology/Physiology** (e.g., Active Growth Period, Fire Resistant, Growth Form, Growth Rate, Height at Maturity, Lifespan).
- **Growth Requirements** (e.g., Adapted To Coarse Textured Soils, Adapted To Medium Textured Soils, Adapted To Fine Textured Soils, CaCO₃ Tolerance, Fertility Requirement, Fire Tolerance, Moisture Use, Precipitation Minimum, Precipitation Maximum, Root Depth Minimum, Salinity Tolerance, Shade Tolerance, Temperature, Minimum (°F)).
- **Reproduction** (e.g., Bloom Period, Commercial Availability, Fruit/Seed Abundance, Fruit/Seed Persistence, Seed Per Pound, Seed Spread Rate, Seedling Vigor, Vegetative Spread Rate).
- **Suitability/Use** (e.g., Palatable Browse Animal, Palatable Graze Animal, Protein Potential).

You can export the output into an Excel spreadsheet; all the data will be imported into the first column of the spreadsheet. By selecting this column and using the Data – Text to Column feature, the spreadsheet can be populated by specifying quotation marks (“”) as delimiters.

To illustrate the use of the Advanced Search Download, an example will be presented to determine native perennial grasses of San Juan County, New Mexico.

Selections made for this Advanced Search include:

- County Distribution - New Mexico: San Juan
- Family – Poaceae
- Duration – Perennial
- Native Status – L48 Native

Identify any characteristics to be used for sorting or information purposes. Check the display box next to these characteristics (for example, scientific name, national common name, drought tolerance, moisture use, and precipitation [minimum]).

A total of 70 perennial species in the Poaceae family were found; of these, 40 species had Plant Characteristics Data. Using Excel, the data can be sorted according to user needs. For instance, if the user wanted to select those grasses which can grow in the lowest precipitation regions, a sort using the Precipitation Minimum will yield 26 species which can persist in areas of 10 inches or less annual precipitation, and 16 of these 26 species are Low Moisture Use and High Drought Tolerance, and 9 of these 16 are typically commercially available and are highlighted in yellow. Sandberg bluegrass and bluebunch wheatgrass cultivars are commercially available, but the origins are all from northern latitudes (i.e., Wyoming and Oregon and further north) and may not be adapted to Northwest New Mexico. The species, drought tolerance, moisture use and precipitation minimum are presented for the 40 species in Table 2.

Table 2: Results of a PLANTS Database Advanced Search Download
Example - County Distribution - New Mexico: San Juan; Family – Poaceae; Duration – Perennial;
Native Status – L48 Native

Scientific Name	Common Name	Drought Tolerance	Moisture Use	Precipitation (Minimum)
<i>Aristida purpurea</i> var. <i>longiseta</i>	Fendler threeawn	High	Low	2
<i>Elymus elymoides</i>	squirreltail	High	Low	5
<i>Hesperostipa comata</i> ssp. <i>comata</i>	needle and thread	High	Low	5
<i>Sporobolus airoides</i>	alkali sacaton	High	Low	5
<i>Sporobolus flexuosus</i>	mesa dropseed	High	Low	5
<i>Achnatherum hymenoides</i>	Indian ricegrass	High	Low	6
<i>Pleuraphis jamesii</i>	James' galleta	High	Low	6
<i>Bouteloua eriopoda</i>	black grama	High	Low	7
<i>Bouteloua hirsuta</i>	hairy grama	High	Low	7
<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	thickspike wheatgrass	High	Low	8
<i>Muhlenbergia pungens</i>	sandhill muhly	High	Low	8
<i>Poa secunda</i>	Sandberg bluegrass	High	Low	8
<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	bluebunch wheatgrass	High	Low	8
<i>Sporobolus cryptandrus</i>	sand dropseed	High	Low	8
<i>Leymus salinus</i>	saline wildrye	High	Low	10
<i>Poa fendleriana</i>	muttongrass	High	Low	10
<i>Festuca arizonica</i>	Arizona fescue	Medium	Low	10
<i>Bouteloua gracilis</i>	blue grama	High	Medium	8
<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	slender wheatgrass	High	Medium	8
<i>Pascopyrum smithii</i>	western wheatgrass	High	Medium	8
<i>Agrostis exarata</i>	spike bentgrass	Low	Medium	6
<i>Sphenopholis obtusata</i>	prairie wedgescale	Low	Medium	10
<i>Distichlis spicata</i>	saltgrass	Medium	Medium	5
<i>Sporobolus wrightii</i>	big sacaton	Medium	Medium	5
<i>Bouteloua curtipendula</i>	sideoats grama	Medium	Medium	6
<i>Leymus triticoides</i>	beardless wildrye	High	High	7

Table 2: Results of a PLANTS Database Advanced Search Download

Example - County Distribution - New Mexico: San Juan; Family – Poaceae; Duration – Perennial; Native Status – L48 Native

Scientific Name	Common Name	Drought Tolerance	Moisture Use	Precipitation (Minimum)
<i>Andropogon gerardii</i>	big bluestem	High	Low	12
<i>Muhlenbergia asperifolia</i>	scratchgrass	Low	High	12
<i>Phragmites australis</i>	common reed	Low	Medium	12
<i>Schizachyrium scoparium</i>	little bluestem	High	Low	12
<i>Muhlenbergia montana</i>	mountain muhly	High	Medium	13
<i>Koeleria macrantha</i>	prairie Junegrass	High	High	14
<i>Phleum alpinum</i>	alpine timothy	Low	Medium	16
<i>Alopecurus aequalis</i>	shortawn foxtail	Low	High	18
<i>Bromus inermis</i>	smooth brome	Medium	Medium	18
<i>Elymus canadensis</i>	Canada wildrye	Medium	Medium	20
<i>Hordeum brachyantherum</i>	meadow barley	Medium	Medium	20
<i>Poa pratensis</i>	Kentucky bluegrass	Low	High	24
<i>Puccinellia nuttalliana</i>	Nuttall's alkaligrass	Low	Medium	24
<i>Phalaris arundinacea</i>	reed canarygrass	Low	High	30
<i>Elymus virginicus</i>	Virginia wildrye	Medium	Medium	36

Using the NatureServe Explorer Website to Find Plant Association Information

Disclaimer

The NatureServe Explorer example is included for the information and convenience of the reader and does not imply endorsement or preferential treatment by the USDA-NRCS. NatureServe has granted permission to include the following example in this technical note.

NatureServe represents an international network of biological inventories-known as natural heritage programs or conservation data centers-operating in all 50 U.S. states, Canada, Latin America and the Caribbean. NatureServe Explorer is an authoritative source for information on more than 70,000 plants, animals, and ecosystems of the United States and Canada.

If the dominant plant species are known for a site, these species can be used to define a probable vegetation association using NatureServe Explorer. This association will often provide a listing of other plant species that are typically found in this plant community. Refer to the following steps:

Step	User Action	Result
1	Access the website: http://www.natureserve.org/explorer	Displays the NatureServe webpage.
2	Click the Search tab and select <u>Ecological Communities and Systems</u>	Displays the selection criteria choices.

Step	User Action	Result
3	Enter the name of any ecological unit (e.g., galleta big sagebrush). Select among Systems, Associations, Alliances, or All (e.g., All) and click Search Now	Association or Alliance Records are reported based on search results (e.g., only two New Mexico Association Records are displayed with: 1. Basin Big Sagebrush / James' Galleta Shrubland and 2. Basin Big Sagebrush / Blue Grama - James' Galleta Shrubland)
4	Click the link for the species for which you wish to generate a report (e.g., Basin Big Sagebrush–James' Galleta Shrubland)	An Ecological Association Comprehensive Report is downloaded and includes a Summary, Classification, Distribution, Vegetation, Environmental Setting, Use Guidelines and Citations (see Example 2 for sections from the above association record).

Example 2: Ecological Association Comprehensive Report

***Artemisia tridentata ssp. tridentata* / *Pleuraphis jamesii* Shrubland**

Translated Name: Basin Big Sagebrush / James' Galleta Shrubland

Unique Identifier: CEGLO01015

Classification Approach: International Vegetation Classification (IVC)

Summary: This association has been described from the Colorado Plateau in southeastern Utah and may occur in parts of Colorado, New Mexico and Arizona. Most stands occur on valley floors, alluvial flats and on the terraces of intermittent drainages. A few stands have been reported from mesas. Sites are located between 1866 and 2200 m (6122-7220 feet) elevation on level to gentle slopes (<5%). Up to 80% of the unvegetated surface is covered by bare ground. Soils are generally deep, calcareous and alkaline sandy loams or clay loams derived from alluvium. This association occupies dry sites on valley floors in the Colorado Plateau. Total vegetation cover is variable; some disturbed stands may appear to be sparsely vegetated with total vegetation cover less than 10%. Stands are characterized by an open shrub canopy (5-35% cover) dominated by *Artemisia tridentata ssp. tridentata*. Associated shrubs may include *Chrysothamnus viscidiflorus*, *Ephedra viridis*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Opuntia polyacantha*, *Atriplex* spp., and *Krascheninnikovia lanata*. Total woody canopy ranges from 5-35% cover. The sparse herbaceous layer (5-15% cover) is dominated by graminoids such as *Pleuraphis jamesii* (= *Hilaria jamesii*), *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Elymus elymoides*, and *Sporobolus cryptandrus*. Forbs are sparse and variable; species recorded from plots include *Castilleja linariifolia* and *Psoralidium lanceolatum*.

Vegetation Summary: This association occupies dry sites on valley floors in the Colorado Plateau. Total vegetation cover is variable; some disturbed stands may appear to be sparsely vegetated with total vegetation cover less than 10%. Stands are characterized by an open shrub canopy (5-35% cover) dominated by *Artemisia tridentata ssp. tridentata*. Associated shrubs may include *Chrysothamnus viscidiflorus*, *Ephedra viridis*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Opuntia polyacantha*, *Atriplex* spp., and *Krascheninnikovia lanata*. Total woody canopy ranges from 5-35% cover. The sparse herbaceous layer (5-15% cover) is dominated by graminoids such as *Pleuraphis jamesii* (= *Hilaria jamesii*), *Achnatherum hymenoides*, *Aristida purpurea*, *Bouteloua gracilis*, *Elymus elymoides*, and *Sporobolus cryptandrus*. Forbs are sparse and variable; species recorded from plots include *Castilleja linariifolia* and *Psoralidium lanceolatum*.

Floristic Composition									
Species Name	Stratum	Growth Form	Char-acter-istic	Domi-nant	Con-stant	Cover Class %	Min Cover %	Max Cover %	Con-stancy %
<i>Chrysothamnus viscidiflorus</i>	Short shrub/sapling	Broad-leaved deciduous shrub	✓						
<i>Ericameria nauseosa</i>	Short shrub/sapling	Broad-leaved deciduous shrub	✓						
<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	Short shrub/sapling	Broad-leaved evergreen shrub	✓	✓					
<i>Opuntia polyacantha</i>	Herb (field)	Dwarf-shrub							
<i>Achnatherum hymenoides</i>	Herb (field)	Graminoid							
<i>Pleuraphis jamesii</i>	Herb (field)	Graminoid	✓	✓					

Use Guidelines and Citation

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NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 9, 2009)

Summary

With many of these search strategies, inappropriate species for a particular site may be downloaded. The use of ESIS and Ecological Site Descriptions should provide the most reliable information if an ESD can be well matched to the revegetation or restoration site.

Web Soil Survey allows a site to be precisely located on aerial photo maps and the ESD's to be determined for a particular area of interest.

VEGSPEC can report some inappropriate species or cultivars, but if care is taken in examining the characteristics of suspect species or the origin of suspect cultivars, then many of these concerns will be addressed.

The Advanced Search Download can determine appropriate species if vital characteristics can be identified to sort the candidate species.

If the dominant plant species are known for a site, using NatureServe Explorer can help you to define the probable vegetation association.

After identifying the appropriate species, the next step is to determine if the species are commercially available and who are the vendors. The Native Seed Network can provide vendor names for particular species (<http://www.nativeseednetwork.org/>). Other vendor lists are available from native plant organizations (e.g., The Arboretum at Flagstaff, http://www.thearb.org/seed_sources.htm) and from NRCS Plant Materials Centers (e.g., Tuscon Plant Materials Center, <ftp://ftp-fc.sc.egov.usda.gov/AZ/PMC/NativeSeedVendors-2008.pdf>)