

A Field Guide for Collecting Native Seeds in Nevada



Jay Davison
Area Plant and Soil Specialist



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Jay Davison

University of Nevada Cooperative Extension

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The Bureau of Land Management

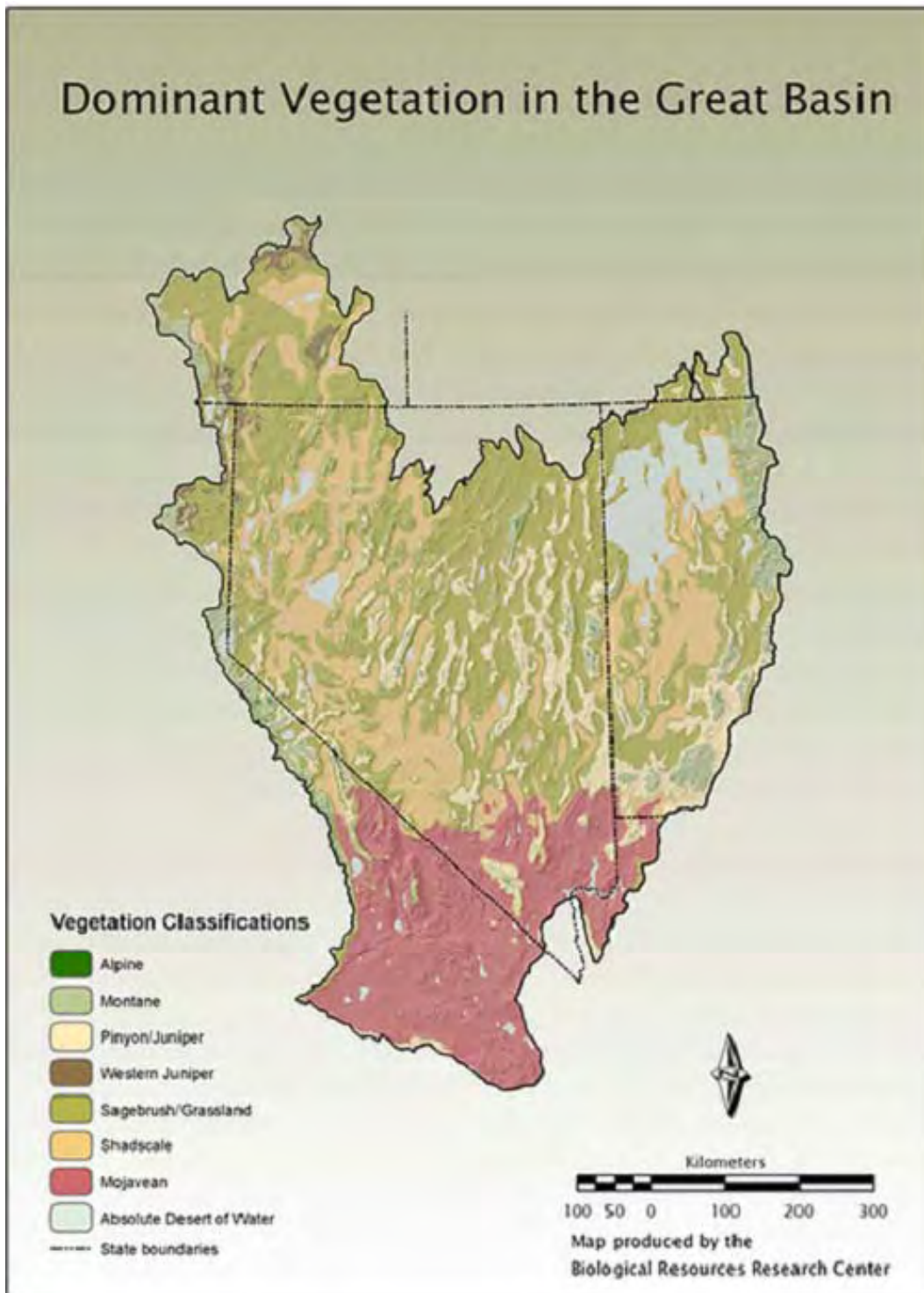
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A Field Guide For Collecting Native Seeds In Nevada

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The Great Basin Restoration Initiative and Need for Native Seed Collections in Nevada



Chapter 1

The Great Basin Restoration Initiative and Need for Native Seed Collections in Nevada

Introduction

The purpose of this field guide is to make the process of wildland seed collection easier and more successful for anyone who desires to collect native seed on Bureau of Land Management (BLM) administered land in Nevada. The native seed collection project was funded by a grant from the Nevada State Office of BLM. It is part of an ongoing process that is aimed at increasing the amount of native seed available for restoration of Nevada's rangelands. Additional seed supplies will lower the cost of native seed, and result in an increase of their use in revegetation projects in Nevada.

Nevada's native rangelands are under attack from invasive weeds, wildfire, commercial development, and other activities that displace the native plant communities. The majority of Nevada's rangelands are located within the Great Basin and the BLM is committed to: 1) reducing the degradation that is occurring, and 2) restoring those lands that have already been adversely affected. The Great Basin Restoration Initiative (GBRI) is a process that the BLM has implemented to achieve these goals. The entire project description, including pertinent publications, can be found at www.fire.blm.gov/gbri. The major emphasis of the GBRI is to restore Nevada's rangelands with native plant species whenever possible and practical.

The use of native plant species will be critically important when attempting revegetation on many of these lands. Unfortunately, native plant seed is normally in short supply and very expensive. Demand and costs will only increase as more and more acres are slated for restoration under the GBRI, and other necessary projects. In an attempt to improve this situation in Nevada, the BLM has initiated a two-step program aimed at increasing the supply of native seeds available for restoration. The first step is to increase the amount of seed collected from wildlands in Nevada. The second is to increase the number of agricultural producers who are willing and able to grow native seeds in Nevada. The results will benefit the BLM by increasing the availability of seed, and ultimately reducing its price. It will also benefit local communities that depend on the agricultural sector by increasing the income of local agricultural producers growing native

seed. This should improve the local economy that depends on agricultural receipts for a portion of their tax base.

The first step in the process was to form a broad based committee charged with achieving the overall goal of increasing the supply of native seeds available from collection and field production. The committee was composed of agency personnel, agricultural producers, seed collectors, and processors, researchers, and cooperative extension specialists. They discussed and agreed on several actions required to achieve the broad goal. This document is one of the results.

The demand for native seed is large and expected to grow rapidly in the near future. This provides increasing opportunity for individuals or groups to earn money by collecting and selling native seeds. Collecting, and selling native seed is not a “get rich quick” scheme, but can be a viable economic enterprise. Potential collectors need to learn to identify native species that are in demand, identify an outlet willing to buy the seeds collected, locate a seed collection site, and monitor seed development. They will need to learn how to collect, clean, and store the seeds, and a whole host of other items related to starting a successful small business. This manual provides useful information to the new collector or those considering getting into the business.

Additional resources and references used to prepare each chapter in this handbook are provided at the end of each individual chapter as appropriate. The resources provide the reader a source of in-depth information on the subject presented in each chapter. New collectors are advised to learn as much about seed collection as possible before starting a seed collection effort.

Priority Plant List for Nevada Native Seed Collections and Production



Chapter 2

Priority Plant List For Nevada Native Seed Collections And Production

The native seed production committee prioritized the native seed needs for the Great Basin portion of Nevada. A sub-committee consisting of representatives of the U.S. Forest Service (USFS), BLM, U.S. Agricultural Research Service, Nevada Division of Forestry, Nevada Division of Wildlife, the University of Nevada, and Nevada Association of Counties met in Reno in April 2002 to develop a priority list of native plant species for collection, production, and use in Nevada. This species list was developed using several criteria. The criteria included:

- Past agency seed buys for commonly requested native species.
- Species with broad adaptation throughout the Great Basin in Nevada.
- Current availability of native species.
- Ongoing research results available to growers.
- Species, which had the best opportunities for successful agricultural production, and seeding success on Nevada wildlands.

The revegetation needs, of the southern portion of the state outside the Great Basin is not included in the final species listing. This does not mean that some of those lands are not in need of revegetation, and a supply of native seed. The committee was focused on the needs of the Great Basin. The Las Vegas Field Office has an active revegetation program, and native seed collectors interested in the southern portions of the state are urged to contact the Las Vegas Field Office at the numbers listed in Table 1, Chapter 4 of this manual.

The initial list was compiled, sent out for review and comment to all agencies, and individuals that were participating on the native seed production committee. The correspondence asked each individual for comments and suggestions concerning the proposed species. Comments were incorporated and a final list was prepared.

The purpose of the list is to provide collectors, and growers of native seed in Nevada, direction in species selection when planning to either collect or plant native species. This priority list should not be considered an exclusive or restrictive list, but rather a first attempt to provide guidance to those interested in collecting, producing or selling native seed. The list will undoubtedly be expanded as the need for additional native species are identified by the primary users, which are federal and state agencies.

Nevada's rangelands are diverse, but the lower elevation vegetation types are especially difficult to revegetate after a major disturbance has occurred. They include salt desert shrub communities located on high pH (alkaline) soils that are often salty, and receive low amounts of precipitation. Sagebrush and sagebrush/bunchgrass communities are the most common vegetation types found in Nevada. They occur at higher elevations than the salt desert shrub communities and are some of the most critical vegetation types in need of revegetation from disturbances such as fire, noxious weeds, urban expansion etc. The pinyon-juniper woodlands across central and eastern Nevada also burn frequently and are in need of revegetation. Each vegetation type has very different seed production potentials and plant species mix. New collectors need to become familiar with each type to determine the species of plants present and the seed production potential.

The common and scientific plant names listed in this publication are from a publication by the U. S. Department of Agriculture's Natural Resources Conservation Service (NRCS) titled "Nevada Plant List". The publication replaces the National List of Scientific Plant Names that was originally published by the predecessor of the NRCS in 1982.

Seed Collection/Transfer Zones

Seed collection/transfer zones are areas of land that support native plants with genetic backgrounds adapted to the environmental conditions present within a particular zone. These zones have been established in an attempt to maintain the genetic purity of native plants by restricting native seed collection, production, and subsequent replanting to plants growing within established zones. Seed collected for revegetation projects within these zones are considered to be adapted and can be moved within it without fear of seeding failure or disrupting the genetic purity of existing plants. This approach is well intentioned, but several major problems currently limit the application of these zones in Nevada.

The primary limiting factor for seed collection zones is the lack of genetic and environmental data between widespread populations of the same species. The genetic information available for a limited number of species indicates broad geographic similarities and adaptations between populations. However, at the same time the data suggest geographically adjacent populations have genetic differences resulting in different responses to elevation, temperatures, precipitation, and soils. While genetic studies such as DNA comparison can provide useful information about relationships between plant populations, they cannot predict seedling establishment or performance in the field. Long-term studies and observation are

necessary to predict the utility of a particular species on a particular site to be reseeded. Little data exist for the majority of native species currently in use or desired for revegetation purposes.

Another problem inherent in the establishment of seed collection zones is related to the availability of native seeds from those zones. Successful collection of native seeds is dependent on the collection area experiencing favorable climatic conditions to produce adequate seed. If those conditions do not occur, seed production is greatly reduced or non-existent within that zone. In Nevada, favorable climatic events for seed production are the exception not the rule. By limiting collections to certain zones, the supply of native seeds needed to respond to unforeseen events is greatly reduced and may be unobtainable in most years.

A similar problem exists for field production of native seeds. If an agricultural producer is limited to production of native seed for a small zone or area, the market for his/her seeds may be uneconomical. Under current procurement regulations, which do not limit sale of native seed to particular zones, native seed production is extremely risky, and few producers are willing to attempt to produce them. Further restrictions will only make the problem worse.

Huge areas throughout Nevada are in need of revegetation with native seeds. Current native seed supplies are low, and costs high. The establishment of small seed transfer zones will only make the problem worse. In addition, research is not available that supports the presumption that reseeding an area with a native plant species that originated outside the immediate area will cause damage to the remaining native plants of the same species. The major problem with using native species from areas that originated in environments too different from the planting site is seeding failure.

Nevada BLM has not established a policy concerning the establishment of seed collection or transfer zones, and zones have not been established. The Nevada Native Seed Coordinating Group is in the process of developing a policy concerning seed transfer zones that incorporates the best scientific knowledge while recognizing the problems listed above. This manual will be updated when that policy is developed.

Resources and Literature Used to Prepare This Chapter:

Ogle, Dan. 2002. Snake River Wheatgrass. Natural Resources Conservation Service Plant Fact Sheet. Natural Resources Conservation Service. Idaho State Office. Boise, ID

United States Department of Agriculture, Natural Resources Conservation Service. 1998. Nevada Plant List. Natural Resources Conservation Service, State Office Reno, NV.

Priority Plant List for Nevada Native Seed Production/Collection
5-9-02

GRASSES

Common Name	Scientific Name
Indian Ricegrass	<i>Achnatherum hymenoides</i>
Desert Needlegrass	<i>Achnatherum speciosum</i>
Thurber's needlegrass	<i>Achnatherum thurberianum</i>
Bottlebrush Squirreltail	<i>Elymus elymoides</i>
Thickspike wheatgrass	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>
Snake River Wheatgrass	<i>Elymus wawawaiensis</i>
Needleandthread grass	<i>Hesperostipa comata</i>
Basin Wildrye	<i>Leymus cinereus</i>
Sandberg's Bluegrass	<i>Poa secunda</i>
Bluebunch Wheatgrass	<i>Pseudoroegneria spicata</i>

SHRUBS

Low Sagebrush	<i>Artemisia arbuscula</i>
Black Sagebrush	<i>Artemisia nova</i>
Basin Big Sagebrush	<i>Artemisia tridentata</i> ssp. <i>tridentata</i>
Mountain Big Sagebrush	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>
Wyoming Big Sagebrush	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>
Fourwing Saltbush	<i>Atriplex canescens</i>
Shadscale	<i>Atriplex confertifolia</i>
Torrey Saltbush	<i>Atriplex torreyi</i>
Winterfat	<i>Krascheninnikovia lanata</i>
Desert Bitterbrush	<i>Purshia glandulosa</i>
Stansbury Cliffrose	<i>Purshia stansburiana</i>
Antelope Bitterbrush	<i>Purshia tridentata</i>

FORBS

Western Yarrow	<i>Achillea millifolium</i> var. <i>occidentalis</i>
Lewis or Blue flax	<i>Linum lewisii</i> var. <i>lewisii</i>
Scarlet Globemallow	<i>Sphaeralcea coccinea</i>

Native Plant Identification

Desert Needlegrass



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Chapter 3

Native Plant Identification

Introduction

Proper identification of native plants targeted for seed collection is critical. Every effort has been made in this manual to keep the process as non-technical as possible. That includes minimizing the use of technical language and phrases normally used in plant identification texts. However, the potential collector must be familiar with a few critical plant parts that are absolutely necessary to identify the various grasses, shrubs, and forbs targeted for collection in Nevada. Seed collectors must be certain of the identity of native plant species that they are collecting and selling. Most seed buyers will refuse to do business with individuals who sell misidentified seed. Therefore, a collector should be sure to ask for assistance from botanists and others who work with native plants if they are unsure of the identity of the species they are collecting.

The following pages use definitions and line drawings to assist the collector in identifying Nevada's priority native plant species. The collector should become familiar with the few terms presented and use the plant descriptions, habitat preferences, and line drawings as identification aids. Figure 3- 1 shows the major parts of a grass plant used to identify a species. The plant parts depicted are often used when trying to identify a grass, especially when it has not yet produced seed heads. As another aide, definitions used in this guide are provided following Figure 3-1. Nearly all, comprehensive plant identification books have a section that includes common definitions of the various plant parts used in identification. These definitions are necessary because most plant identification guides use technical terms to describe plant parts. All potential collectors should obtain and use one or more of the plant identification books listed at the end of this chapter before starting the collection process.

Several of the plants listed as priority species in this manual are closely related to other "look alike" species. Therefore, collectors must be certain that they are collecting the correct seed. Because the time period can be very short between seed ripe and seed fall or shatter, collectors are advised to have positively identified desired plant species well in advance of the time when the seed is ready to be picked. Normally, early flowering is an ideal time to identify a plant, while allowing enough time for positive identification before the seed are ready for harvesting.

Resources available to help identify the plants include professionals from the local offices of the BLM, U.S. Forest Service (USFS), Natural Resources Conservation

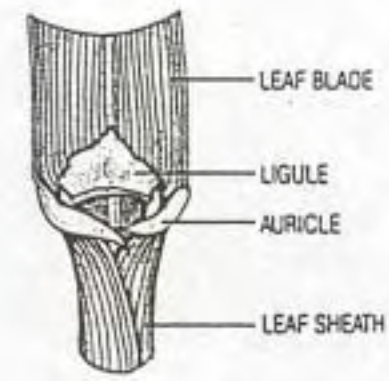
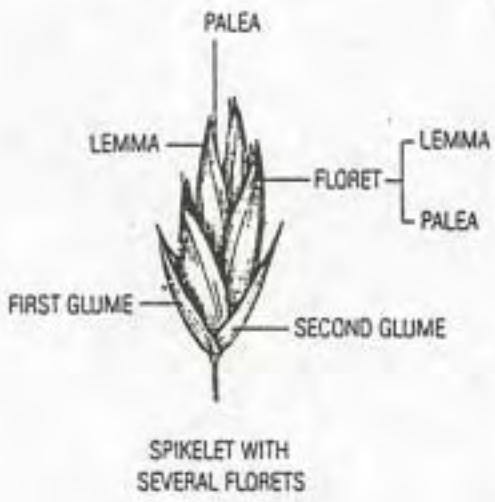
Service (NRCS) and University of Nevada Cooperative Extension (UNCE). The University of Nevada, Reno and University of Nevada, Las Vegas have herbaria staffed with botanists who can identify any plant collected in Nevada.

Because the listed sagebrush species can be difficult to identify, and separate line drawings are not available for each species, the following website is included to help the new collector separate the various sagebrush species. It provides a picture, plant descriptions, soil types where the sagebrush grows, and other useful information including a plant key and list of excellent references. The web address is:

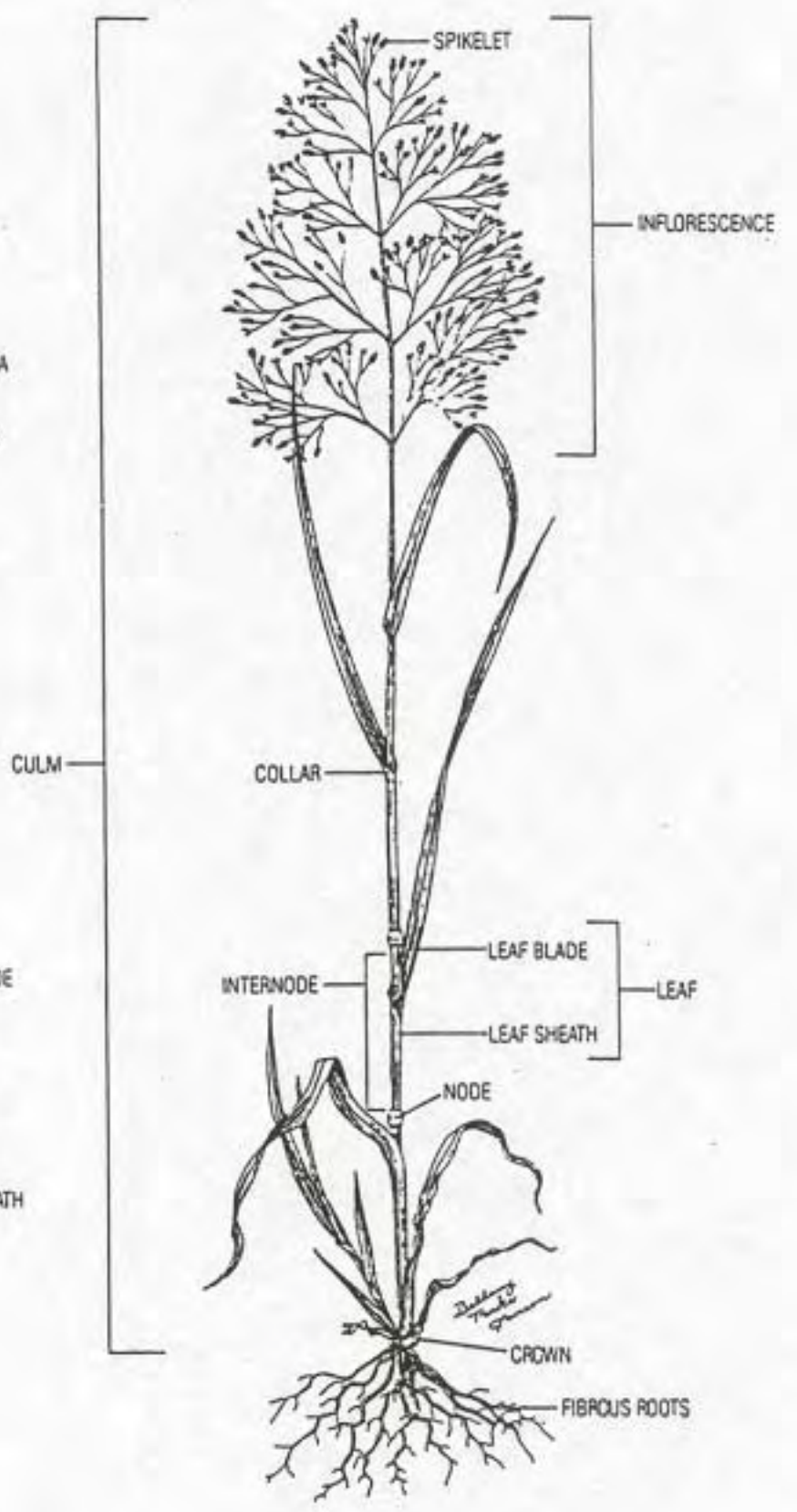
http://www.fs.fed.us/wcnf/unit/eco/sagebrush_workshop/sagebrush_ecology.htm

Definitions of Grass Plant Parts

<u>Auricle</u>	An ear shaped appendage(s) that grows from the leaf sheath below where the leaf blade meets the stem.
<u>Awn</u>	A slender bristle or hair, normally growing from the top of a seed structure. It is often bent one or more times.
<u>Glume</u>	Glumes are reduced or small leaflike structures that grow in pairs just below the individual seed(s) structures.
<u>Inflorescence</u>	The cluster of flowers that will become grass seeds growing from a stem above the leaves.
<u>Leaf blade</u>	The wide, flat portion of the leaf growing above the stem.
<u>Leaf sheath</u>	The rounded, tubular shaped portion of the leaf that grows around the stem.
<u>Ligule</u>	A thin collar-like appendage that grows on the inside of the leaf blade at the junction with the leaf sheath and stem.
<u>Veins</u>	Thread-like structures that grow in leaves parallel to the leaf edges.



ENLARGEMENT OF THE JUNCTION OF THE BLADE AND SHEATH WITH ASSOCIATED PARTS



GRASSES

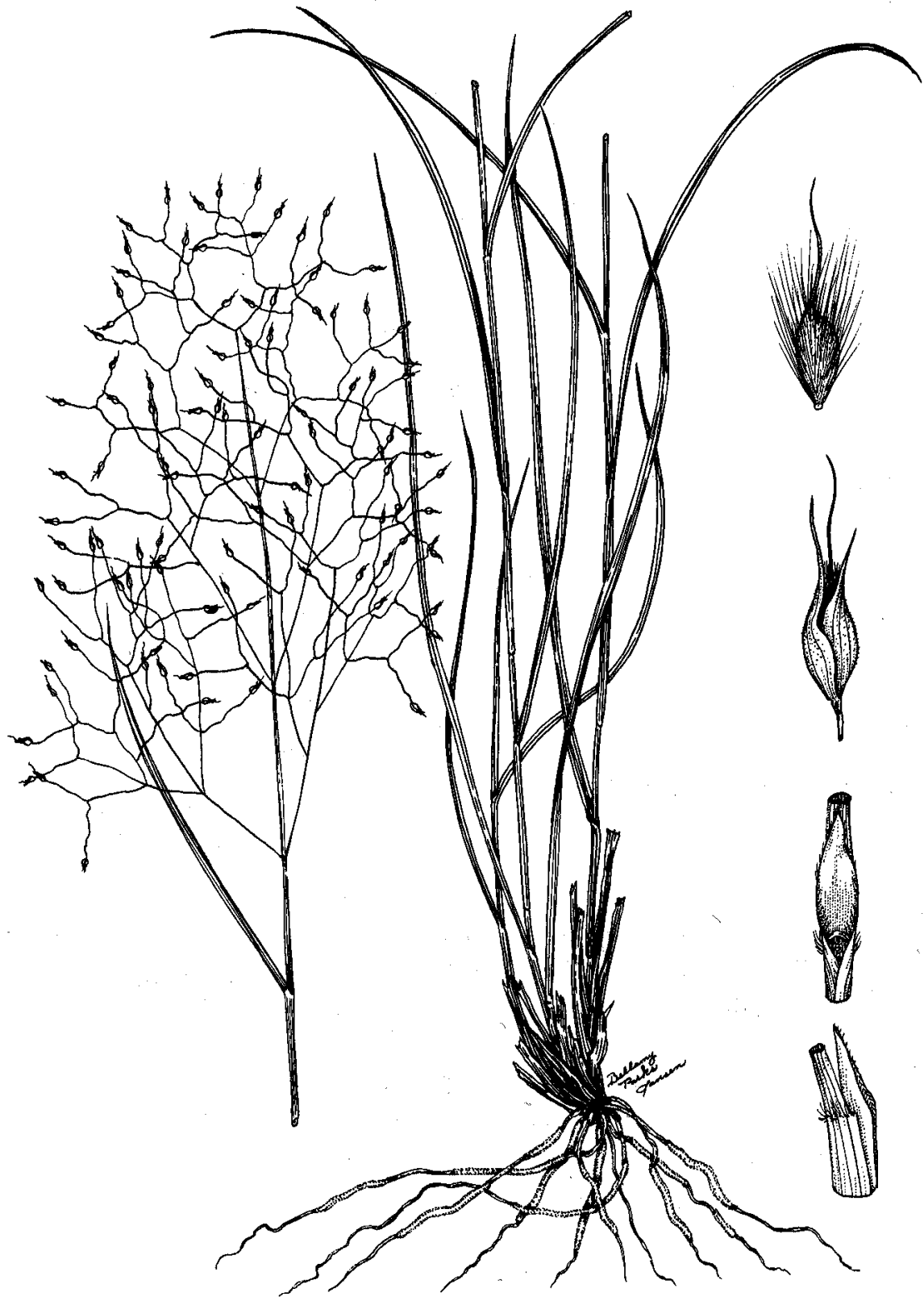
Common Name: Indian Ricegrass

Scientific Name: *Achnatherum hymenoides*

Description: Indian ricegrass is a cool season perennial bunchgrass. It grows in dense tufts that spread from 8-12 inches wide. It normally reaches 8-30 inches tall. The leaves grow thickly from the base of the plant. They are slender, tightly rolled, and grow almost as tall as the seed stalks. The thin, rolled, leaves give the plant a wiry look. The leaves have a pointed ligule growing to about ¼ inch, with a papery appearance. The seed stalks are upright and open with numerous branches. The branches end with a shorter, hair-like pair of branches that produce a single seed. The seeds are round, brown to black in color, and have a fringe of dense short light colored hair at the base.

Preferred Growth Sites: Indian ricegrass grows throughout Nevada and is most abundant on dry sandy soils. It grows from valley bottoms to higher elevations (2,000-10,000 feet) but does not thrive on wet or poorly drained soils of any type. It is often a dominant species on the sandy areas of the sagebrush and salt desert shrub types. It can grow on areas receiving as little as 4 inches of annual precipitation. It can occur in thick stands for several years following wildfires or other disturbances in the more arid rangelands of Nevada.

Seasonal Development: Indian ricegrass generally begins growth in early spring and flowers before the driest part of the summer. The dates vary tremendously in Nevada due to its wide distribution and ability to flower over a long time period. Flowering can continue until summer if frequent spring rains occur. Reports from south-central Nevada indicate that Indian ricegrass begins growth in late March-early April. Flower heads are formed in late April, with pollination occurring in mid-May. Seed ripe occurs approximately in early-mid June with seed shatter beginning by late June-early July. However, these dates vary by year due to climatic differences. The dates would be expected to be a month or so later in northern Nevada and earlier in southern Nevada.



Indian Ricegrass (*Achnatherum hymenoides*)

Common Name: Desert Needlegrass

Scientific Name: *Achnatherum speciosum*

Description: Desert needlegrass is a cool season, perennial bunchgrass. Stems are 12-24 inches tall and emerge from large dense clumps of leaves. The sheaths are brownish in color, and can be smooth to hairy on the lower portions to covered with felt like hairs at the very bottom. The leaf blades are long, narrow, almost thread like, and covered with long, soft, wavy hairs. The leaf blades grow from the base of the clump, and older leaves often drop from the plant. The seed head is dense, narrow, and usually not much longer than the leaves. The seed head is light colored and looks feathery due to the dense hair at the base of the awns. The awns, which have 1 sharp bend, are an important identification feature, with the lower section being approximately 3/4 of an inch long. It is tightly twisted into a spiral. The section above the bend is approximately 1 inch long. The hairs covering the lower portion of the awns are dense, long, soft, and straight. They cover the lower 2/3 of the awn while the remaining portion is rough and hairless.

Preferred Growth Sites: Desert needlegrass grows primarily in western and south-central Nevada. It is normally found on coarse-textured soils without distinct profiles. Most sites are located on sandy or gravelly alluvial slopes or fans and/or in canyons. In Nevada, this species grows best at elevations ranging from 4,000 to slightly over 5,000 feet in elevation.

Seasonal Development: Most vegetative growth occurs during late spring and early summer before excessive heat and lack of moisture begin to retard growth. Seed production and shatter normally occur from May until June, but seed will not develop if soil moisture is low and temperatures are excessive.



Desert Needlegrass (*Achnatherum speciosum*)

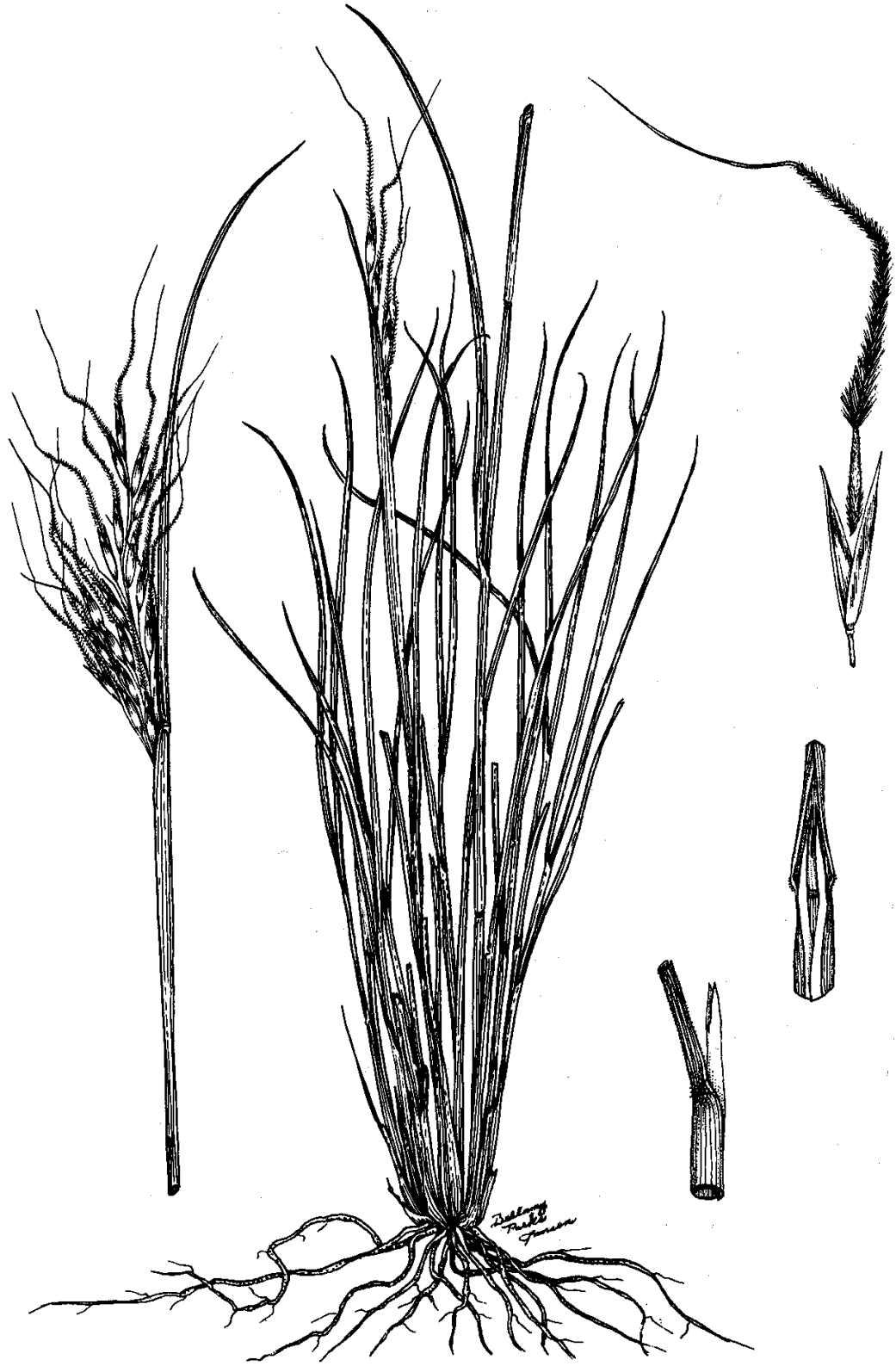
Common Name: Thurber's needlegrass

Scientific Name: *Achnatherum thurberianum*

Description: Thurber's needlegrass is a cool season bunchgrass that grows in dense clumps. The narrow stems grow upright 12 to 24 inches in height. The leaves are 4 to 10 inches in length and the edges roll inward, giving the leaves a thread like appearance. They can be covered in short, stiff hairs or short, soft hairs. The sheath is normally without hairs but may be slightly rough to the touch. The ligule is colorless or translucent and about $\frac{1}{4}$ of an inch long. The seed head is normally sparse, and grows 3-6 inches long. The seeds produce an awn that is bent twice with the lower 2 segments covered with fine feathery hairs. Older plants may appear circular with a dead center.

Preferred Growth Sites: Thurber's needlegrass is common throughout northern Nevada. It grows on a large variety of soil types but prefers those that are well drained. It is very often found growing on hillsides with big sagebrush and on north or east slopes where moisture levels are a little higher. It grows best at elevations between 5,000 and 7,500 feet.

Seasonal Development: Thurber's needlegrass begins growth in early spring and flowers from May to June. Seed ripe normally occurs in mid-late July in Nevada. As with all plants, elevation and aspect where the plants grow will impact these dates.



Thurber Needlegrass (*Achnatherum thurberianum*)

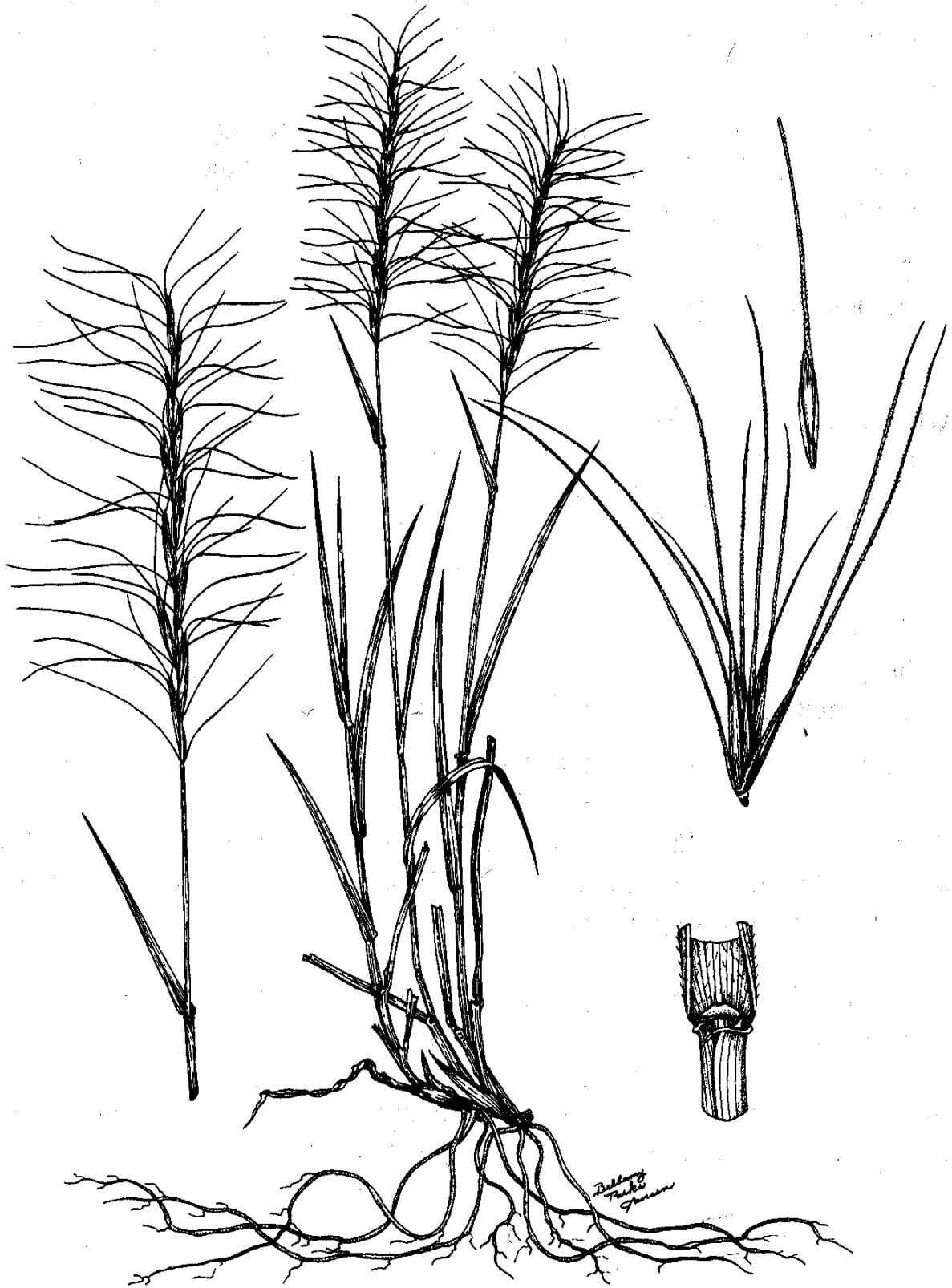
Common Name: Bottlebrush Squirreltail

Scientific Name: *Elymus elymoides*

Description: Bottlebrush squirreltail is a short to mid-sized cool season perennial bunchgrass. It is a highly variable species with several different types growing throughout Nevada. It also crosses readily with other related grasses, which can make positive identification somewhat tricky. Stems grow from 4 to about 18 inches tall but normally in Nevada they will be less than 12 inches. Leaf blades are flat and narrow, with prominent veins. They grow upright from the base, reach a length of 2 to 8 inches, and can range from hairless to slightly hairy to covered with dense white hairs. Some leaves curl or spiral, giving un-grazed plants a distinctive look that can be used as an easy identification aid. The seed heads begin growth as a narrow spike like inflorescence that spreads as the seeds ripen. The seed head produces numerous, prominent rough awns 2-3.5 inches long that bend at 90 degrees to the seed head when ripe, giving the head the appearance of a “squirrels tail.” The seed head breaks apart as the seed ripens.

Preferred Growth Sites: Bottlebrush squirreltail grows throughout Nevada at elevations ranging from 2,000 to over 11,000 feet. It is very drought tolerant, growing in areas receiving as little as 6 inches of annual precipitation. It is normally found on dry, open hillsides associated with big sagebrush and valleys dominated by greasewood. However, it grows well from salt desert shrub communities to lower elevation alpine grasslands. It thrives on disturbed sites and grows abundantly on these rangelands. It is tolerant of a wide variety of soils and of saline-alkaline conditions. It does not grow well in the wet areas associated with riparian vegetation.

Seasonal Development: Because it is able to grow in such a wide range of conditions and soil types, growth stages of squirreltail are difficult to predict. In the big sagebrush zones of Nevada, growth normally begins in late March to mid-April. In south-central Nevada growth can begin as early as February. Flower stalks begin to grow in mid-April to mid-May with full bloom occurring in early-mid June. Seed ripe occurs in early July, but elevation, soil moisture levels, and temperature can retard or accelerate these dates.



Bottlebrush Squirreltail (*Elymus elymoides*)

Common Name: Thickspike Wheatgrass

Scientific Name: *Elymus lanceolatus* ssp. *lanceolatus*

Description: Thickspike wheatgrass is a long-lived, cool season, sod forming grass. It produces thick, shallow, fibrous root masses and widely spreading underground stems. The stems are hollow and grow upright from 1 to 3 feet in height. The leaves are narrow (<1/8 inch wide), green to blue green in color, flat to rolled inward, and rough to the touch. They grow from 1-10 inches long. The leaf sheath produces 2 prominent pointed ear-shaped appendages known as auricles, which loosely wrap the grass stem. The seed heads grow in thin zigzag shaped spikes on the top of the stems and are normally 6-9 inches long. The actual seeds are produced in clusters of 3 to 8, which grow alternately on each side of the single central stem. The seed clusters normally grow flat against the seed stem, with the seeds being covered with small fine hairs.

Preferred Growth Sites: Thickspike wheatgrass is produced throughout Nevada with the exception of the extreme southern regions. This species is normally found on dry, well-drained sites with coarse to medium textured soils, but can grow on moister, fine textured soils. Thickspike wheatgrass is easily confused with streambank wheatgrass, a closely related species that prefers wetter sites and looks very similar to thickspike wheatgrass. It also grows on sand dunes. It grows in a wide variety of precipitation zones, being found on sites, ranging from 6 to 18 inches of precipitation yearly. It is also highly variable in its ability to grow over wide elevation ranges. In Nevada the range is from 2,000 to over 10,000 feet in elevation. Thickspike wheatgrass is often found in association with big sagebrush communities, and growing with needle-and-thread grass, bluebunch wheatgrass, and Idaho fescue.

Seasonal Development: Thickspike wheatgrass begins growth later in the spring than the bluegrasses, normally beginning in mid-April. Flowering starts in mid-late May. This plant has a relatively long flowering period with peak flowering in early July. Seed ripe occurs in late July to early August with seed shatter expected in early-mid August.



Thickspike Wheatgrass (*Elymus lanceolatus* ssp *lanceolatus*)

Common Name: Snake River Wheatgrass

Scientific Name: *Elymus wawawaiensis*

Description: Snake River wheatgrass is a cool season perennial bunchgrass that closely resembles bluebunch wheatgrass. The stems of Snake River wheatgrass grow mostly upright from 1.5 to 4 feet tall in tufts. The leaves are produced along the stems, are narrow, flat or loosely rolled inward, grow approximately 8 inches long and drooping. Young seedling leaves on Snake River wheatgrass are densely covered in fine hairs giving the immature leaves a velvety feeling. The sheath has a short, membranous ligule, is normally hairless and sometimes produces short, purple-colored auricles. The stems that produce the seed heads are shorter than for bluebunch (generally not exceeding 6 inches), are narrow, upright, slender and often wavy or zigzag shaped when the seed clusters are removed. The seed clusters grow in an alternate pattern on opposite sides of the wavy stem. The seed clusters of Snake River wheatgrass are closer together on the stem than bluebunch wheatgrass giving the head a more compact appearance. They produce between 4 and 8 seeds per cluster, with most clusters producing several ½ to 1-inch long awns. The awns project at a sharp angle to the stems when mature. Snake River wheatgrass always produces awns. The glumes below the seed are more narrow and pointed than glumes on bluebunch wheatgrass.

Preferred Growth Sites: Like bluebunch wheatgrass, Snake River wheatgrass grows best on medium to coarse textured soils that are at least 10 inches deep. It is very drought tolerant and can grow on soils that range from as coarse as sands to very rocky. It occurs naturally in the drainages of the Snake, Salmon and Columbia River systems, but the variety “Secar” has been planted in numerous northern Nevada locations and may be encountered when collecting. The locations where it has been planted may be available from local BLM Field Offices. It can grow on slightly salty soils but will not grow on wet sites or those with extended flooding in the spring. It grows in areas receiving as little as 8 inches of annual precipitation but thrives when total precipitation averages over 12 inches annually. In Nevada, it grows most commonly at elevations ranging from a little over 4,000 to almost 10,000 feet in elevation. It grows in mixed stands with bottlebrush squirreltail, Idaho fescue, Sandberg bluegrass, and big sagebrush

Seasonal Development: Snake River wheatgrass normally begins growth in mid-April, with seed heads beginning to form in mid-late May. Seed heads begin to flower in late June with seed ripe occurring in mid-July and shatter following in late-July early August. Because of Snake River wheatgrass’ wide adaptation these dates can move forward or back depending on the site where it is growing.



Snake River Wheatgrass (*Elymus wawawaiensis*)

Common Name: Needleandthread grass

Scientific Name: *Hesperostipa comata*

Description: A cool season mid-sized bunchgrass with upright smooth stems that grow from 1 to 4 feet tall. The narrow, flat leaves grow 8 to 12 inches long and can roll inward as they mature. The leaf tips are often dry and withered. The leaves grow from the base of the plant. The ligule that grows at the top of the sheath is long, membranous, and split or notched. It is an important identification aid. The seed head is narrow and often bunched, with the lower portions remaining in the sheath. The most striking feature of this grass is the rather long (4-5 inches), bent, twisted awn, which resembles thread, and the sharply pointed seed head, that gives the plant its name. The long awns are often bunched together, giving an appearance of a tangled head of hair.

Preferred Growth Sites: Needleandthread grass is a very drought tolerant grass that grows on a variety of soils. It is normally found on coarse, sandy, soils in Nevada, but is also found on rocky sites with shallow alkaline soils. It does not grow well on soils with a high clay content. Good growth occurs on areas that receive as little as 10 inches of annual precipitation. Needleandthread grass will colonize disturbed areas and can be found in nearly pure stands when that occurs. It is found throughout Nevada, but usually above 3,500 feet in elevation.

Seasonal Development: In northern Nevada, needleandthread grass begins growth in late March to early April. It begins to develop seed heads in May, with full flowering in early to mid-June. Seed ripe and shatter normally occur by late June to early July. These dates will be earlier in south-central Nevada or on lower elevation rangelands.



Needleandthread (*Hesperostipa comata*)

Common Name: Basin Wildrye

Scientific Name: *Leymus cinereus*

Description: Basin wildrye is a large, conspicuous, cool season perennial bunchgrass. The stems of Basin wildrye grow erect and often exceed 6 feet in height, while clumps are up to 3 feet across. The leaves grow up to $\frac{3}{4}$ of an inch wide, are flat, and nearly 3 feet long. The veins in the leaves are raised and prominent. The auricles are long and pointed. The ligule is large, broadly pointed, and papery in texture. The seed heads grow from 4 to over 10 inches in length and are shaped like a thick stiff spike. Several seed clusters (2-7) are produced at each joint on the stem, giving the seed head a dense, bottlebrush appearance. The individual seed parts are tipped with a short bristle.

Preferred Growth Sites: Basin wildrye is usually found in drainages or valley bottoms throughout northern and central Nevada. It grows best in fine textured soils that are seasonally wet and have a shallow water table. It can grow well in soils affected by high salt levels and alkaline in nature. Valley bottoms that have been burned or protected from excessive grazing may produce nearly pure stands of basin wildrye. It grows well on sites that produce greasewood and rabbitbrush. Basin wildrye is a highly variable plant that grows well on higher elevation slopes (8,000-9,000 feet) with rocky coarse soils. It is drought tolerant and grows well in areas receiving 10 inches of annual precipitation.

Seasonal Development: Basin wildrye's growth stages occur over an extended time as compared to other cool season grasses. It begins growth in early spring (mid-March) but because of its long vegetative growth state, flower stalks do not begin forming until mid-late May. The seed heads begin the pollination process in mid-late June, with seed ripe occurring in late July to early August.



Basin Wildrye (*Leymus cinereus*)

Common Name: Sandberg Bluegrass

Scientific Name: *Poa secunda*

Description: Sandberg's bluegrass is a small-medium sized cool season bunchgrass that grows in dense tufts. The stems grow from 8-16 inches tall but are generally less than 12 inches in height. The smooth leaves grow thickly from the base of the plant and are short (1-4 inches long), folded or rolled inward, and end in a boat-shaped tip. The leaves when unfolded have a pair of prominent parallel veins running down the center of the leaf from the tip to the base. The leaves often die back and fall off after the seed heads form. The ligule is approximately 1/8 of an inch long, strongly pointed, and membranous. The seed heads are narrow, short, and often purple colored. The seeds do not have a web of hairs at the base, which is an identifying feature that separates this plant from Kentucky bluegrass.

Preferred Growth Sites: Sandberg bluegrass is adapted to almost all soil types and is abundant throughout central and northern Nevada. It will not tolerate soils that are wet for long periods but will live on sites that are briefly flooded in the spring. It is also not generally found on coarse sands or dense clays. It occurs from low elevation rangelands to alpine meadows.

Seasonal Development: Sandberg bluegrass greens up very early in the spring (early-mid April) and is mature by early July. Seed production begins in mid-May, and seed shatter occurs approximately a month later. By mid-July the plant is a normally dormant except on higher elevation or wetter sites.



Sandberg's Bluegrass (*Poa secunda*)

Common Name: Bluebunch Wheatgrass

Scientific Name: *Pseudoroegneria spicata*

Description: Bluebunch wheatgrass is a cool season perennial bunchgrass that is highly variable in growth form. It is often mistaken for Snake River wheatgrass. The stems grow mostly upright from 1.5 to 4 feet tall in tufts. The leaves are produced along the stems, are narrow, flat or loosely rolled inward, grow approximately 8 inches long, and drooping. Immature leaves are hairless, and feel smooth, while Snake River wheatgrass leaves are covered with fine hairs and feel velvety when young. The sheath has a short, membranous ligule, is normally hairless and sometimes produces short, purple colored auricles. The stems that produce the seed heads are 3 to 8 inches long, narrow, upright, slender, and often wavy or zigzag shaped when the seed clusters are removed. The seed clusters grow in an alternate pattern on opposite sides of the wavy stem. They produce between 4 and 8 seeds per cluster, with most clusters producing several ½ to 1-inch long awns. The awns project at a sharp angle to the stems when mature. Some types do not produce awns, and the seed heads appear as a smooth spike. The glumes below each seed are wider and more blunt than Snake River wheatgrass.

Preferred Growth Sites: Bluebunch wheatgrass grows best on medium to coarse textured soils that are at least 10 inches deep. It is fairly drought tolerant and can grow on soils as coarse as sands or on very rocky sites. It grows across northern Nevada, with the best sites generally located north of highway 50. It can grow on slightly salty soils but will not grow on wet sites or those with extended flooding in the spring. It grows in areas receiving as little as 8 inches of annual precipitation but thrives when total precipitation averages over 12 inches annually. In Nevada, it grows most commonly at elevations ranging from a little over 4,000 to almost 10,000 feet in elevation. It grows in mixed stands with bottlebrush squirreltail, Idaho fescue, sandberg bluegrass, big sagebrush, and other plants commonly found in sagebrush/mountain brush types.

Seasonal Development: Bluebunch wheatgrass normally begins growth in mid-April, with seed heads beginning to form in mid-late May. Seed heads begin to flower in late June, with seed ripe occurring in mid-July, and shatter following in late-July to early August. Because of bluebunch wheatgrass' wide adaptation these dates can move forward or back depending on the site where it is growing.



Bluebunch Wheatgrass (*Pseudoroegneria spicata*)

SHRUBS

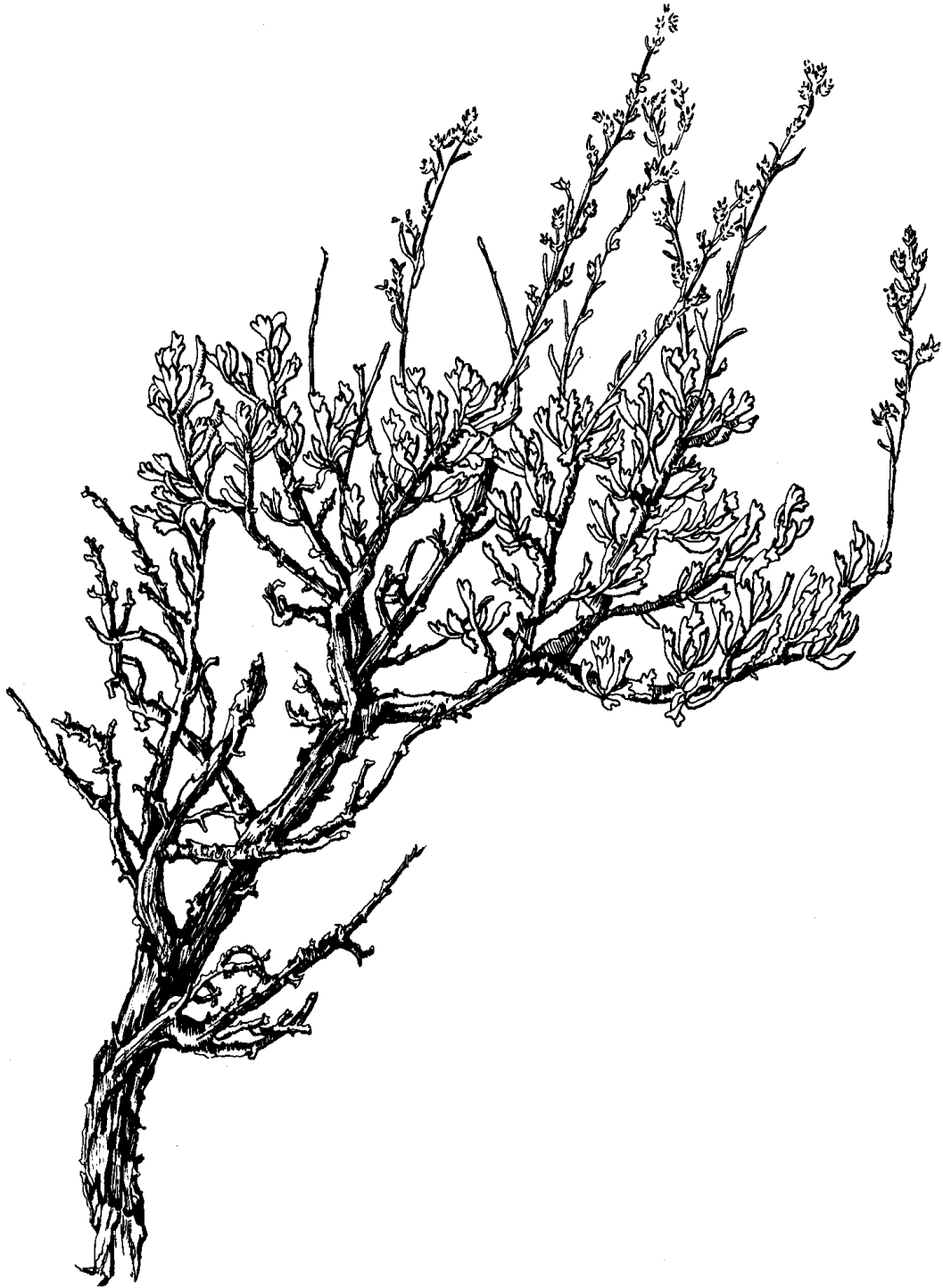
Common Name: Low Sagebrush

Scientific Name: *Artemisia arbuscula*

Description: Low sagebrush is a cool season, low growing shrub with many branches. It normally grows between 4 and 16 inches in height but may be taller (1-3 feet), as is the case with the Lahonton variety. It grows in a mounded form with a light gray-green coloration that darkens as the season progresses. It has a pungent “sage” smell when crushed, and the leaves remain on the plant all year. The leaves can be used to quickly separate the low sagebrushes from the big sagebrush varieties. Low sagebrush leaves are 3 tipped but much more broad at the tip (fan shaped) than big sagebrush. If the leaves are less than 3 times as long as they are broad, the plant is low sagebrush. The flower heads are very narrow about 0.5 inch long, and produce 4-9 flowers/head. They grow on spikes that can reach 12 inches in length and stand well above the top of the shrub. They are grayish in color and stay on the plant through the early spring. Low sagebrush can be separated from the closely related black sagebrush by placing a small amount of leaf material in a clear glass container with enough methanol, alcohol, or ethanol to completely saturate the leaves. Wait at least ½ hour shine the light from a long-wave ultraviolet light on the leaves in a dark room. Low sagebrush fluoresces a cream-blue color while black sagebrush will fluoresce a brownish-red.

Preferred Growth Sites: Low sagebrush normally grows on soil considered less productive and shallower than that producing the nearby big sagebrush communities. The preferred soils often include rock and gravel. This species grows from approximately 2,000 to over 11,000 feet in elevation on many soil types. It generally grows where a restrictive layer such as bedrock, clay pan, or hardpan occurs within 8 to 13 inches of the soil surface. The types of soil producing low sagebrush are extremely varied. Low sagebrush can stand spring flooding and is relatively drought tolerant. It grows where precipitation ranges from less than 7 to over 18 inches annually. Low sagebrush sites normally have a large amount of bare ground present and surface rock is common.

Seasonal Development: Generally, new growth on low sagebrush begins in May. New leaves are produced on the ends of stems first, and then the lower side branches develop new leaves. Flower heads begin to form in July, with peak flowering in August and September. The seeds are normally ripe by October and seed ripening continues through November. Seed scatter is from November through December, with some seed retained through spring.



Low Sagebrush (*Artemisia arbuscula*)

Common Name: Black Sagebrush

Scientific Name: *Artemisia nova*

Description: Black sagebrush is a small, cool-season, semi-evergreen shrub that produces low spreading branches from which stems grow in an upright fashion. It normally grows between 1/2 to 2 feet tall. It has wide, fan-shaped leaves that grow to about 1/2 inches in length and generally have 3 tips on the ends. The leaves are dark-green in color when compared to other sagebrushes. The leaves can be used to quickly separate black sagebrush from the big sagebrush varieties. Black sagebrush leaves are 3 tipped but much more broad at the tip (fan shaped) than big sagebrush. If the leaves are less than 3 times as long as they are broad, the plant is black or low sagebrush. Black sagebrush can be separated from low sagebrush by examining the leaves with a 10X hand lens. Black sagebrush leaves have small, black leaf glands that stick above the leaf hairs. The flower heads produce from 3 to 5 flowers each and are approximately 1/2 inch long. The flower heads grow on stalks that are about 1 foot in length, grow well above the top of the plant and turn a golden brown to orange color with age. They often remain on the plant for 2 years. Black sagebrush can be separated from the closely related low sagebrush by placing a small amount of leaf material in a clear glass container with enough methanol, alcohol, or ethanol to completely saturate the leaves. Wait at least 1/2 hour then shine the light from a long-wave ultraviolet light on the leaves in a dark room. Low sagebrush fluoresces a cream-blue color, while black sagebrush will fluoresce a brownish-red.

Preferred Growth Sites: Black sagebrush typically grows on dry, rocky, shallow soils that are sometimes high in calcium. It grows in dry valleys, on the lower slopes of high elevation foothills with a south or west exposure and on ridges. More than any other sagebrush except budsage (*Artemisia spinescens*), it is associated with salt desert plant communities. It is also found in association with big sagebrush and pinyon-juniper communities. It is found most commonly in Nevada at elevations between 5,000 and 7,500 feet. Black sagebrush grows in regions receiving between 6 and 20 inches of precipitation annually. It is not very tolerant of shade and usually grows in open, plant communities with a low density of grass and forbs.

Seasonal Development: Black sagebrush growth begins in late April, with leaf growth on the upper stems. It begins to form flower heads in July, but flowering usually does not begin until September. The seeds ripen in October and begin to scatter in November.



Black Sagebrush (*Artemisia nova*)

Common Name: Basin Big Sagebrush

Scientific Name: *Artemisia tridentata* ssp. *tridentata*

Description: Basin big sagebrush is a cool season, upright, spreading shrub that grows between 1 and 10 feet tall. It occasionally grows in a tree form that may reach heights of 16 feet. The shrub form produces several branches above the soil surface that are light brown to silver colored when young and gray to brown and shaggy when old. The spreading branches produce the appearance of an uneven top when they are viewed in profile. Basin big sage produces leaves that are usually 3 tipped with the tips only shallowly divided. The leaves are gray-green, wedge shaped, and not belled out at tip as with Wyoming big sage. It produces 3-5 small flowers in heads that are less than ¼ inch long. The heads grow on stalks that are < 12 inches tall, and are produced throughout the entire shrub. The leaf producing stalks are usually >1/2 the length of the flower stalks. Another technique helpful in identification is to place a small amount of leaf material in a clear glass container with enough methanol, alcohol, or ethanol to completely saturate the leaves. Wait at least ½ hour and then shine the light from a long-wave ultraviolet light on the leaves in a dark room. Basin big sagebrush fluoresces either a brownish-red or is colorless.

Preferred Growth Sites: Basin big sagebrush is the most widespread big sagebrush in Nevada and is often found growing adjacent to Wyoming big sage. However, it normally occupies deeper, more moist, and fertile soils. It is often found in valley bottoms, drainages, and lower foothill areas. It prefers well-drained soils that maintain deep moisture. It thrives on sandy loams, and many sites once producing basin big sagebrush are now farmland. Basin big sagebrush thrives where annual precipitation is from 10 to 18 inches. It grows over a wide elevation range (2000-7000 feet) but is generally found below 6000 feet. It generally produces more seed than Wyoming big sagebrush, and seed collectors often mistake basin big sagebrush for Wyoming when collecting and selling the seeds.

Seasonal Development: Basin big sagebrush begins stem growth in May, with rapid leaf growth occurring through June. It begins to flower in late July-early August, which continues through October. Full flower is generally later than with Wyoming sagebrush. Seed ripe occurs from October through December, and most seed is scattered by the end of the winter months.

Common Name: Mountain Big Sagebrush

Scientific Name: *Artemisia tridentata* ssp. *vaseyana*

Description: Mountain big sagebrush is a cool season, upright shrub that grows from 1 to 4 feet tall. The stems are branched with the new stems being hairy and silver in color. The old stems are brown to gray in color with shredding bark. The leaves on mountain big sagebrush generally have 3 tips on the end, are shaped as a narrow wedge or bell, and are 1/2 to 1 1/2 inches in length. They are gray-green in color and smell very pungent when crushed. The small, inconspicuous flowers (5-8/head) are produced on short (1/4 inch) flower heads, which grow on stalks that which are usually less than 12 inches tall. The flower stalks are produced on the upper portion of the shrub and grow evenly above the leaves. This gives mountain big sagebrush a flat-topped appearance when it is viewed from the sides. The leaf producing stems growing near the flower stalks are less than 1/2 the size of the flower stalks.

Another technique helpful in identification is to place a small amount of leaf material in a clear glass container with enough methanol, alcohol, or ethanol to completely saturate the leaves. Wait at least 1/2 hour and then shine the light from a long-wave ultraviolet light on the leaves in a dark room. Mountain big sagebrush will fluoresce shades of a cream-blue color.

Preferred Growth Sites: Mountain big sagebrush grows best in the upper elevations of Nevada, usually above 5500 feet. It is normally found on moderately deep, well-drained loams where annual precipitation is between 10 and 16 inches. The soils are often deep and well developed on sites producing mountain big sagebrush. This plant is normally found on soils that are more moist and cool than those producing Wyoming big sagebrush. It grows best where soil moisture is available throughout most of the summer. It is often found growing with and above the pinyon-juniper woodlands, in association with aspen, subalpine fir, white fir, and limber pine. Mountain big sagebrush sites are often very productive and will produce a large number of grasses and forbs growing in the same area.

Seasonal Development: Mountain big sagebrush development was studied in Idaho and found to begin growth approximately 2 weeks after Wyoming or Basin big sagebrush, but seed ripening occurred 2 weeks earlier than either. Shoot growth begins in Late May to early June with flower heads beginning to form in July. Full flowering occurs in August with pollination occurring in early September. Seed ripe occurs in late September, and seed scatter begins soon after, continuing through mid-winter.

Common Name: Wyoming Big Sagebrush

Scientific Name: *Artemisia tridentata* ssp. *wyomingensis*

Description: Wyoming big sagebrush is a cool season shrub that grows from 1 to 3 feet tall. It produces a stout woody trunk that is normally divided at the base of the plant. The bark is fibrous, peeling, and brown to gray in color. It produces numerous branches that spread out from the base and grow upright, which results in the top of the plant appearing uneven when viewed in profile. The leaves are gray-green in color, very aromatic when crushed, and remain on the plant throughout the year. The leaves are covered in silvery hairs and are 1/4-1/2 inches long. The leaf tips are divided into 3 rounded lobes and are generally wedge to bell shaped. Approximately 3-5 small flowers are produced in short (<1/4 inch) heads that grow on short (<1/4 inch) stalks. The vegetative stems growing around the flower stalks are normally a little more than 1/2 the length of the flower stalks.

Another technique helpful in identification is to place a small amount of leaf material in a clear glass container with enough methanol, alcohol, or ethanol to completely saturate the leaves. Wait at least 1/2 hour and then shine the light from a long-wave ultraviolet light on the leaves in a dark room. Wyoming big sagebrush will fluoresce a brownish-red, or less commonly, a very pale cream-blue color.

Preferred Growth Sites: Wyoming big sagebrush is the least widespread of the 3 subspecies of big sagebrush that grow in Nevada. It is most common on mid-elevation sites (3000-7000 feet) that occur in areas receiving from 8 to 14 inches of annual precipitation. It grows on a variety of soils but thrives on loamy, relatively deep, well-drained soils that occur on the drier aspects of the landscape. It is relatively tolerant of drought and salts but will perish quickly if flooded. It grows on nearly all types of terrain, but will occupy the shallowest, driest, and hottest soils of the 3 subspecies of big sagebrush growing on the same site. In riparian areas it will be present on gravelly washes and high floodplains. It is often located below the pinyon-juniper communities and above the salt-desert shrub type.

Seasonal Development: Wyoming big sagebrush begins growth early in the spring, with shoot growth occurring in mid-late April through June or until soil moisture becomes limiting. It begins to flower in late July, and continues until cold temperatures stop the process in September. The seeds ripen in the late fall (October-November) and seed scatter follows soon after. Most seeds are shed by late winter.



Basin, Mountain, and Wyoming Big Sagebrush, (*Artemisia tridentata*)

Common Name: Fourwing Saltbush

Scientific Name: *Atriplex canescens*

Description: Fourwing saltbush is a warm season, medium sized shrub that can be evergreen or lose its leaves each winter, depending on where it is growing. It has great variability in appearance throughout the area in which it grows. It produces stout stems that can be upright or more spreading. It grows up to 8 feet tall, 15 feet wide, and the new growth is white and hairy. The leaves grow in an alternate pattern on the stems and can grow to 2 inches in length. They have smooth edges, are two to three times as long as they are wide, and have rounded ends. The leaves are gray colored and covered with tiny scales. Fourwing saltbush plants normally produce either male or female flowers, but some produce both. The male flowers are red to yellow in color and form dense spikes at the ends of the branches. The female flowers are small, inconspicuous, and grow between the leaf stem and branch. A distinctive, dull, yellow-colored organ that gives the plant its common name surrounds the seeds. The seed coverings are about 1/2 inch in diameter, and have 4 papery “wings” that project from the center. They often remain on the plant all winter.

Preferred Growth Sites: Fourwing saltbush can grow on a wide variety of sites and is found throughout Nevada. It normally grows where annual precipitation is between 8 and 15 inches but is considered extremely drought tolerant and can grow on sites receiving as little as 4” in southern Nevada. It tolerates a wide variety of soils but will not grow where it is periodically flooded or on soils with a high water table. It grows best on deep, well-drained, sandy soils but can be found on heavy clays. It is very tolerant of saline soils, but is less so of sodium affected soils. Generally, the largest populations are found in valley bottoms or washes. It is found from the lowest elevations in Nevada up to about 8500 feet. It is most commonly associated with other salt-desert species, but is common in the sagebrush, blackbrush and greasewood communities in Nevada.

Seasonal Development: Growth normally begins in mid-late spring, with flowering beginning in May and continuing through September. The seeds ripen in October through December. Seed dispersal begins approximately 3-4 months after the seeds ripen. Seeds often remain on the plants for over a year.



Fourwing Saltbush (*Atriplex canescens*)

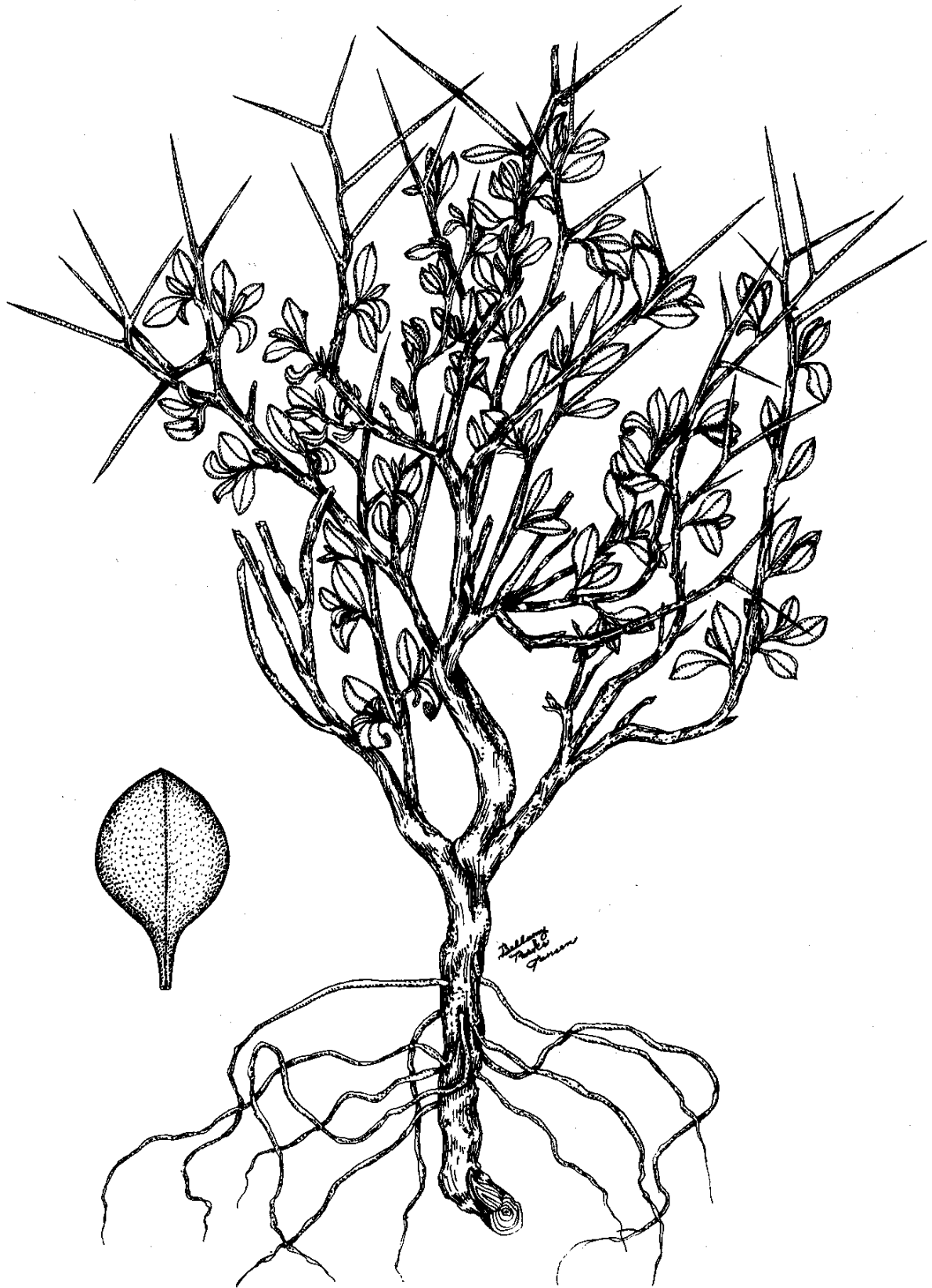
Common Name: Shadscale

Scientific Name: *Atriplex confertifolia*

Description: Shadscale is a dense, short, shrub with a rounded, compact appearance. It's height ranges from less than a foot to nearly 3 feet. It has stiff brittle branches that become spine tipped as the plant ages. The leaves are mostly evergreen, with some leaf drop in the winter. The leaf shape varies from almost round to oblong to long and narrow, reaching 1 inch in length. The leaves are normally gray colored with a tinge of red and covered with tiny, papery scales. Shadscale produces male and female flowers on separate plants. The male flowers are clustered on the ends of short branches and are red-yellow in color. The female flowers are small, inconspicuous, and grow on small branches at the base of the leaves. The female flowers grow on top of a pair of small bracts or leaves that are joined at the base. These flowers produce the seed, which is enclosed in a small chamber above the bracts.

Preferred Growth Sites: Shadscale grows in areas that receive as little as 4 inches and up to 8 inches of annual precipitation. It is normally found in Nevada on dry, rocky, well-drained soils that have relatively high salt levels. However, it can grow on a wide variety of soils ranging from fine textured soils in valley bottoms to sands and gravels in washes, on slopes or ridges. It grows over much of Nevada, from the blackbrush communities of southern Nevada to the northern sagebrush regions. It is very common in the salt-desert shrub communities found below the sagebrush communities in central and western Nevada. Shadscale can be found at elevations ranging from approximately 3000 feet to about 7500 feet above sea level.

Seasonal Development: Leaf growth begins in March-April. Twig growth begins in April and flowering occurred in the April-May period. Seed ripening occurs in June-July with seed dissemination occurring from June through August.



Shadscale (*Atriplex confertifolia*)

Common Name: Torrey Saltbush

Scientific Name: *Atriplex torreyi*

Description: Torrey saltbush is the largest member of the saltbush plants growing in Nevada. It often reaches nearly 10 feet in height. It produces prominent ridges growing along the length of branches, resulting in the branches growing at sharp angles. The branches can become quite spiny with age. The leaves are gray-green in color, fading to a lighter gray-white color. The leaves are oval to a rough arrowhead shape. They grow about an inch in length. Torrey saltbush can produce both male and female flowers on the same plant or on separate plants. The flowers are crowded densely on the end of the branches. The seed is produced on top of 2 very small leaves or bracts that grow together at the base. They are similar in appearance to shadscale seeds except that the bracts are much smaller.

Preferred Growth Sites: Torrey saltbush grows from southern Nevada along the Colorado River to the central and western areas of the state. It prefers heavy, salt affected soils with seasonally high water tables. These soils are common on the lower reaches of the Truckee, Carson, and Walker Rivers of western Nevada. It is found most often growing in association with greasewood, fourwing saltbush, and desert blite. It is not common in most of the central and northern Great Basin, but can be found in relatively pure stands where it does appear.

Seasonal Development: The timing of growth stages of Torrey saltbush has not been well studied in the Great Basin. However this species is closely related to quailbush (*Atriplex lentiformis*) and its development may be estimated from what is known of that shrub. Based on the information available for quailbush and the other *Atriplex* species, Torrey saltbush probably begins growth in March-April, with flowering occurring in early April-May. The seed ripe stage should occur in the June-August period, with seed scatter occurring in September to October.



Torrey Saltbush (*Atriplex torreyi*)

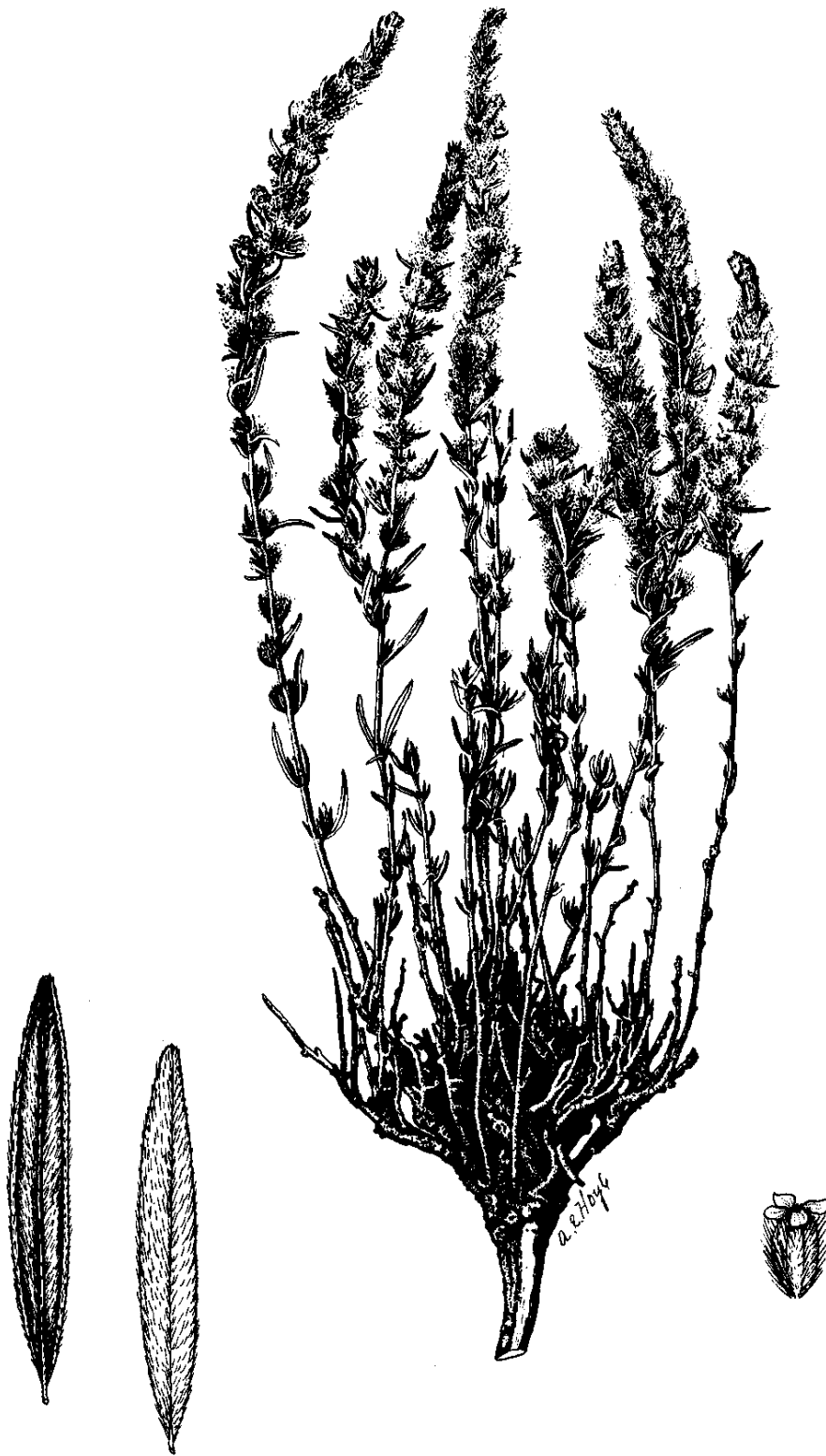
Common Name: Winterfat

Scientific Name: *Krascheninnikovia lanata*

Description: Winterfat is a small, short, woody, cool season shrub that can produce stems each year that grow between 1 and 3 feet tall. The woody branches producing the stems are normally much shorter (4-6 inches) and grow from a woody crown. The stems and leaves re-grow each year and are covered with thick wooly, gray-white hairs. The hair gives the plant a very obvious silvery-white color. The leaves are narrow, about 1 1/2 inches long, and pointed, with smooth edges. They grow in an alternating pattern on the stems. The flowers are very small, without petals, and grow clustered in a narrow spike from the upper portion of the stems. They have 2 small leaves or bracts that grow together covering the seed.

Preferred Growth Sites: Winterfat grows over a large portion of Nevada. It can be found growing on dry hillsides, mesa tops, outcroppings, and in dry valley bottoms. In the central portions of Nevada, winterfat often grows in large, pure colonies in the valley bottoms and on alluvial fans. It will grow in almost all soil textures, but seems to thrive on finer textured soils such as silt and clay loams. It will not grow where the ground is flooded for prolonged periods and is very drought tolerant. It will grow on soils moderately affected by salts and high in calcium. It is found in regions receiving as little as 5 inches and as much as 20 inches of annual precipitation. It grows at elevations ranging from 2,000 to over 9,000 feet. In Nevada, winterfat can be found growing with big, black, and low sagebrush, pinyon-juniper communities, and in the salt desert shrub regions.

Seasonal Development: Winterfat begins growth in early spring, which varies tremendously in Nevada from the southern to northern portions of the state. In the central portions of the state growth normally begins in mid-March. Leaf and stem growth continues until mid-May, when flower buds begin to form. It flowers in June through early July, with seed ripe occurring a month to 6 weeks later. Seed scatter begins in August and continues through September. Because of winterfat's wide distribution, these dates can vary by as much as 2 months.



Winterfat (*Krascheninnikovia lanata*)

Common Name: Desert Bitterbrush

Scientific Name: *Purshia glandulosa*

Description: Desert bitterbrush is very similar in appearance to antelope bitterbrush with a few exceptions. It is a short to tall evergreen shrub. The shorter variety is normally multi-stemmed, spreading to upright, with reddish to brown stems. The upright types are usually single stemmed, with a large, stout stem or trunk that produces stems or leaves that grow upright in a column form. The leaves on desert bitterbrush are green on the top and bottom with little to no hair on them, as compared to antelope bitterbrush that produces leaves with green tops and gray bottoms due to leaf hairs. The leaves have 3 rounded tips on the end, are wedge shaped, and about ½ inch long. The leaf edges are often rolled inward and have sunken glands on the edges. The flowers are single, yellow to white in color, and grow on the ends of short branches. They have five petals that grow in a tube pattern. After the petals drop, the hairy spindle shaped seed remains on the end of the short branches that produced the flowers.

Preferred Growth Sites: Desert bitterbrush only occurs in the southern portion of Nevada. It crosses readily with antelope bitterbrush, so there is no doubt an area in south-central Nevada may contain both species and/or hybrids. As with antelope bitterbrush, desert bitterbrush prefers moderately deep, well-drained soils, which are medium to coarse in texture. It grows on almost all aspects and slopes in association with big sagebrush, pinyon-juniper communities, salt desert shrub, creosote bush, and blackbrush. On sites where it is plentiful, grasses and forbs will be a minor part of the community, with shrubs dominating the site.

Seasonal Development: Desert bitterbrush development will mimic that of antelope bitterbrush except that in lower elevation, more southern regions, the development would be expected to start approximately 1 month earlier. In the southern portions of the state, growth would start in early to mid-March. Flowering would be expected in mid to late April, with seed ripe occurring in June to July. Seed scatter will begin shortly after the seeds mature.



Desert bitterbrush (*Purshia glandulosa*)

Drawing courtesy of Mike Whalen
BLM Winnemucca, NV

Common Name: Stansbury Cliffrose

Scientific Name: *Purshia stansburiana*

Description: Cliffrose is a tall (3-12 feet) shrub or small tree that produces many brittle branches. It is often mistaken for bitterbrush, but has several distinctive differences. The branches are covered with rough bark that is green to reddish-brown when young, developing an almost black color as it ages. The leaves are mostly evergreen, a medium to dark to gray-green color on top white-gray below due to leaf hairs, and approximately 1/2-1-inch long. They grow in an alternate pattern on the stems, are narrow rather than wedge shaped as in bitterbrush, and are usually clustered at the ends of small branches. The outermost ends of the leaves of cliffrose are usually divided into 5 to 7 shallow tips rather than the 3 found on bitterbrush. In addition the leaves are covered with scattered translucent dots that are obvious when held up to sunlight. The flowers of cliffrose are larger (3/4 inches across) and much more conspicuous than those found on bitterbrush. They are a light cream to bright yellow in color, and grow only 1 flower on the tips of small stems. The flowers have 5 petals, which fall as the seed matures. The seeds (4-10) are inside a hard, hairy, outer covering that is attached at the base of the flower. A distinctive feature of this seed container is that it produces a 2-inch long feathery tail that makes cliffrose appear as if it is covered with a haze when seeds are present.

Preferred Growth Sites: Cliffrose grows best on thin, rocky soils that are well drained and exhibit high calcium levels. It can be found growing on most soil textures but prefers those with low water holding capacity. Cliffrose sites are normally dry and often on south and west exposures. It will grow where precipitation ranges from 10-20 inches annually. It is found growing on elevation ranging from 3,000-8000 feet. In Nevada, it is found in the south-central south-eastern and southern portions of the state. It is associated with pinyon-juniper communities, big sagebrush, rabbitbrush, salt desert shrubs, and galleta grass.

Seasonal Development: Cliffrose begins growth in late March through April depending on the elevation and exposure. Flowering usually begins in early May to June. It has a long bloom period, with flowering plants common until the first frost in the fall. Generally, the first seeds are ripe in mid-July. However, the seed can mature and begin to scatter from August through October of most years.



Stansbury Cliffrose (*Purshia stansburiana*)

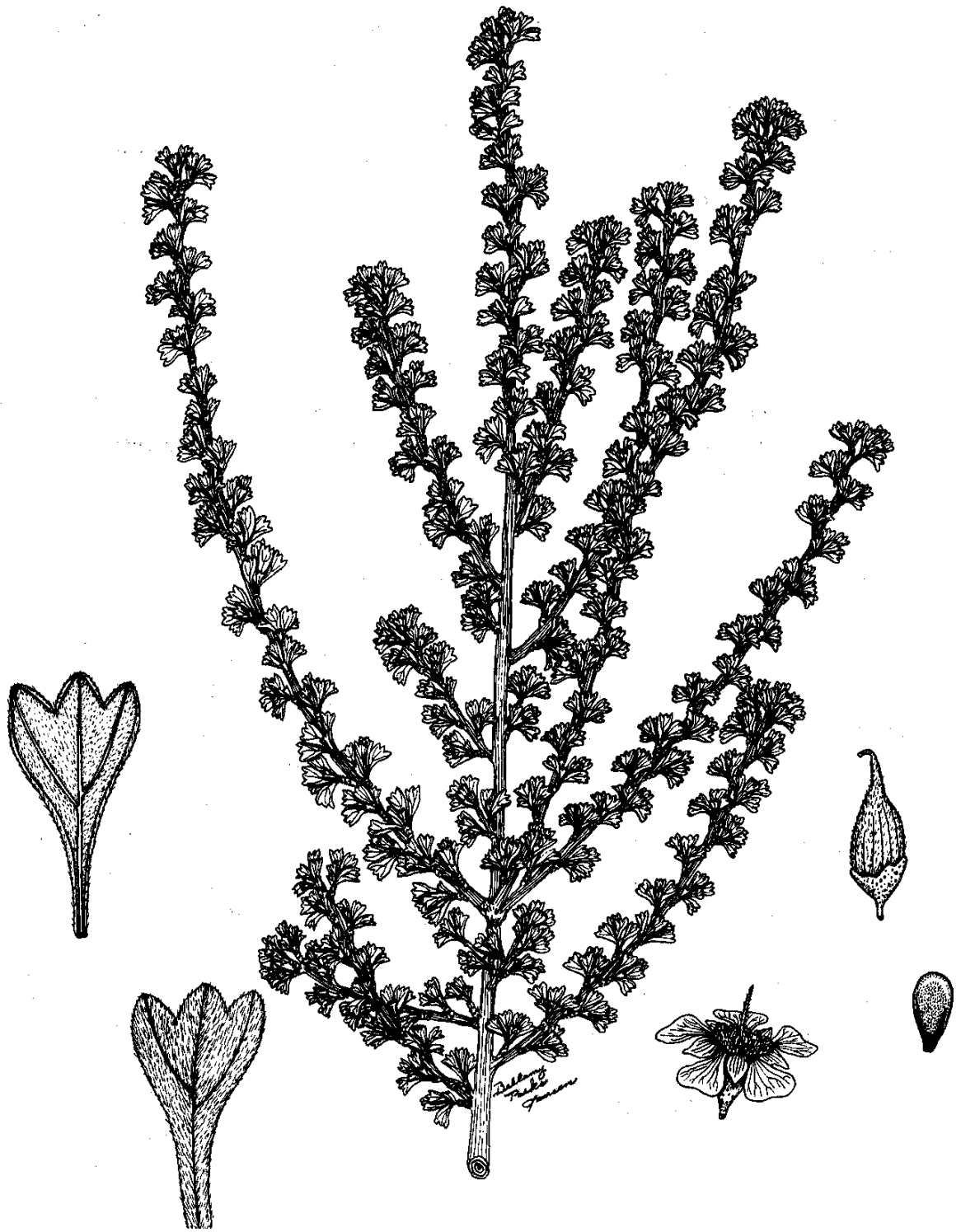
Common Name: Antelope Bitterbrush

Scientific Name: *Purshia tridentata*

Description: Antelope bitterbrush is a long-lived, cool season shrub that can be evergreen or lose its leaves each winter. It can be short (2-5 feet) or tall (15 feet) with the shorter plants usually producing several smooth reddish colored branches and the taller plants producing a large single trunk. Bitterbrush can grow with layered, spreading branches or be more upright. The leaves are 1/4-1/2 inches long, dark-green on top, and covered with white wooly hairs on the bottom. They grow in an alternate pattern on the stems. They have 3 rounded tips and smooth sides. The flowers are single, yellow to white in color, and grow on the ends of short branches. They have five petals that grow in a tube pattern. After the petals drop the hairy spindle shaped seed remains on the end of the short branches that produced the flowers.

Preferred Growth Sites: Antelope bitterbrush grows in most of northern Nevada. It grows best on well drained, medium to coarse textured soils at elevations between 4,000-8,000 feet. It is fairly drought tolerant and occurs on upland slopes, ridges, and rocky outcrops. It can grow on finer textured soils if they are laced with rock and cobbles. Antelope bitterbrush tolerates a wide range of alkaline and acid soils but will not grow if the salt content is too high. Antelope bitterbrush will grow with as little as 8 inches of annual precipitation or with up to 20 inches. In western Nevada, it occurs in extensive stands in the foothills of the Sierra Nevada range. It grows with big sagebrush, pinyon-juniper, low sagebrush, mountain mahogany, and the bunchgrasses such as Idaho fescue, bluebunch wheatgrass, and the needle grasses. It is also common the pine and fir forest types of the higher elevation rangelands.

Seasonal Development: Antelope bitterbrush begins growth in early April to early May depending on the location. It flowers from mid-May to early-June. Seed ripening occurs from July through early August and seeds begin to fall within a few days of ripening.



Antelope Bitterbrush (*Purshia tridentata*)

FORBS

Common Name: Western Yarrow

Scientific Name: *Achillea millefolium* var. *occidentalis*

Description: Western yarrow is a hardy, perennial, forb or herb that is covered with soft, wooly hairs. Yarrow has a fibrous root system and will produce underground stems known as rhizomes. It grows from 1 to nearly 4 feet tall depending on the site. Yarrow will normally produce several stems from a group of leaves growing at the base of the plant. Younger plants or those growing on poor sites may produce only single stems from each plant. The stems can be unbranched or weakly-branched on occasion. Yarrow leaves also grow on the stems and are normally spaced equally along the entire stem below the flower heads in an alternate arrangement. The leaves are larger on the lower to middle part of the stem and smallest below the flowers. They grow from 2 to 6 inches long and about 1/4 to 1 inch wide. The leaf blades are divided into many fine segments, giving the leaves a soft, feathery, fern-like appearance. The flowers are produced in several, tight, flat-topped, or slightly domed clusters. They are almost always white but can be pink in color. The clusters are made up of a few (4-5) ray flowers and several (10-20) disk flowers. A closely related plant known as common yarrow is often mistaken for the native because the appearance is very similar. Common yarrow has flat leaves while the native types have leaves that grow in different planes giving the plants a three dimensional appearance.

Preferred Growth Site Conditions: Western yarrow can be found throughout Nevada in a wide variety of vegetation types. It thrives on dry, well-drained soils, but is found from subalpine grasslands to aspen groves to the dry meadows of the sagebrush zone. It does not grow well in dense shade or on saturated soils in wet meadows. It is often found on disturbed sites since it is an early invader under these conditions. Western yarrow normally grows in a scattered pattern, with large thick stands unusual.

Seasonal Development: Western yarrow flowers over a long time period beginning in late April to early May. The flower clusters will bloom through June and July to August at higher elevations. Seed ripening can be expected to occur from mid-August to mid-September, with seed scatter occurring approximately 2 weeks after seed ripe.



Western Yarrow (*Achillea millefolium* var. *occidentalis*)

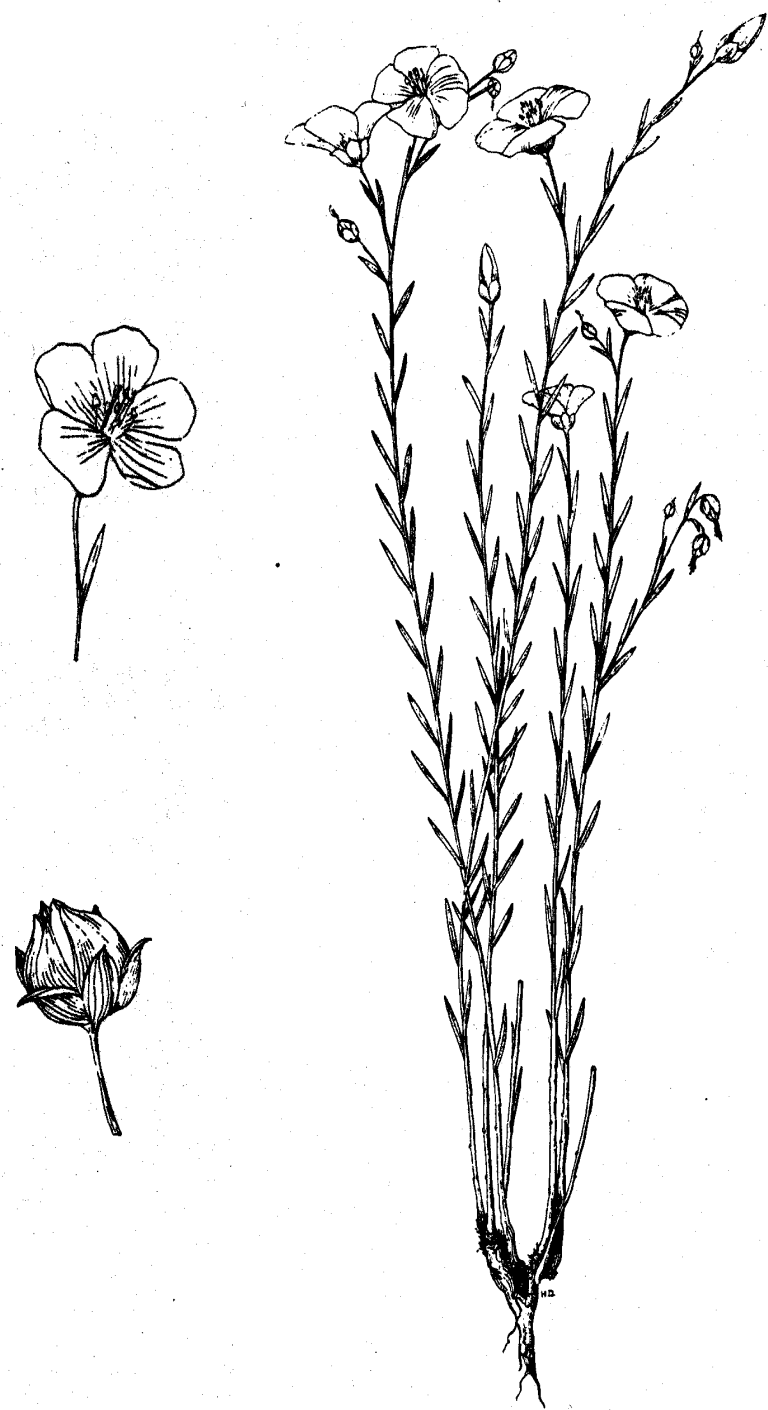
Common Name: Lewis or Blue Flax

Scientific Name: *Linum lewisii* var. *lewisii*

Description: Lewis or blue flax is a short-lived native perennial herb or forb that is often mistaken for “appar” perennial flax, which is an introduced perennial forb that is very similar in appearance. Lewis flax produces slender, drooping to upright stems 2-3 feet tall. The stems grow from a woody, long taproot. The leaves grow closely spaced in an alternate pattern on the stems. They are thin, smooth-edged, pointed, and up to an inch long. They grow directly from the stems without a stalk. The leaves are green to blue-green in color. The flowers are produced in groups on drooping stalks, grow about 1 inch across, and have 5 sky blue overlapping petals that are 1/2 to 1 inch long. The flowers open at dawn and the petals normally drop by noon. The seeds are produced in a round capsule, which contains up to 10 seeds. The introduced flax normally has smaller flowers, capsules and seeds than the native variety.

Preferred Growth Site: This plant is common throughout Nevada and the Intermountain West. It grows in a very broad range of habitats from blackbrush communities in the southern deserts, through the salt desert shrub ranges, to the sagebrush and pinyon juniper-communities and mountain meadows. It is normally found growing at elevations between 1000 and 6000 feet. It does not usually grow in thick stands but is found as scattered populations in many different areas. Lewis flax prefers full sun and well-drained soils. It will not persist on poorly drained soils or those that flood. It grows well in areas receiving at least 10 inches of precipitation, but best production is expected on sites receiving from 15-20 inches. Flax is also found on disturbed, infertile sites that may have been previously seeded. “Appar” blue flax is a selected release that has been used in many seed mixes. It was thought to be a native variety, but was later found to be a naturalized species from Europe.

Seasonal Development: Lewis flax begins growth in early spring, and flowering starts around mid-May. It will bloom until mid-late summer, depending on the amount of moisture available and the elevation. The seed capsules mature approximately 6 weeks after flowering.



Lewis or Blue Flax (*Linum lewisii* var *lewisii*)

Common Name: Scarlet Globemallow

Scientific Name: *Sphaeralcea coccinea*

Description: Scarlet globemallow is a warm season perennial forb or herb that grows from a thick woody taproot. It grows up to a foot tall and can grow upright or more flat to the ground. The plant normally produces many stems from the base, which are a yellowish-gray color. The leaves are a light gray to silver-green color and grow in an alternate pattern along the plant stems. The leaves are deeply divided into numerous lobes that reach to the base of the leaves. The leaves are covered with gray star-shaped hairs. The flowers grow in clusters on the ends of the branches. They are red to pink when first blooming then, fades to an orange color as the flowers mature. The centers are yellow. They have five petals and are cup shaped like others in the mallow family. Collectors should be aware of another globemallow that grows in Nevada but is considered rare and should not be collected. It is Jone's globemallow (*Sphaeralecea caespitosa*), which grows only in northeastern Nye County. It can be easily separated from scarlet globemallow by its leaves, which are nearly round or diamond shaped without the deep divisions common to scarlet globemallow. The leaf edges have rounded "teeth" or shallow divisions and are a pale grey green in color. The flowers are similar to scarlet globemallow but described as peach colored.

Preferred Growth Site: Scarlet globemallow grows best on dry open sites that receive 10-20 inches of precipitation annually. It thrives on sandy loam-to-loam soils at elevations between 3500-9000 feet. It is not usually found on tight poorly drained soils such as clays. Scarlet globemallow can be found in sagebrush, pinyon-juniper, saltbrush-greasewood, and the sagebrush-grassland communities of Nevada. It readily invades sites that have been disturbed by fire, excessive grazing, or disking prior to seeding. It does not compete well with established plants and may be reduced in numbers as the site recovers.

Seasonal Development: Scarlet globemallow begins growth in April to May, with flowering occurring shortly thereafter. It blooms over a relatively long time period but will stop growth and even lose leaves if soil moisture is limiting. The seed matures in June to July, but viability will be very low if moisture is not abundant during the flowering growth stage.



Scarlet Globemallow (*Sphaeralcea coccinea*)

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Recommended Native seed Collection Sites on BLM Lands in Nevada



Chapter 4

Recommended Native Seed Collection Sites On BLM Lands In Nevada

Each BLM Field Office is responsible for record keeping about native seed collection, including preferred or recommended collection sites. The amount of information available varies by location, but generally is not compiled into a single document that delineates recommended areas by species.

All existing information concerning potential seed collection locations is available from each resource specialist assigned to coordinate native seed collections and sales. Some field offices have maps available delineating traditional collection sites for various species. Each Field Office can provide information on areas where native seeds have been previously collected. They will also provide suggestions to collectors regarding sites that may have potential for native seed collections. Finally, all the field offices are receptive to requests by native seed collectors for permits to collect in new areas.

Collectors must ensure they are collecting seed from public lands and do not stray into private parcels. Chapter 6 discusses Nevada laws regarding collections on private land. The use of Global Positioning Satellite (GPS) receivers and accurate maps is strongly recommended. Land status maps, which depict private and public lands, are available in each field office for a nominal fee.

The following table displays the status of collection sites by field office as of the fall 2002. To obtain the most up-to-date information contact the resource specialist responsible for the native seed sale program in the appropriate field offices.

**Table 4-1 BLM Field Offices and Native Seed Collection Resources
Available in Nevada as of November 2002.**

BLM Field Office	Maps Available	Traditional Collection Locations Identified	Suggested Collection Locations Provided	New Collection Locations Available By Request
Battle Mountain 50 Bastian Rd. Battle Mountain, NV 89801 (775) 635-4000	No	Yes	Yes	Yes
Carson City 5665 Morgan Mill St. Carson City, NV 89701 (775) 885-6000	No	Yes	Yes	Yes
Caliente PO Box 237 US Highway 93 Caliente, NV 89008 (775) 726-8100		Yes	Yes	Yes
Elko 3900 E. Elko St. Elko, NV 89801 (775) 753-0200	No	Yes	Yes	Yes
Ely 702 N. Industrial Way Ely, NV 89301 (775) 289-1800	Yes (limited)	Yes	Yes	Yes
Las Vegas 4701 N. Torrey Pines Dr. Las Vegas, NV 89103 (702) 515-5000	Yes (limited)	Yes	Yes	Yes
Tonopah 1553 S. Main St. Tonopah, NV 89409 (775) 482-7800	No	Yes	Yes	Yes
Winnemucca 5100 E. Winnemucca Dr. Winnemucca, NV 89445 (775) 623-1500	No	Yes	Yes	Yes

BLM Permits, Fees, and Regulations Related to the Collection of Native Seeds on Public Land



Chapter 5

BLM Permits, Fees and Regulations Related To The Collection Of Native Seed On Public Land

How BLM Seed Collection Permits Are Issued:

Permits for collecting seed from BLM lands in Nevada are normally issued on a “first come, first served” basis by the field office that administers the land where the seed collection will occur. This process is adequate due to the low number of collectors who request permits to collect each year. If more than one collector requests a permit to collect in the same area, a bid process may develop. In that case the authorized or contracting officer will publicize the availability of the collecting sites, species etc. and request bids from competing collectors. The highest bidder will then be awarded the permit to collect on the advertised site.

Most BLM field staff currently work closely with native seed collectors in identifying preferred sites on which to collect native seed. The field staff can suggest collection sites if the collector is unfamiliar with the area or will review sites that are requested by the collector seeking a permit.

BLM Permits Required to Collect Native Seed in Nevada

The native seed collection industry in Nevada is relatively small. The vast majority of Nevada BLM field offices receive fewer than 10 requests for native seed collection permits each year. In addition, the requests are normally for relatively small amounts of seed, with the values of the seed collected being less than \$2,500.00. Due to these factors, obtaining seed collection permits is normally quick and uncomplicated. Although a process is in place where competing collectors would be required to bid on desirable native seed sources, it is not used at this time due to a lack of demand. The following information will help a potential collector understand the process, anticipate costs, and reduce the confusion associated with obtaining permits to harvest seed on federal lands. The permits required for seed collection are available at the field office responsible for the geographic area where the collection will occur.

Federal regulations require that all commercial vegetation resources collected on BLM lands be permitted using 1 of 2 forms. Form #5450-5 is titled “Vegetative or Mineral Material Negotiated Cash Sale Contract”. Form #5450-1 is titled “Contract For The Sale Of Vegetative Resources” and is used for larger value contracts

and/or when the contracting officer thinks additional contract stipulations are necessary to avoid resource damage. A copy of both forms is attached as Appendix A. The regulations or stipulations governing seed collection on federal lands are listed on each permit form.

Form #5450-5 is used when the value to the BLM of the native seed collected will be less than \$2,500.00. The value of the contract is determined by multiplying the estimated quantity (in pounds) of seed to be collected by the price of the seed (per pound) as determined by the authorized officer in each field office. The seed price is determined by: 1) surveying wholesale seed suppliers, 2) examining the price paid by the BLM during past seed purchases, and 3) negotiations with the potential seed collector.

In addition to the amount and price to be paid by the collector the form lists: 1) the species to be collected, 2) the location(s) where the seed collection is permitted, 3) contract terms to be followed by the permit holder, 4) general stipulations, and 5) specific stipulations that must be followed during the collection process.

The contract terms are listed on this form under Section 1, **Contract Terms**. The authorizing officer will check the boxes relevant to the specific contract for seed collection. The general stipulations are also printed on the permit form and only require a box to be checked by the authorizing officer. Section 3 is for special stipulations that are pertinent to the specific contract. They include written instructions and/or a map of the permitted collection area. Special stipulations generally include items such as; 1) fire fighting equipment be supplied to the collecting crews, 2) all vehicles remain on existing roadways, 3) all collections be by hand only, and 4) all cultural or important wildlife sites not be disturbed, etc. The stipulations listed normally will be different for each contract and are decided on by the authorizing officer in each field office.

The other permit is issued when a collector requests a contract for seed with a value in excess of \$2,500.00. However, it can be used for smaller contracts if the authorizing officer feels he/she needs more control over the collection process. This permit is form #5450-1 and titled "Contract for the Sale of Vegetative Resources". Form #5450-1 typically requires more and/or different stipulations before a contract is issued. Other differences are related to how payment to the government will be made, using the term contracting officer instead of authorized officer and requires posting a bond for larger contracts.

If permit form #5450-1 is used, the contracting officer will, in **Section 1** of the form identify the collection area by listing the specific Section, Township, Range, and sectional subdivision where the collection will occur. The officer will then complete **Section 2**, which lists the type(s) of seed collected, the quantities collected, the price per unit (pound), and then multiply the price/unit by the number of pounds for each species to determine the total contract value. Payment for the seed can be either collected at the contract signing or in payments as designated on the form.

Section 3 concerns posting of a bond by the collector to ensure the contract is completed following all stipulations listed. If the stipulations are not followed to the satisfaction of the contracting officer the bond may be revoked and if the amount of damages exceed the bond, additional money may be due the government. The bond is returned to the collector when the contract is completed to the satisfaction of the contracting officer.

Section 4 lists the time period allowed to complete the contract and the regulation that governs time extensions.

Section 5 indicates that both parties are bound by the standard provisions (#6-16) and the special provisions (#17) listed on the permit.

Section 6 defines the terms used in the permit.

Section 7 states that the government keeps title to the seed collected until they are removed from the collection site. Also, that all risks associated with loss of the seed are with the group holding title at the time the material is lost.

Section 8 discusses the process that will be followed if violations of the contract occur and provides timelines for the cancellation of the contract if the collector does not remedy the violations.

Section 9 details the actions that the collector must take to prevent and/or suppress wildfires related to the collection process.

Section 10 prohibits the collector or his/her employees from removing from government land any vegetative materials not specifically listed in the permit.

Section 11 indicates that the collector is liable for all damages that occur during the collection process. The collector will be responsible for paying the government to repair any damage that might occur.

Section 12 relieves the government from any responsibility related to the condition of the seed collected or the quantity available. All contracts for seed are on an “as is” basis.

Section 13 states that more than one collector may be allowed in each collection area at the same time.

Section 14 states that all collectors must comply with equal opportunity regulations in effect at the time the contract is issued.

Section 15 prohibits any officials of the government from benefiting from the proceeds of the contract.

Section 16 details the process that will occur in the event that a dispute occurs between the government and the collector.

Section 17 contains the special provisions attached to the contract/permit that must be followed by the contractor. These provisions can be different for each contract and are designed to prevent environmental damage, accurately specify collection sites, and ensure that all collections meet all land use plans or other regulations in place at the time the contract is issued.

Any collector who is considering entering into a contract with the BLM to collect seed on BLM administered land is advised to read and understand all the provisions listed on the collection permit. Failure to do so may result in unintended violations and conflicts with the contracting or authorized officer. The contracting or authorized officers in each field office are available to discuss any of the provisions listed on the permits and assist the collector in any way possible.

BLM Fees for Seed Collection on Federal Lands

The fee collected by BLM field offices in Nevada generally is 10% of the wholesale value of the cleaned seed collected under the terms of the permit. Wholesale value is determined by surveying commercial seed vendors, and reviewing recent prices paid by the BLM during large-scale seed buys. The contracting or authorizing officer in the pertinent field office sets the price the

government feels is fair market value for the seed to be collected. The fees can be negotiated if the collector can demonstrate that the officer overlooked important criteria used to set the price. The BLM field offices in Nevada have some latitude as to how payment at fair market value is collected. Most require cash at the time of sale but, under special circumstances, some may accept 10% of the volume of the seed collected. Table 5-1 lists the preferred payment method by each BLM field office.

Table 5-1. Preferred Payment Methods for Native Seed Collections by BLM Field Offices in Nevada

BLM Field Office	Payment
Battle Mountain 50 Bastian Rd. Battle Mountain, NV 89801 (775) 635-4000	Cash
Caliente PO Box 237 US Highway 93 Caliente, NV 89008 (775) 726-8100	Cash
Carson City 5665 Morgan Mill St. Carson City, NV 89701 (775) 885-6000	Cash
Elko 3900 E. Idaho St. Elko, NV 89801 (775) 753-0200	Cash
Ely 702 N. Industrial Way Ely, NV 89301 (775) 289-1800	Cash
Las Vegas 4701 N. Torrey Pines Dr. Las Vegas, NV 89103 (702) 515-5000	Cash
Tonopah 1533 S. Main St. Tonopah, NV 89409 (775) 482-7800	Cash
Winnemucca 5100 East Winnemucca Dr. Winnemucca, NV 89445 (775) 623-1500	Cash

Collection Methods Allowed on BLM Lands

BLM Field Offices in Nevada both allow and prefer that seed collections be done by hand. They allow collectors to use items such as tarps and tennis rackets to facilitate collection, but want steps taken to ensure that the collection process does not damage the seed plants. They are also concerned about the impact of vehicles on federal lands and generally restrict vehicular access in the seed collection process to existing roads. However, some mechanical collection may be permitted on sites with a very low potential for resource damage. The authorized or contracting officer evaluates each request for mechanical collection on a site-specific basis. The officer will consider the type of harvester (combine, flails, brush strippers, etc), the target plant species, cultural resource limitations, potential for damage to natural resources, and other factors related to the proposed collection site. If the potential for resource damage to the site is minimal, a mechanical collection permit may be issued.

State of Nevada Rules and Regulations for Native Seed Collection



Chapter 6

State of Nevada Rules And Regulations For Native Seed Collection

Nevada has very few rules or regulations concerning the collection of native seed on state or private lands. The regulations governing native seed collection are found in Chapter 527 of the Nevada Revised Statutes (NRS). The pertinent section is NRS 527.050, which is titled Protection of Trees and Flora. The statute was in effect as of December 2002. However, a collector is advised to check the current statute in order to be sure that it has not changed.

The regulations basically state that collection of any tree, shrub, plant, fern, wild flower, cacti, desert or montane flora, or any seed roots or bulbs from private or state lands is illegal unless the collector has written permission from the landowner. In addition, the collection of any plant species listed as endangered (by the state forester) from any state or federal lands require a permit issued by the state forester or his designated agent. Appendix B is the pertinent section printed directly from the Nevada Revised Statutes.

Other sections of chapter NRS chapter 527 details the laws related to the harvest of Christmas trees, cacti, and yucca. Anyone desiring to collect those species is advised to obtain a copy of the pertinent sections and read them before collecting any plants or seeds.

Wildland Seed Collections Site Identification Log



Chapter 7

Wildland Seed Collections Site Identification Log

Introduction

The Nevada Department of Agriculture (NDOA) is responsible for certifying seed that is produced under conventional agricultural practices or collected from wildlands. Seed produced or collected is not required to be certified. However, many seed brokers/conditioners require some sort of assurance that the material they are buying from a producer or collector is: a) the species or variety they think they are buying, b) collected from a specified area, and c) not infested with noxious or injurious weeds. Wildland seed collectors can meet some of these needs by having the seed they collect certified by NDOA. The NDOA can provide the collector and seed broker/conditioner a log that helps meet the needs of both the collector and seed broker/conditioner.

The site identification form used to certify collected seed and the regulations necessary to obtain certification are currently being revised by the NDOA. The process should be completed by the summer of 2003. The form will be available from the NDOA and must be completed and signed by the collector, seed broker/conditioner where appropriate, and a representative of the NDOA. All wildland seed collectors are urged to have the seed they collect inspected and certified by NDOA personnel.

The initial step in obtaining certification under the site identification program is to contact an NDOA representative at (775) 688-1182 ext. 244. A minimum of two weeks is requested to allow scheduling of a site visit by an NDOA representative. After notification, the NDOA representative will arrange to meet the collector in the field for a site inspection whenever possible. If a site inspection at the time of collection is impossible, the representative will visit the site following the collection to verify the plant species growing on site, obtain voucher specimens if necessary and ensure that no noxious weeds are present.

Under the certification process being considered a "Certified Seed Site Identification Log" is completed by each collector for each species/site combination collected and submitted for certification. The log is supplied with instructions for completing it. This handbook will be updated when the log becomes available.

Collecting and Preserving Voucher Plant Specimens



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Chapter 8

Collecting And Preserving Voucher Plant Specimens

Voucher plant specimens are plants that are collected during the seed collection process and represent the plant(s) from which the seed is being collected. Specimens are used to verify the genus, species, and subspecies or variety of seed collected. An example might be the collection of a Wyoming big sagebrush plant to verify that the seed collected is indeed from Wyoming big sagebrush and not from basin big sagebrush. Basin big sagebrush that grows in conjunction with Wyoming big sagebrush is more competitive on the better habitats and produces significantly more seed. As such, it is often collected in place of the lower seed producing Wyoming big sagebrush. A voucher plant specimen should be obtained for each seed lot that is collected.

Collecting and preserving voucher specimens is easy and uncomplicated. It requires a few tools and equipment. However, to be useful a specimen must be preserved properly and include the plants major identifying features of the plant. Important features include the leaves, stems, flowers, and/or seed heads. Smaller plants can be collected and preserved whole, including the root. For large plants that cannot be preserved whole, a representative stem that includes the leaves, flowers, and seed head is collected. If the collector notices that underground stems are an important part of the plant's reproduction process and thinks that underground stems would help in identification, they should be collected and included with the specimen. Plant guides can be useful to indicate when a certain plant part is needed for proper identification.

Plant specimens are preserved using a plant press. A plant press can be purchased or made from materials commonly available. A plant press consists of 2 rigid end panels made of wood (12" X 18"), several "press units" of the same size consisting of blotter paper or newsprint and corrugated cardboard, and 2 buckle straps about 4 feet in length to hold everything together and provide pressing force on the collected plants. An individual press unit is a combination of 1 piece of cardboard between 2 pieces of blotter paper or thick folds of newsprint. Several press units are necessary and are placed between the wooden end panels, which are bound by the buckle straps.

Appendix C provides directions and details for the construction of a simple plant press. The original plans are available from: Cooperative Extension Service at Purdue University. The website is,

<http://www.fnr.purdue.edu/extension/kp/bapp.html>. University of Nevada Cooperative Extension Fact Sheet 94-46 “Leaf Collecting and Making a Plant Press” will also give you directions for the construction of a plant press.

To press plants, the press is placed on the ground and the buckles removed. The top end piece is set aside and a press unit is removed. Each plant specimen is placed in newspaper between the blotter material in such a manner as to make identification of the pressed and dried plant easy. After the specimen(s) are placed in a press unit, they are stacked in the press. The end unit is placed on top and the straps tightened as much as possible. The idea is to flatten and dry the specimens as quickly as possible. Pressed plants normally remain in the press (in a dry area) for 2 weeks. The blotter paper or newsprint surrounding the plant specimens may need to be replaced after the first 4-5 days to avoid mildew.

Plants should be cleaned prior to pressing if they are excessively dirty. The leaves must be spread out flat so that the front and back are visible. Plant stems, if too thick to be easily pressed and dried, should be split with a pocketknife before pressing. Tall or large plants must be trimmed or bent to fit in the press. Thick fruits should be split as well. Flowers and seed heads must be arranged so that all parts are visible before the press is reassembled and the pressing/drying process begins. Pressed samples can be examined and rearranged if necessary at the end of the day. The buckle straps will need to be retightened as the plants dry.

Each voucher specimen needs to be identified in some manner. Often a number is assigned to the plant as it is placed in the press. The number is then written on the blotter or newsprint holding the plant before it is returned to the press. The number corresponding to the plant is entered in a journal or marked on the collection sheet that is used in the seed source identification program. If it is entered in a journal, recorded information includes; 1) collector, 2) date collected, 3) plant genus, species, and common name, 4) location/elevation of collection, and 5) associated plant species in the community.

Resources and Literature Used to Prepare This Chapter:

Rowley, P. (1994). Leaf Collecting and Making a Plant Press. Fact Sheet # 94-46. University of Nevada Cooperative Extension, Reno, Nevada.

Native Seed Collection, Handling and Storage Tips



Chapter 9

Native Seed Collection, Handling, And Storage Tips

Factors Influencing Harvest of Native Seed

Noxious and Invasive Weeds

Noxious, invasive weed species are rapidly invading ever-increasing areas of wildlands in Nevada. Their populations range from large monocultures to small, scattered, patches to individual plants pioneering in new areas. A collector must learn to recognize these weeds in order to avoid inadvertently collecting them while gathering native seed. If a collection of native seed is found to contain noxious weed seed, it may be completely worthless as most states prohibit the planting of seed that contain noxious weeds. A collector must avoid harvesting in any area that contains noxious or injurious weeds that may contaminate their collection. The best resource available to identify weeds for the novice collector is titled “Weeds of the West” and is published by the Western Society of Weed Science. This book consists of over 600 pages of color photographs and descriptions of the most common weeds found in the western United States. It is available at all major bookstores. Most offices of the BLM, NRCS and Cooperative Extension have a copy that can be used to help identify these pests. The Nevada Department of Agriculture maintains a list of weeds considered noxious by the State of Nevada. It is attached as appendix D.

Timing of Seed Collections

One of the most important items to consider when beginning collecting native seed is the timing of the harvest. If the seed are collected too early they will not be mature enough to germinate and grow. If the collection starts too late the seed may have already dropped from the plant and be lost. Another task that must be completed before the collection begins is determining if the seed have “filled.” “Filled” seed are those that have been successfully pollinated, and have produced viable embryos, a food source used to begin early growth (endosperm), and a seed coat to protect the embryo. Not all seed have an obvious endosperm surrounding the embryo but most do. This endosperm can be very useful in determining when to harvest native seed.

The endosperm changes as the seed matures. Following pollination the seed enters a phase known as the “milk” stage. Seed in this stage will produce a milky fluid when squeezed between the thumb and forefinger. Following the milk stage is the stage known as “soft dough” stage. In this stage, the seed will emit a material that resembles soft, kneaded, bread dough when squeezed. Finally, the endosperm of the seed will harden into the “hard dough” stage. During this stage the seed is fully mature and is hard to the touch when squeezed. Normally, the endosperm will be too hard to compress with the fingers and even splitting the seed by biting it will be difficult. Obviously, the larger the seed is the easier it is to determine which stage of maturity it has reached. However, this method can be used on even small seed with the help of a hand lens and tweezers.

Determining if a group of seed has “filled” and their stage of maturity is relatively easy. A sample of the seed that will be collected is removed from several different, widely spaced plants in the collection area. Individual seed are squeezed as described above. If the seed are flat and do not produce any liquid when squeezed, they either have not filled or are in a very early stage following pollination. If this is the case, the seed should not be collected at that time. Individual seed can also be sliced perpendicular to the long axis with a sharp knife to check for the presence of the soft or hard-dough stage endosperm. If the endosperm is not visible, the seed has probably not filled. If the seed are in the hard dough stage they may need to be cut with a scissor, clippers, Leatherman type tool, or other cutting instruments that will allow the collector to cut the seed in half without crushing it. Once the seed is cut, it should be examined with a hand lens to ensure that the endosperm is developed and that the seed has filled.

Grass seed can be difficult to determine whether they have filled. The actual seed is often buried inside a covering of other seed parts, which can be mistaken for the actual seed. The seed are normally the innermost organ and can be squeezed, bitten or cut like larger seed to determine maturity.

Predicting when seed will mature is difficult, given the wide area within which native seed grow, differences in climate from year to year, and the effect that micro-sites have on seed maturity. The descriptions provided for the priority plants listed in this guide include rough estimates of when seed can be expected to mature. However, the only sure way to determine the proper time to harvest is to visit the collection sites several times over a period of time and note the stage of seed maturity. Dry, warm years will typically result in early seed maturation, while the opposite is true of cold, wet years. Higher elevations and north aspects generally result in seed maturing later than those growing on lower elevations and

with a southern exposure. Native seed normally mature over a relatively long time given that the seed head continues to grow and produce new seed even as the earliest seed ripen. This factor can be an advantage because it extends the time that viable seed can be collected, but means that multiple collections may be necessary from the same area.

Many native seed will fall from the plant when reaching maturity, making single collections difficult to time accurately. No seed should be collected until they have passed the soft-dough stage. A fully mature seed will be hard and nearly impossible to flatten when squeezed. The collector must decide if the number of seed in the seed heads that have reached this stage is enough to make collection practical. If only about 50% the seed in the heads are mature and repeated collections are impractical, the seed heads can be cut from the plant and the seed allowed to mature on the plant parts that were removed. For this method to work, a relatively large amount of plant material should be cut and spread enough to dry without mildewing. Repeated collections after the seed have matured on the plant is the most successful method to maximize the collection of mature seed. However, the time taken to repeat a collection should be compared to the amount of seed harvested with each pass, as the amount of seed collected normally drops each time.

Damage from Insects and Disease

Other items that must be considered when deciding to collect a population of seed, is the presence of damage from insects or disease. Insect damaged seed will often have entrance and exit holes in the seed coat indicating that damage to the seed has occurred. If a majority of seeds have been damaged, collection is usually not warranted. The seed heads may be infested with insect larvae, and cause ongoing damage. The seed should be examined for off colors (the endosperm is normally white to cream colored), or unusual looking endosperm when compared to a fully filled normal sample.

Fungal diseases can damage seed. Ergot is common in some grass species and shows up as a dark brown or black powder in the seed heads. It causes unusual growth of the seed heads and damages seed. Other fungi may be white or light gray and any indication of unusual growth on the seed should be identified before collection begins.

Harvesting seed in the rain is not recommended. It makes seed collecting much more difficult. Also it increases the moisture content of the collected seed making drying more challenging.

Methods of Seed Collection

Hand Harvesting

The vast majority of native seed that will be collected on BLM lands will be collected without the use of machines. Opportunities for machine harvesting seed from BLM lands is limited, and each case will be decided upon at the Field Office level based on the potential for resource damage. Well over 90% of all seed currently collected from BLM lands is collected by hand. Hand collection of seed takes many forms, and simple tools such as sports rackets and tarps increase seed collection efficiency. Most BLM Field Offices permit the use of hand tools for wild-land seed harvesting as long as the plants are not permanently damaged.

The most basic collection method is hand stripping. It requires only heavy gloves and a bag to hold the seed that has been stripped from the plant. Stripping seed works especially well with grass species. In stripping, the seed are pulled from the seed stalks by hand and placed in the bag. The hand is cupped around the seed head and pulled toward the top, stripping the seed from the head. The collection bag is typically made of nylon or canvas and suspended from the collector's body by a strap. In that way both hands are free to strip the seed heads from the plant.

Another method used by hand collectors is to cut or clip the seed heads from the plant. Only the seed stalks are removed. The seed heads are allowed to dry on a tarp or in a porous bag, and the seed then shaken or stripped from the heads. This is useful when the seed being collected matures over a long time period. If enough plant material is removed when the seed head is clipped, many seed will mature while the heads dry.

Native seed can also be collected by hand by beating or shaking them from the seed bearing plants. Normally, an instrument such as a stick, tennis or badminton racket, or paddle will be used to knock the seed loose and into some sort of collection device. A tarp, hopper, box, or open bag is placed under the seed bearing plant, and the seed is swept or knocked into the collection container. As with hand stripping, the tarp or bag is often suspended from the collector's body, placed under or in front of the seed heads, and the seed are swept into the tarp with the beater. The seed of many shrub species are collected using this method.

Harvesting with Hand-held Machines

There are currently some hand-operated machines that use a modified, gas powered, weed eater to harvest seed. The weed eater's cutting head is replaced with interchangeable stripper reels. The reels are equipped with various types of flails that strip the seed from the heads. The seed are swept backwards into a collection bag or hopper as the reels rotate. Prairie Habitats Inc. (www.prairiehabitats.com/hand.html) is one company that sells such a machine. They can be contacted at PO Box 10, Argyle, Manitoba Canada ROC OBO. Another company that markets a similar device is Grass Seed Australia. They can be contacted at (07) 46326 888 or (07) 46322 104. The company address is PO Box 132, Darling Heights QLD 4350. Impacts from these harvesters should be minimal. They use much the same flailing action as hand beaters using a racket or something similar. The author is not recommending either machine but is simply presenting the information as a service to collectors who may be interested in harvesting equipment. The BLM District personnel in Nevada consider all such hand held, engine powered seed strippers as machine collecting, and collector's considering using such machines must ensure that they can be legally used when collecting on BLM lands.

Hand-held vacuum harvesters have been developed in Australia for seed that are easily removed from the seed heads. However, they have never been very successful for the native plants identified as priority species in Nevada. The vacuum power required to remove the seed is tremendous and the seed can be damaged when they pass through the propeller necessary to create the suction. An article published by personnel working for the New South Wales Department of Agriculture discusses several different vacuum machines currently in use in that country. This information can be viewed at www.agric.nsw.gov.au/reader/7573 and is interesting in that development of vacuum harvesters is being pursued with interest in Australia. Some of the newer machines may be adapted for Nevada conditions, but have not yet been tested.

Machine Harvesting

When machine harvesting is possible and cleared for use on BLM lands three primary options are available to the collector. Each option is adapted to rather limited situations on wildlands and should be attempted on a small-scale basis before a large seed collection project is begun.

Seed Stripping

Pull type seed strippers are often used to harvest seed in environmentally sensitive areas. They are similar in operation to the hand held models described above, but are larger and are pulled by a vehicle. The strippers consist of a frame, wheels, pull arm, and a stripper reel or head that is normally constructed of stiff brushes. A small engine that rotates the head in a counterclockwise direction powers the reel. The brushes sweep the seed from the seed heads, and they are deposited in a hopper that sits at the rear of the collector reels. Normally, a little moisture on the plants is desirable to reduce shattering. Excessive wind can reduce harvest efficiency, therefore a stripper should be pulled into the wind when harvesting.

Seed strippers are normally pulled by a tractor, all terrain vehicle, or pickup truck. The height of the reel is adjusted to the height of the seed heads that are being collected. They are used in sensitive habitats because they have minimal environmental impact. Most of the seed heads remain standing after seed harvest, which maintains wildlife habitats and soil protection. Information presented by Packard and Mutel (1997) in: The Tallgrass Restoration Handbook: for Prairies, Savannas, and Woodlands indicates that seed strippers did not produce any negative impacts on the harvested species. The stripper and the pulling vehicle will leave tire tracks, but they normally disappear in a short time unless the soil was too wet when the seed were harvested.

Direct Combining and Swathing

Combines are machines that cut seed heads from plants and direct the heads through a threshing machine, where the seed are separated from the other plant materials. Seed can be directly or indirectly combined. Direct combining cuts (by the combine) and threshes the seed in one operation. Indirect combining uses a swather to cut the seed heads and places them in rows on the ground (windrowed) where they are allowed to dry. The windrows are then picked up and processed with a combine to separate the seed from the plant materials.

Combines are large heavy machines that work best when operated on smooth rock-free ground like fields. They can collect large amounts of seed when the target species being collected are growing in a heavy, uniform stand. This normally limits their use in Nevada to grasses such as basin wildrye and Indian ricegrass. Seed harvest with combines may be possible with some shrubs, such as winterfat or sagebrush that are growing in thick stands and produce seed heads that extend above the rest of the plant leaves, stems, etc. Most native forb species do not grow

in sufficient quantities in the wild to merit harvest with combines. Combines used to harvest native seed are sometimes modified to improve the harvest. The reel that pushes the plants being harvested into the cutter bar is often removed when harvesting native seed. If not, the reel action will often cause excessive seed loss when the reels contact the seed heads. Special screens may need to be manufactured for the combine to be effective on some native seed. With native seed, the combine adjustments (cylinder, air, screens) will normally be set using a trial and error method, because most manuals do not have native seed adjustment recommendations. An article by Fred Faessler and Steve Apfelbaum in Restoration and Management Notes (1988 6(2): 79-80) provides some valuable information concerning combine adjustments. A reprint is attached in Appendix E. The Natural Resources Conservation Service (NRCS) Plant Material Centers (PMC) are good places to obtain information on using combines for harvesting native plant materials. Nevada is served by three Plant Material Centers: Aberdeen Idaho; Tucson Arizona; and Lockeford, California. The Agriculture Research Service's Forage and Range Research Laboratory in Logan, Utah is also an excellent source of information. The USDA Forest Service Shrub Sciences Research Laboratory can also provide valuable information concerning native seed harvesting. The address and telephone numbers of the pertinent PMCs, the Forage and Range Laboratory in Logan and the Shrub lab in Provo, Utah are listed in Appendix F.

Mr. Dwight Tober, manager of the USDA PMC in Bismarck, North Dakota provided information about the advantages and disadvantages of the three machine harvesting methods. The information is presented below. Collectors considering mechanical harvest are cautioned that the information presented is for harvesting conditions found on seeded fields.

Table 9-1. Advantages And Disadvantages Of Using Seed Strippers For Harvest.

Advantages	Disadvantages
Ability to harvest seed as it ripens	Slow process-go over field many times
Easy clean out (1-2) between harvests	More seed lost on ground
Handle less residue-cleaner seed	Windy conditions cause problems-stripper must be driven into the wind (dead-ending)
Easy operation/transport	

Table 9-2. Advantages And Disadvantages of Direct Combining.

Advantages	Disadvantages
Combines are readily available	Greater seed loss by shattering
People are familiar with combines	Delays harvest to last critical moment while waiting for best harvest conditions
Requires less time	Crop is more vulnerable
Less labor intensive	Seed is higher in moisture, therefore may have harder time combining
Seed is more mature when harvested (seed is almost at hard dough stage)	Harvesting is slower
	Time required to clean combine between collections/fields

Table 9-3. Advantages and Disadvantages of Swathing (cut and let crop dry in field and then combine).

Advantages	Disadvantages
Can harvest earlier; do not have to wait until all seed is mature with potential to shatter	If you have a light crop then you have a light swath which is hard to pick up with a combine
More uniform seed ripening	Poor drying in windrow
More even crop harvest	Slightly more weed seed
Less drying time-runs through combine more quickly	Possible wind damage to windrow before combining
Harvesting time is more rapid	More time involved cleaning two pieces of equipment (swather, combine)
Drying is less of a problem	

Harvesting Summary

The type of seed to be harvested, topography, and land use regulations will largely determine which seed harvesting methods are possible and most efficient. The majority of native seed harvested on wildlands in Nevada will be harvested by hand; however, some machine harvest may be possible. A collector is advised to talk with as many individuals as possible with knowledge about machine harvesting of native seed. These contacts are found at the NRCS PMCs, Agricultural Experiment Stations at Land Grant Universities, United States

Department of Agriculture Research Laboratories, and at private seed companies. Peer reviewed research on harvesting methods for native seed is limited, but Internet searches can provide a potential collector with printed information from many sources that may be useful. One of the best is the book by Young and Young, titled "Collecting, Processing, and Germinating Seed of Wildland Plants." It is available from Timberland Press, The Haseltine Building, 133 S.W. Second Ave. Suite 450, Portland Oregon 97204. As with all new practices, some experimentation and modification will be necessary before the most efficient harvest method is discovered. A collector should keep good records on yields, harvest times, costs of machinery/support materials, and repairs before starting a commercial scale harvest operation.

Seed Handling after Harvest

Because seed is alive it must be handled carefully to prevent damage following harvest. Recently harvested seed usually have high moisture content, especially if stems and leaves were harvested at the same time. The most important consideration during harvesting and immediately after harvest is to dry the collected seed sufficiently to prevent mold and subsequent spoilage. This requires large, porous collection/drying containers that permit easy air circulation around the seed in the bag. Paper bags are often used when small quantities of seed are harvested. Mesh bags, shallow trays or baskets can be used when large amounts of seed are collected. The seed may need to be spread on a tarp or another clean dry surface and allowed to air dry in a warm location. If seed is placed outside to dry, it must be protected from rain, high winds, rodents and birds. Placing seed in direct sunlight may cause overheating and the death of the seed being dried. A covered, warm, well-aerated building with air temperatures near 100° F is ideal for drying seed. If the seed of the priority species listed in this manual are dried to below 13% moisture, no damage should occur during long-term storage provided the air surrounding the seed has the same or lower moisture content. If seed are collected late in the year or are dried when moisture in the air is higher than that desired in the seed, they should be dried using warm air circulated around the seed. If forced air-drying is necessary, the air must not only be warm but relatively dry. Avoid excessive heat when drying the seed. They can be killed at higher temperatures. If the seed is dried too rapidly they may crack and be damaged.

If the harvested material contains large amounts of other plant parts in addition to the seed, the material should be screened before drying. In screening seed, the first screen used must have holes large enough to allow the collected seed to pass through but small enough to prevent the other plant parts from passing. The second

screening requires a screen with mesh too small to allow the seed to pass through but small enough to allow trash to fall out. The collected seed are placed on the screen and rubbed lightly across the mesh to force the seed or trash through the holes of the screen.

Seed Storage

Native seed vary in their response to storage. Some can be stored a long time (years) under normal storage conditions with little damage to their ability to germinate and grow. Others have a very short shelf life unless strict, species specific, storage conditions are maintained. Regardless of the long term storage characteristics of the seeds collected, they will need to be stored for a period of time until they are marketed. Storing seeds properly will reduce the chance of damage before they are sold.

After the seed are dried and screened they can be stored for a short time in porous bags that allow fresh air to circulate around the seed. However, the moisture content of the seed will soon equal that of the moisture content of the air. If the moisture in the air is too high the seed may reach a moisture content that promotes spoilage. Fortunately, most of Nevada has naturally dry air, and the majority of seed stored here are in large open warehouses, with little damage from excess moisture. If insect damage is a potential problem the dried seed can be stored in plastic or metal containers that keep the insects at bay. Dried seed that will be kept only a short time are best stored under cool, dry conditions such as in a basement, under a house, or in a garage if the outside temperatures are cool.

The success of long-term storage of seed is dependent on seed moisture content and seed temperature. Young and Young in their classic book on seed collection, processing and germination state "Each 1% reduction in seed moisture doubles the life of the seed, and each 10° Fahrenheit reduction in seed temperature doubles the life of the seed." Non-dormant seed with moisture contents above 30% can actually germinate in storage. Moisture levels above 18% can promote heat generation and seed death. Fungi can destroy oily seed when moisture levels are above 10%, and starchy seed when moisture levels exceed 13%. Seed that have been dried to below 14% moisture and stored at that moisture content will suffer very little damage. However, it is possible to allow stored seed to get too dry. Once seed dry below 6% moisture viability and survival will drop as compared to seed stored between 6% and 13%.

Cold storage temperatures above 32° Fahrenheit will not physically harm seed regardless of the moisture content. After temperatures drop below freezing, any seed with moisture contents above 14% will be damaged from the ice crystals, which form inside the endosperm. When seed moisture levels are below 14%, freezing temperatures will not harm the seed since ice crystals cannot form due to a lack of moisture in the seed. If the subfreezing air around the seed has high moisture content, the seed will gain moisture and be damaged by ice crystals as described above. If seed are to be stored in subfreezing temperatures, they must be dried to below 14% moisture and placed in containers that prevent them from gaining moisture from the air.

Collectors are advised to determine the optimum long-term storage environment necessary for the species of seed they have collected if they expect to hold the seed for more than a few months. As explained previously, long-term storage of seed is best under controlled environmental conditions (optimum temperature and humidity), and most collectors do not have the facilities to store collected seed a long time in the ideal environment. Therefore, most collectors will benefit from selling their seed in a relatively short time period after they are collected.

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Native Seed Marketing Possibilities



Chapter 10

Native Seed Marketing Possibilities

As with nearly all-agricultural commodities, the marketing of native seed may be the most difficult part of the process for new seed collectors. To receive the best price, a collector must first identify the potential consumers of the seed collected and which seed will be a priority for specific consumers of the seed. Then they must determine the requirements of the consumer concerning the quality and quantity of seed desired. Finally they must price the seed competitively based on market prices and be able to consistently deliver a high quality product.

Native seed prices vary dramatically by season and from year to year. A small shift in supply, either positive or negative, can result in large price changes. The biggest consumer in Nevada of native seed is government agencies, especially the BLM. The BLM is not in the business of producing native seed but relies on seed collectors, growers, and vendors to provide the seed necessary to implement Congressional directives. In 2000, the U.S. Congress directed the BLM “to build a long term native plant materials program to supply native plant materials for use in fire rehabilitation and restoration projects”.

The number of acres burned in wildfires largely drives the demand for seed. As burned acres increase the demand and price for seed increases. Because native seed production on wildlands is dependent on climatic conditions, the supply of desired seed is extremely variable. On years with favorable climatic conditions the amount of seed available for collection can exceed demand and the price received may not cover the cost of collection, handling, cleaning, testing etc. When production is low the price received may be greatly above the related cost of collection. A collector should thoroughly understand the potential market for the seed to be collected, and develop realistic estimates of the demand and potential price before collecting any seed. If possible, collectors should identify potential markets for the seed and discuss potential sales with the consumer before large-scale harvests are attempted.

Seed collectors are advised to keep accurate, complete records concerning costs associated with native seed harvest. Items such as measured yields, time required to collect each species, per diem, vehicle, travel, and equipment costs, cleaning costs, permits, inspection charges, and supplies should be recorded for each lot of seed collected. Without such information future decisions on pricing, which species to collect, return on investment and taxes due, will be impossible to accurately determine.

Native seed collected on Federal lands are normally sold in three ways. First, seed is sold directly to the BLM or other agencies under a competitive bid process. In this case the collector agrees to sell a set quantity of seed at a set price. Using the information provided by the BLM or other agency a collector offers the government a price on the seed. If they are the lowest bidder, they are awarded the contract. Second, the collector can sell the seed directly to a seed dealer who will resell it in a variety of markets. Third, is direct selling of the seed by the collector on the retail market.

Sales to Government Agencies

The BLM or other contracting agency lists the species or variety of seed desired, the country of origin, the collection location, the quantity desired, the minimum quality standards they will accept for the seed (purity, germination, and pure live seed percentages, cleaning standards), where and when the seed is to be delivered, and other pertinent standards. Collectors who wish to bid on a Government contract normally have to meet all licensing and bonding requirements for seed dealers for the state in which delivery is made.

A collector who wishes to compete on a government contract must complete a solicitation form. The form normally provides information on the amount of seed for sale, the price desired, where the seed was collected, past performance on similar contracts, and references. Information concerning whether the collector has ever completed a contract before, a delivery date and a host of other information is required by the contracting agency.

The government bid process allows a collector to set a price for the seed they collect that covers their costs of collecting, delivery, taxes and any profit that the collector feels is due. If the collector's price is the lowest and accepted by the contracting agency the marketing process is simplified as the collector is dealing with one purchaser and all the requirements are known before a price is set. In addition, government agencies that purchase the seed will always pay for the seed delivered as long as it meets contract specifications. If the successful bidder fails to meet the contract specifications he/she may be liable for the unmet needs of the contracting agency and be required to reimburse the agency for that portion of the contract that was in default. A collector who does not meet the terms of a contract may not be acceptable to the agency as a contractor on future seed bids thus losing the opportunity to sell seed to the largest consumer of native seed in the western United States.

BLM Internet Sales Process

The BLM is converting to an electronic purchasing system in 2003. They are phasing out paper transactions and will use the Internet to solicit, and purchase, all goods and services that they acquire. After October 1, 2003 BLM will no longer maintain bidders mailing lists. It will be the interested party's (Vendor/offer or/potential Contractor) responsibility to use the five Internet sites discussed below to search for business opportunities with the BLM. Collectors will need to become a Vendor if they wish to sell directly to the BLM. Collectors interested in becoming vendors and making an offer on BLM seed purchases must complete several steps on-line before they can participate in the bidding process. A critical step in the process must be completed by October 1, 2003. However, if they decide not to sell directly to the Government they can still use the second internet site listed below as an information tool.

First Internet site: Vendors must first obtain a **Duns & Bradstreet** number (D-U-N-S® number) before they can access any of the other sites required to complete the process. A Duns number can be acquired by completing a form available from Duns & Bradstreet at <http://www.dnb.com> or by calling them at (800) 333-0505. A valid Duns and Bradstreet number will be assigned to a vendor about 30 days after the form is completed.

The second important website vendors will use is the **Federal Business Opportunities (FBO) site** at www.FedBizOpps.gov. The FBO site is the only location that lists all Federal government procurement opportunities over \$25,000 in value. Government buyers post information about upcoming seed buys and other government purchases for goods or services directly on this site. Vendors may search, monitor, and retrieve the information from this site. The FBO site does not require registration to use, but vendors may register for a Vendor Notification Service. This service will notify registrants by email of specific upcoming procurement opportunity like seed buys. To register, click on Vendor Notification Service and select option 2. Register to receive all notices from selected organizations and product service classifications. Registered vendors will receive by email; 1) presolicitation and post-award notices and related amendments, 2) solicitation and solicitation amendment notices, and 3) general procurement announcements. In addition to BLM purchasing opportunities, this site has a wealth of information about agency purchases in the U.S. Department of the Interior. For information about opportunities under \$25,000, it is recommended that the collector contact the native seed program coordinator at the local BLM office. Vendors interested in this site can obtain help by calling toll free (877) 472-3779 or email fbo.support.gsa.gov.

The third site, The **Central Contractor Registration (CCR)** site is a registration site for both government and Vendors. Vendors must register at this site by October 1, 2003 in order to receive contracts or purchase orders. Registration is available at www.ccr.gov This site has been selected as the single, government-wide system for storing contractor procurement and payment information. The Office of Management and Budget has instructed all federal agencies to use this system. This system is a self-service database and vendors register and maintain their own information through the CCR website.

IMPORTANT! As a security precaution, vendors must register themselves through the on-line system. Government officials should never ask a vendor to provide CCR registration information from this site directly to them. Nor should a vendor provide the Trading Partner Identification Number (TPIN) registration number directly to any agency. If asked to do so, a vendor should refuse and immediately call the Department of Transportation Inspector General hotline at (800) 424-9071.

For assistance regarding the CCR site contact the CCR Assistance center toll free at (888) 227-2423 or (269) 961-4725. Collector assistance is available twenty-four hours a day, seven days a week.

The fourth site necessary is the **Business Partner Network (BPN)** www.bpn.gov This site is used by federal officials to retrieve information about vendors interested in bidding on government contracts. Vendors should enter the site and complete a Representations and Certifications Application (ORCA) by clicking on ORCA and then Vendor. Once this is done this ORCA can be used for all Federal contracts instead of completing a new Representations and Certifications for each individual purchase as had been required on large contracts in the past. Federal Procurement officials can retrieve data related to the Past Performance Information Retrieval System. In addition they can use the CCR and Federal Agency Registration systems from the BPN site.

For assistance with the BPN site contact the CCR Assistance center at the number listed above.
For assistance with technical problems with the ORCA homepage-contact orcaatus.ibm.com

The fifth important site is **IDEAS ELECTRONIC COMMERCE (IDEASEC)**. The website address is; <http://ideasec.nbc.gov/> This site does not require registration and may be used to:

- Review all requirements posted by Department of Interior Bureaus and Offices.
- Search for Request for Quotation (RFQ), Request for Proposal (RFP), Invitation to Bid (IFB).
- Read the RFQs, RFPs, and IFBs.
- Download the clauses and attachments to solicitations.
- Submit quotes electronically before posted closing dates.
- Receive electronic awards and notices.
- Review award notices.

There is no cost for the IDEASEC service. Anyone registered in the CCR can access and use this site. It is accessible from the Fedbizopps site. For assistance with the IDEASEC website call (703) 390-6633 or email ec helpdesk@nbc.gov.

The information presented above was taken from a presentation and handout titled: Business Opportunities With The Bureau of Land Management by Barb Bellio, Contracting Officer, BLM Denver Colorado. She can be contacted at Barbara_Bellio@blm.gov

Wholesale Sales to Existing Seed Dealers

The second, and more common way that new collectors sell seed they collect is by contacting an established seed dealer and offering seed for sale. Several seed companies operate in the western United States and many of them rely on independent collectors of native seed. Some companies contract with independent collectors to supply specific seed and or seed from specific locations. These companies will often combine several lots of seed to meet the demands of large consumers like the BLM. Established companies that buy seed from smaller, independent collectors normally cannot pay retail market prices for the seed they purchase. They have expenses related to market risk, cleaning, storage, transportation, handling etc. that must be subtracted from the retail market price they pay the smaller collector. This can reduce the price received by the smaller collector significantly from the retail market price existing at the time of the sale. However, because the costs borne by the established companies are real, smaller vendors would have to absorb these costs if they wished to sell the seed at the retail level. Appendix G lists individuals and companies that have bid on BLM seed buying contracts. The list can be useful for new buyers who may want to contact a listed bidder in order to sell any seed they have collected or inquire about potential contracts for custom seed collections.

When selling seed to an established company, the price, quality, quantities, delivery point, and all other factors are open for negotiation by both parties. Generally, individuals selling seed to established companies are advised to develop a contract, that spells out details of the sale and remedies for both parties if the contract terms are not met. The more specific the contract, the less chance there is for misunderstandings to occur between the two parties.

Direct Retail Sales

The other method used by seed vendors to market their product is direct sales to the retail market. In this case, the only limit to the methods used to market the collected seed is the imagination of the collector. Individuals who sell seed on the retail market are not required to have a license issued by the state of Nevada, but may need a local business license, tax number, and other items required of a local business. They are required to conform to the seed laws of the state of Nevada, which set standards for purity, germination, allowable weed seed percentages, etc. Nevada state seed law can be found at <http://www.leg.state.nv.us/nac/nac-587.html>. The applicable laws can also be found in Nevada Administrative Code, NAC 587.222 to 587.810 inclusive.

Seed are sold to companies or individuals involved in revegetation projects, wildlife habitat improvements, low maintenance landscape projects, mine land reclamation, and a host of related industries. A collector can contact potential consumers directly, advertise in trade magazines, attend pertinent conferences and trade shows to contact consumers, sell at farmers markets, or use the Internet to advertise the seed that they have collected. A relative new website known as the Native Seed Network <http://www.nativeseednetwork.org> has been established to promote the use of native seed. One of the functions this site provides is to act as a marketplace where seed collectors and producers can list native seed for sale. Potential sellers and buyers must register and agree to a set of conditions before they can access the marketplace section. Once that has occurred, a collector can list the species, quantities, price and location where collected. Buyers from all over the world are then able to access that information and contact the seller. Another alternative for collectors to use is develop their own website and seed sales.

Appendix H lists recent prices paid by the BLM for many of the priority species listed in this document. The prices listed are for clean seed that met all BLM specifications. The prices paid by the BLM and other seed buyers can change rapidly due to demand and supply. A potential collector is advised to contact several seed dealers to determine potential seed prices before deciding to collect.

When selling directly to the retail market, the collector is responsible for cleaning, testing, packaging, handling, and marketing the product. All of these steps add costs that must be recovered when the seed is sold. The following information was included to help new collectors understand the processes required before selling native seed on a wholesale or retail level.

Processing, Testing, and Labeling Seed for Sale

Before being sold, native seed collected by hand, stripper, or vacuum harvesters will often require a rough cleaning and threshing. These processes occur after the seed have been collected and dried. Often more than one operation is required to complete the entire cleaning operation. Seed harvested by properly adjusted combines will normally be clean and have already been threshed during the harvesting operation. Seed collected by other methods will need a rough cleaning that can initially be completed in the field and be as simple as using a screen with openings sized to allow the seed to fall through while trapping plant materials larger than the

seed. A second screen can then be used with openings smaller than the collected seed. This allows the small trash to fall through while the seed are retained on the screen.

Threshing is the process of removing unwanted plant parts. The process is normally completed after the seed have dried. The goal is to knock the seed loose from the seed stalks, remove awns, bracts, and other materials that cover the actual seed. Threshing can be as simple as hand rubbing the collected seed on a rough surface or as complicated as using hammer mills and other special threshing machines to completely thresh the seed. Regardless of the method used, care must be taken to avoid damaging the seed during this process. Seed can be cracked or crushed between the bars or cylinders used to remove the unwanted plant materials surrounding the seed.

Many native seed collected from wildlands require further cleaning before they are offered for sale. Cleaning can range from hand picking to gravity or air separating machines. Hand picking is possible with small seed lots and with large seed. However, large amounts of seed and/or small seed will be cleaned much more efficiently with cleaning machines. Air-screen cleaners use streams of air and screens of various sizes to separate the trash, chaff, and light seed from full plump seed. The amount and velocity of the air stream can be adjusted as necessary for efficient cleaning. The screen opening sizes and shapes are selected based on the shape and size of seed being cleaned. The screen's oscillation rate and pitch is adjusted to allow separation to occur.

Air separators use a column of air moving at different speeds to separate seed from trash and chaff. Light materials are forced out at low speeds. As the speed of air in the column increases, larger, heavier plant particles are forced out the top of the column. Small rocks, dirt clods, etc. fall to the bottom. Full seed are suspended and fall into containers depending on weight.

Gravity separators use an oscillating table and jets of air to separate seed, trash, and chaff. The air is forced through small holes in the table, which suspends the light materials, while heavier materials remain in contact with the table. The table is inclined and moved back and forth, causing the seed to move differently than heavier and lighter materials.

Most small-scale collectors will not be able to afford complicated cleaning and threshing equipment and will send their seed to a commercial cleaning facility for processing. If the seed will be sold to a wholesaler they can be sold unclean and the cleaning costs deducted from the amount paid to the collector. Seed cleaning facilities are normally under private ownership. A new collector can find these facilities on the World Wide Web, phone book yellow pages, by contacting seed companies, or by contacting seed testing laboratory personnel.

Seed Tests

After the seed is cleaned and threshed, it is tested to determine their purity, viability, germination percentages, inert matter, other crop seed, and the percentage of weed seed in the lot. Another test that can be completed is the seed weight test. The seed weight test is normally expressed as thousand seed weight (TSW) in grams.

Purity is a measure of the percentage of pure seed by weight in the seed lot. Purity is determined by separating and weighing normal seed from a sample of known weight. The weight of the

normal seed is expressed as a percentage of the total sample weight. Seed viability is a term used to describe seed that are able to grow when exposed to the proper conditions. Germination tests measure the percentage of pure seed that will begin to grow when exposed to the proper conditions for that seed. However, some seed can remain dormant during a germination test, but are viable and will germinate later. Viability percentages can be estimated using a tetrazolium (TZ) test in which living seed tissue is stained red. Dead tissue in non-viable seed remains the original color. The seed are cut apart, examined under a microscope, and evaluated for the presence of red-stained tissue. The test can be used to give seed dealers or collectors an estimate of the percent of viable seed that should grow. It is also used with standard germination tests to separate living, viable, but dormant seed from those that are dead.

Inert matter is the material in the seed lot that is not seed. Other crop seeds are seed other than the collected species. Weed seed is composed of seed from weeds.

Many native seed consumers require minimum levels of purity and germination. For example, a BLM solicitation normally lists the minimum acceptable standards by species. The minimum accepted purity will often be 90% or greater. The minimum germination percentage is often 70% or greater. These figures are important because seed are ultimately purchased and planted on a “pure live seed”(PLS) basis. Pure live seed is calculated by multiplying the percent purity by the percent germination, and then by 100. The resulting value is the percent of pure live seed that can be expected to germinate and grow under the proper conditions. The PLS figure is then used to adjust the planting rate in order to achieve the desired seeding rate. If the PLS of a native seed is 75% and 10 PLS pounds per acre is the desired seeding rate, 13.33 total pounds of that seed must be planted (13.33lbs X .75 PLS= 10 lbs pure live seed planted). Appendix I is a chart that simplifies the determination of PLS. As with other methods the purity and germination percentages are required to determine PLS. Appendix J is another chart that can be used to determine how many pounds of total seed is required to achieve a pound of pure live seed.

Native seed testing is conducted by certified seed testing laboratories and certified seed analysts. Both public and private labs are certified in the West to test native seed lots. NVDOA maintains a certified seed lab and certifies private labs that can test seed. Seed testing laboratories follow testing protocols established by the Association of Official Seed Analysts (AOSA). Information about AOSA is found at <http://www.aosaseed.com/>. The protocols govern how seed samples are taken and tested. They are available from the NVDOA or the AOSA web site above. The AOSA web site also lists seed testing laboratories in all 50 states. Appendix K is a list of some seed testing laboratories in Nevada and surrounding states.

Seed Labels/Tags

After the seed has been tested, a label or tag is attached to each bag or lot. According to NAC 587.251 “The seller is responsible for compliance with the requirements for labeling seed regarding the analysis of the seed pursuant to the law of the country, state, or province into which the seed is shipped or sold.” Although some variation exists in labeling requirements most states require the label to list the following information: 1) sellers name/address, 2) lot number (to identify the lot tested), 3) kind of seed in the package, 4) variety (if known) or VNS (variety not stated), 5) lab number of lab performing the test, 6) % pure seed, 7) % inert matter, 8) %

other crop seed, 9) % weed seed, 10) % noxious weed seed, 11) % germination, 12) date tests performed, 13) % hard seed (live seed that did not germinate), 14) % dormant seed (live seed that did not germinate), and 15) % pure live seed.

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Jensen, E. H., J.W. Doughty, B.E. Wheeler, and C. D. Leedy. (1991). Irrigated Forages for Western Nevada-Type Climate. University of Nevada Reno, Cooperative Extension. Natural Resources Conservation Service. Bulletin # BE-91-02. Reno, Nevada.

Jones, T. A. (1997). The Expanding Potential for Native Grass Seed Production in Western North America. In: Landis, T. D., and J. R. Thompson, tech. coords. National Proceedings, Forest and Conservation Nursery Associations. Gen. Tech. Rep. PNW-GTR-419. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR.

Karrfalt, R. P. (1997). Considerations for Conditioning Seed of Native Plants. In: Landis, T.D., and J.R. Thompson, tech. coords. National Proceedings, Forest and Conservation Nursery Associations. Gen. Tech. Rep. PNW-GTR-419. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR.

APPENDIX A

Form 5450-1 Page 1

Form 5450-1
(May 1991)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
CONTRACT FOR THE SALE OF VEGETATIVE RESOURCES

Issuing Office

Contract Number

THIS CONTRACT is made and entered into the _____ day of _____, 19____, under the authority of Executive Order (L.U. Lands) or the Act of August 28, 1937 (50 Stat. 874) as amended, (43 U.S.C. Sec. 1181a-f), relating to the revested Oregon and California Railroad and reconveyed Coos Bay Wagon Road grant lands, or under the Act of July 31, 1947 (61 Stat. 681) as amended, (30 U.S. C. Secs. 601-604), relating to other lands under the jurisdiction of the Bureau of Land Management, and the regulations as set forth in 43 CFR Group 5400, between the UNITED STATES OF AMERICA, hereinafter called Government, acting through the Bureau of Land Management, and

of _____, hereinafter called Purchaser.

WITNESSETH, That the parties hereto do mutually agree as follows:

Sec. 1. Vegetative Resources Sold. Government hereby sells to Purchaser and Purchaser hereby buys from Government, under the terms and conditions of the contract, the vegetative resources listed in Sec. 2 within the area described below comprising the contract area* and situated in the County of _____ State of _____, and described as follows:

TOWNSHIP	RANGE	SECTION	SUBDIVISION(S)

Sec. 2. Total Purchase Price. (a) Purchaser agrees to pay Government as the total purchase price for the vegetative resources sold hereunder, the sum of _____ dollars (\$ _____).

KIND OF VEGETATIVE RESOURCE	QUANTITY <i>(Units Specified)</i>	PRICE/UNIT	PRICE/UNIT X NO. OF UNITS

All vegetative resources in the contract area in excess of the quantity listed above are reserved to Government.

(b) Unless the total purchase price is paid on or before the date this contract is signed by the Contracting Officer, payments shall be made in installments of not less than _____

dollars (\$ _____) as follows: (1) A deposit equal to one installment shall be paid on or before the date this contract is signed by the Contracting Officer and shall be held to satisfy the final payment due under this contract; (2) the second installment shall be paid prior to severance or removal of vegetative resources sold under this contract; (3) Each subsequent installment shall be due and payable without notice when the value of the vegetative resources severed or removed equals the sum of all payments not including the first installment. Payment hereunder shall be made by cash, money order, bank draft, or check made payable to Department of the Interior-BLM.

Sec. 3. Bond. A performance bond shall be filed by Purchaser on or before the date the contract is signed by the Contracting Officer in the sum of _____ (\$ _____) which bond shall be forfeited to the amount of the damages determined by the Contracting Officer if all the provisions of this contract are not faithfully and fully performed by Purchaser. If the amount of the damages exceed the amount of the bond, Purchaser hereby agrees to pay the excess. Upon satisfactory performance of all provisions of this contract, the bond shall be cancelled, or if cash or negotiable securities are furnished in lieu of a surety bond, such cash or negotiable securities shall be returned to Purchaser.

Sec. 4. Time for Severance and Removal. Except as otherwise provided in this contract, Purchaser may commence severance and/or removal of vegetative resources sold under this contract on the date this contract is signed by the Contracting Officer. Purchaser's right to

*General location of contract area is shown on map marked Exhibit A which is attached hereto and made a part hereof.

sever and/or remove such vegetative resources shall expire () months after such date; provided, however, extension of time may be granted as provided in 43 CFR Subpart 5463 and 5473.

Sec. 5. Standard and Special Provisions. The rights and obligations of the parties hereto shall be subject to the Standard Provisions set forth in Secs. 6 through 16 and to any Special Provisions contained under Sec. 17 attached hereto and made a part hereof.

STANDARD PROVISIONS

Sec. 6. Definitions Used in This Contract:

- (a) "Authorized Officer" means any employee of the Bureau of Land Management to whom has been delegated the authority to take action in connection with this contract.
- (b) "Contracting Officer" means the Bureau of Land Management official who would have authority to execute this contract.
- (c) "Vegetative Resources" means all vegetative material that is not normally measured in units of board feet.

Sec. 7. Passage of Title and Risk of Loss. Title to the vegetative resources sold under this contract remain in Government and shall not pass to Purchaser until such vegetative resources have been severed or removed. Risk of loss shall be borne by the party holding title, except that nothing herein shall be construed to relieve either party from liability for any breach of contract or any wrongful or negligent act.

Sec. 8. Violations, Suspension, and Cancellation. If Purchaser violates any of the provisions of this contract, the Contracting Officer may, by written notice, suspend any further operations of Purchaser under this contract, except such operations as may be necessary to remedy any violations. If Purchaser fails to remedy all violations within thirty (30) days after receipt of the suspension notice, the Contracting Officer may, by written notice, cancel this contract and take appropriate action to recover all damages suffered by Government by reason of such violation.

Sec. 9. Fire Prevention and Slash Disposal. Purchaser shall take such measures for the prevention and suppression of fire on the contract area and other adjacent Government lands or other Government lands used or traversed by Purchaser in connection with operations under this contract as are required by applicable laws and regulations. However, when in the opinion of the Authorized Officer, weather and other conditions affecting fire incidence and control make special precautions necessary to protect the contract area and said Government lands, Purchaser shall take such additional or other fire prevention and control measures as may be required by the Authorized Officer. Disposal of slash shall be done in accordance with a plan approved by the Authorized Officer.

Sec. 10. Trespass. If in connection with operations under this contract, Purchaser, his contractors, subcontractors, or the employees of any of them, cuts, injures, or removes any Government materials, other than the vegetative resources sold under this contract, Purchaser shall be liable for damages under applicable law. Purchaser shall pay Government for such damages after written demand therefor by the Contracting Officer.

Sec. 11. Responsibility for Damage Suffered, Cost, or Expense Incurred by Government. Purchaser shall be liable for any damage suffered, cost, or expense incurred by Government arising out of any operations under this contract whenever such damage, cost, or expense results from any breach of contract or wrongful or negligent act of Purchaser, his contractors, subcontractors, or the employees of any of them. Purchaser shall pay Government for such damage, cost, or expense after written demand therefor by the Contracting Officer.

Sec. 12. Disclaimer of Warranty. Government expressly disclaims any warranty of the fitness of the vegetative resources for any purpose of Purchaser; all vegetative resources sold hereunder are accepted "as is" without any warranty of merchantability by Government. Any warranty as to the quantity or quality of the vegetative resources sold hereunder is expressly disclaimed by Government.

Sec. 13. Simultaneous Use of Contract Area by Others. If the Authorized Officer determines that other use of the contract area will

not seriously interfere with the operations of Purchaser, he may issue permits, leases, or contracts for the simultaneous use of the contract area by others.

Sec. 14. Equal Opportunity. The Purchaser will comply with all provisions of the Executive Order No. 11246 of September 24, 1965, as amended, and the rules, regulations, and relevant orders of the Secretary of Labor.

Sec. 15. Officials Not to Benefit. No Member of, Delegate to, Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR (20.735-24) shall be admitted to any share or part in this contract or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and Secs. 431, 432, and 433, Title 18, U.S.C. relating to contracts, enter into and form a part of this contract so far as the same may be applicable.

Sec. 16. Disputes

(a) This contract is subject to the Contract Disputes Act of 1978 (41 U.S.C. 601 et seq.). If a dispute arises relating to the contract, the Purchaser may submit a claim to the Contracting Officer who shall issue a written decision on the dispute in the manner specified in DAR 1-314 (FPR 1-1.38).

(b) "Claim" means:

- (1) A written request submitted to the Contracting Officer;
- (2) For payment of money, adjustment of contract terms, or other relief;
- (3) Which is in dispute or remains unresolved after a reasonable time for its review and disposition by the Government; and
- (4) For which a Contracting Officer's decision is demanded.

(c) In the case of disputed requests or amendments to such requests for payment exceeding \$50,000, or with any amendment causing the total request in dispute to exceed \$50,000, the Purchaser shall certify, at the time of submission as a claim, as follows:

I certify that the claim is made in good faith, that the supporting data are accurate and complete to the best of my knowledge and belief; and that the amount requested accurately reflects the contract adjustment for which the Purchaser believes the Government is liable.

(Purchaser's Name)

(Title)

(d) The Government shall pay the Purchaser interest:

- (1) On the amount found due on claims submitted under this clause;
- (2) At the rates fixed by the Secretary of the Treasury, under the Renegotiation Act, Public Law 92-41;
- (3) From the date the Contracting Officer receives the claim, until the Government makes payment.

(e) The decision of the Contracting Officer shall be final and conclusive and not subject to review by any forum, tribunal, or Government agency unless an appeal or action is timely commenced within the times specified by the Contract Disputes Act of 1978.

(f) Except as the parties may otherwise agree, pending final resolution of a claim of the contractor arising under the contract the contractor shall proceed diligently with the performance of the contract in accordance with the Contracting Officer's decision.

Sec. 17. **Special Provisions.** Purchaser shall comply with the attached special provisions unless otherwise authorized, in writing, by the Authorized Officer:

PURCHASER, sign here

UNITED STATES OF AMERICA

(Name of Firm)

By _____
(Name)

(Name)

(Title)

(Address)

(Date)

Form 5450-5

Number 	UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT VEGETATIVE OR MINERAL MATERIAL NEGOTIATED CASH SALE CONTRACT (\$2,499 or less for vegetative material) (\$2,000 or less for mineral material)	<p style="text-align: center;">SEC. 1 CONTRACT TERMS <i>(check appropriate block)</i></p> <p><input type="checkbox"/> (a) All materials in contract area in excess of estimated quantity are reserved by the United States. <input type="checkbox"/> Severance and/or <input type="checkbox"/> Removal in excess of that quantity will subject the Purchaser to trespass action.</p> <p><input type="checkbox"/> (b) The quantity of material is a predetermined amount and may be more or less than the actual amount.</p> <p><input type="checkbox"/> (c) Payment shall be made prior to <input type="checkbox"/> Severance and/or <input type="checkbox"/> Removal of additional units which exceed estimated quantity.</p> <p style="text-align: center;">SEC. 2 GENERAL STIPULATIONS <i>(check appropriate block)</i></p> <p>Removal of all materials must be in strict accordance with instructions of the Authorized Officer and the following conditions and requirements: No material may be <input type="checkbox"/> severed <input type="checkbox"/> removed unless marked or otherwise designated by the Authorized Officer. Title to material sold under this contract shall remain in United States and shall not pass to Purchaser until such material has been removed from the contract area. If this contract involves severance of vegetative material, risk of loss shall be borne by the Purchaser after the material is cut. Nothing herein shall be construed to relieve the Purchaser from liability for any breach of contract or any wrongful or negligent act or for any violation of any applicable regulation of the Department of the Interior. The Purchaser shall take such measures for prevention and suppression of fire on the contract area and other United States lands as are required by applicable laws and regulations. The Purchaser shall dispose of refuse in accordance with instructions of the Authorized Officer.</p> <p>If the Purchaser violates any of the provisions of this contract, the Authorized Officer may, by written notice, suspend any further operations of the Purchaser, <i>except</i> such operations as may be necessary to remedy any violations. If the Purchaser fails to remedy all violations within thirty (30) days after receipt of the suspension notice, the Authorized Officer may, by written notice, cancel this contract, take appropriate action to recover all damages suffered by Government by reason of such violation, and inform the Purchaser that they will not be issued any further contracts for up to three years.</p> <p>Forest Product Removal Receipt No(s): _____</p> <p style="text-align: center;">SEC. 3 SPECIAL STIPULATIONS <i>(check appropriate block)</i></p> <p>The <input type="checkbox"/> Special Provisions and/or <input type="checkbox"/> Map(s) attached are made a part of this contract and are to be complied with.</p>																																			
State _____ Field Office/District _____ Date of Sale _____ Name of Purchaser (First, Middle, Last) _____ Address (include zip code) _____																																					
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Purchaser is liable for total purchase price shown above. There will be no refunds. Additional payment, if any, will be made in accordance with Sec. 1 (c). This contract is made under terms of Sec. 1 () and the stipulations indicated. Contract Expires (date) _____ ALL MATERIAL MUST BE REMOVED FROM THE CONTRACT AREA BY MIDNIGHT OF THIS DATE. Location of Sale (Contract Area) _____																																					
RECEIVED AS PAYMENT IN FULL																																					
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Purchaser certifies that he/she is twenty-one years of age or older and if purchasing timber is a citizen of the United States. Purchaser acknowledges that he/she has read and understands the terms and conditions of this contract and any attached provisions. Signature of Purchaser _____ Signature of Authorized Officer _____																																					
Form 5450-5 (January 2002) <i>(See instructions on reverse)</i>																																					

DISTRICT/FIELD OFFICE

APPENDIX B

PROTECTION OF TREES AND FLORA

NRS 527.050 Unlawful removal or destruction of trees or flora; penalty; enforcement.

1. It is unlawful for any person, firm, company or corporation, his, its, or their agent or agents, willfully or negligently:

(a) To cut, destroy, mutilate, pick or remove any tree, shrub, plant, fern, wild flower, cacti, desert or montane flora, or any seeds, roots or bulbs of either or any of the foregoing from any private lands, without a written permit therefore from the owner or occupant or his duly authorized agents.

(b) To cut, destroy, mutilate, pick or remove any flora on any state lands under the jurisdiction of the division of state parks of the state department of conservation and natural resources except in accordance with regulations of the division.

(c) To cut, destroy, mutilate, pick or remove any flora declared endangered by the state forester firewarden from any lands, other than state park lands provided for in paragraph (b), owned by or under the control of the State of Nevada or the United States without written permit therefor from the state forester firewarden or his designate. For the purposes of this subsection, the state forester firewarden may establish regulations for enforcement, including the issuance of collection permits and the designation of state and federal agencies from which such permits may be obtained.

2. Every person violating the provisions of this section is guilty of a public offense proportionate to the value of the plants, flowers, trees, seeds, roots, or bulbs cut, destroyed, mutilated, picked or removed, and in no event less than a misdemeanor.

3. The state forester firewarden and his representative, public officials charged with the administration of reserved and unreserved lands belongs to the United States, and peace officers shall enforce the provisions of this section.

4. Except as to flora declared endangered by the state forester firewarden pursuant to NRS 527.270 or as to flora on state lands regulated by the division of state parks, the provisions of this section do not apply to Indians, native to Nevada, who gather any such article for food or medicinal use for themselves or for any other person being treated by Indian religious ceremony.

[1:80:1937; 1931 NCL § 5581.21] + [2:180:1937; 1931 NCL § 5581.22]-(NRS A 1957, 317; 1967, 608; 1969, 461; 1971, 1462; 1973, 1587; 1977, 1166; 1979, 1485)

Note: These statements were valid as of December 2002.

Source: Nevada Revised Statutes 527.050

APPENDIX C

Building a Plant Press

You will need:

Scrap lumber from a crate
Newspaper
Sheets of cardboard (12" x 18")
2 buckle straps or pieces of rope, about 4' long
A saw
32 small nails or small 1/2" screws
Hammer, screwdriver, and square

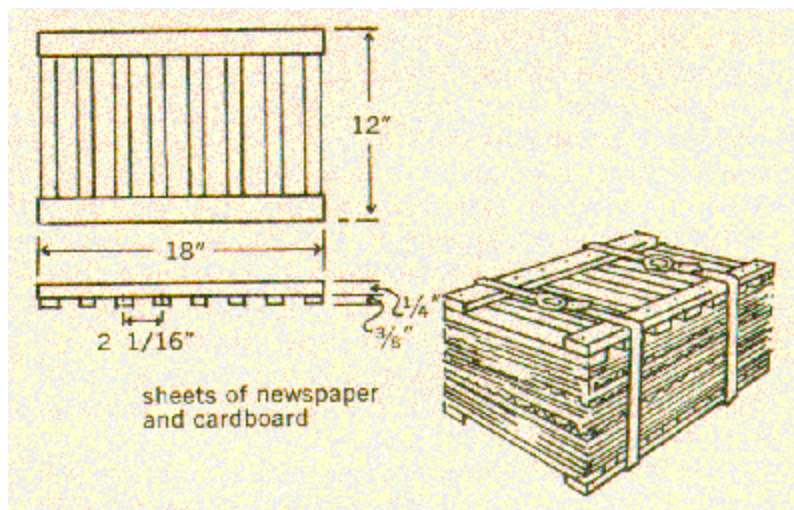
With your saw, cut four pieces of wood, 18" long each, 1 1/2" wide, and about 3/8" thick.

Then cut 16 pieces of wood 12" long, 1" wide, and 1/4" thick.

Make two frames out of the slats. Follow the diagram below:

Place leaf samples in the leaf press within a few hours of collecting them. Put leaves between several sheets of newspaper. Place a piece of cardboard between each sample. Place the stack between the two wooden frames and tie together with straps or rope.

Store the press in a dry area for about 2 weeks. After four days, replace the newspapers with dry ones to avoid leaves molding.



APPENDIX D

NEVADA NOXIOUS WEED LIST

African Rue	<i>Peganum harmala</i>
Austrian fieldcress	<i>Rorippa austriaca</i>
Austrian peaweed	<i>Spaerophysa salsula</i>
Black henbane	<i>Hyoscyamus niger</i>
Camelthorn	<i>Alhagi camelorum</i>
Canada Thistle	<i>Cirsium arvense</i>
Carolina Horse-nettle	<i>Solanum carolinense</i>
Common crupina	<i>Crupina vulgaris</i>
Dalmation Toadflax	<i>Linaria dalmatica</i>
Diffuse Knapweed	<i>Centaurea diffusa</i>
Dyer's woad	<i>Isatis tinctoria</i>
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
Goats rue	<i>Galega officinalis</i>
Hoary Cress	<i>Cardaria draba</i>
Houndstongue	<i>Cynoglossum officinale</i>
Hydrilla	<i>Hydrilla verticillata</i>
Iberian Starthistle	<i>Centaurea iberica</i>
Klamath weed	<i>Hypericum perforatum</i>
Leafy spurge	<i>Euphorbia esula</i>
Mayweed chamomile	<i>Anthemis cotula</i>
Mediterranean sage	<i>Salvia aethiopsis</i>
Medusahead	<i>Taeniatherum caput-medusae</i>
Musk Thistle	<i>Carduus nutans</i>

NEVADA NOXIOUS WEED LIST (continued)

Poison Hemlock	<i>Conium maculatum</i>
Puncture vine	<i>Tribulus terrestris</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Purple Starthistle	<i>Centaurea calcitrapa</i>
Rush skeletonweed	<i>Chondrilla juncea</i>
Russian Knapweed	<i>Acroptilon repens</i>
Saltcedar (tamarisk)	<i>Tamarix ramosissima</i>
Scotch Thistle	<i>Onopordum acanthium</i>
Sorghum Species	
a) Johnson Grass	
b) Sorghum Alum	
c) Perennial sweet sudan	
Sow Thistle	<i>Sonchus arvensis</i>
Spotted Knapweed	<i>Centaurea masculosa</i>
Squarrose Knapweed	<i>Centaurea virgata</i>
Sulfue cinquefoil	<i>Potentilla recta</i>
Tall Whitetop	<i>Lepidium latifolium</i>
Water Hemlock	<i>Cicuta maculata</i>
White Horse-nettle	<i>Solanum elaeagnifolium</i>
Yellow Starthistle	<i>Centaurea solstitialis</i>
Yellow Toadflax	<i>Linaria vulgaris</i>

APPENDIX E

Large–Scale Harvesting Of Prairie Seed

By Fred Faessler and Steve Apfelbaum
Written 1988

Customized farm implements enable an organization to increase harvests – and decrease the cost – of diverse mixes of prairie seed.

A recurring problem for restorationists seeking to create communities that resemble native “model” communities as closely as possible is the availability and cost of seed.

We at applied Ecological Service, Inc. are dealing with this problem in part by harvesting our own prairie seed using a number of standard farm implements and equipment fabricated or especially modified for this purpose.

Most modifications are relatively simple adjustments of standard equipment that can be accomplished by a moderately skill mechanic working with ordinary hand tools. Only a few involve specialized equipment and skill such as welding. Typically, modifications are inexpensive relative to the cost of the original equipment.

The several items of equipment described here are the key elements in a program of mechanization that has allowed us to scale up our harvest and handling of prairie seed considerably in recent years, from only a few hundred pounds of grass and for seed per year in 1985, when we relied principally on hand harvesting, more than 27,000 kg (60,000 lb.) in 1987.

At the same time, the cost of harvesting has fallen dramatically, from an average of about \$14.00 per pound for all seed harvested in 1985, to as low as 20 cents per pound for some species harvested mechanically.

We see this as a major step toward our goals of producing large quantities of inexpensive, locally collected seed in mixtures that reflect the species composition of native communities.

Combine

Central elements in our collection of mechanized prairie seed-harvesting equipment have been several Allis Chalmers combines with a 20-foot grain head, which we use principally for harvesting grass, some wildflower, and some wetland sedges.

Although the use of a combine to harvest seed of prairie grasses is not new, we were soon confronted by problems. The questions we asked were only partially answered by major seed producers in the western United States and even less satisfactorily addressed by equipment manufactures.

The most serious of these are related to cutting the plants cleanly and to seed loss during separation. To cut efficiently the sickle and guards must be sharp. Specially made “after-market” sickles with twice the number of cutting edges work much better than standard sickles. A pick-up reel is generally needed to pull downed or tangled plants into the cutting head. And for proper thrashing, the cylinder bars and concave bars need to be in good shape to maintain consistent clearances. On smaller machines, the fluffy, bulk seed of many native plants tend to plug the augers. We have found that this problem can be reduced by reinforcing the ends of the flighting on the auger and lengthening them slightly to help the material discharge completely.

Probably the most important modification is the relatively simple one of reducing the amount of air being blown through the separation area so that seed is not blown out the back of the combine. Most combine companies offer devices to restrict airflow, and we have also made our own. Depending on the equipment, a small panel (sometimes just a piece of cardboard) over the intake does the job. But it is important to keep in mind that small changes here may make a large difference in airflow, so that adjustment of this system may take some careful fine-tuning

Seed of some species may plug the chaffer, and removing every other louver may be necessary in extreme cases to prevent this. It may also help to flatten any protruding edges that are catching or restricting seed flow.

Because the grain bin will not unload fluffy seed effectively, it is best not to fill it over half full. A two-inch square or round pole several feet long can be used to work the seed into the discharge auger. But be careful to stay clear of any moving parts!

Costs associated with this piece of equipment have turned out to be modest. One combine, a Gleaner Model F, was purchased second-hand, in good condition for \$5,000. Modifications cost \$1,500 for parts and an estimated 60 hours of labor. Operating costs for harvesting, including labor, insurance, depreciation, maintenance and fuel, have so far run between about \$15 and \$40 per hour at a harvest rate of 3-7 acres per hours.

Performance has been highly satisfactory. The combine handles a wide variety of grasses, wetland sedges, wildflowers and other flower seed. It can also operate under a variety of conditions and on difficult terrain, including slopes of as much as 20-30 degrees.

Operating under optimum conditions (dry weather and a dense stand of good prairie in mature condition) this piece of machinery can bring in as much as 1,500-2,000 lbs., (680-910 kg) of bulk seed per hour. Operated on single species stand in an artificially established "seed orchard" it has brought in yields as high as 1,000 lbs., (450 kg) per hour for Indian grass and 1,500 for big bluestem.

We carry out this operation with a trained operator for the combine and an assistant who handles unloading of the seed. Ancillary equipment for unloading includes a pneumatic seed evacuator (Hanlair Model 1400), which required certain modifications in order to handle prairie seed effectively. These include sharpening of the air lock rotor blade to prevent pinning of grass stems, which eventually resulting in clogging of the machine.

We unload seed from the combine directly into grain trucks, and then deliver it to the company farm for unloading with the evacuator. After unloading the seed, we store it in storage facilities made from semi-trailers modified with forced-air ventilations systems for drying. After grass seed is debearded and hulled in modified farm feed mill, it is unloaded into bins which gravity-feed into fanning mills. After cleaning, seed is bulk bagged or placed in bins for mixing.

We move our combine equipment long distances over highways using our own flatbed trailer or we have implement dealers move the equipment. In this way we have carried out harvest at sites as much as 180 miles/300 km away from company headquarters at a cost of about \$2 per mile.

Sweeper

Though highly effective at harvesting many species, our modified combine has limited value for many other prairie and wetland species, especially in wet or unstable areas on very steep slopes, or in areas with many trees.

In order to harvest seed of these species more effectively, we have devised a seed sweeper, which consists of a 24-inch diameter street sweeper-style brush mounted on an all-terrain vehicle (a standard four-wheel drive Honda Forman which cost around \$3,500.00).

A framework attached to the front of the ATV holds the sweeper brush that can be raised or lowered to adjust to the height of vegetation by a winch unit with controls on the steering column of the ATV.

The device works rather like a power lawn mower attached to vacuum cleaner. The spinning brush detaches seed and also creates a vacuum that draws the seed into a bin on the back of the unit for later bagging.

Like the combine, one person operates it, though it is helpful to have an assistant to help with unloading. Operating cost vary from \$6,50 to \$150.00 per hour, depending mainly on the amount of use, since much of the expenses is due to fixed costs.

The all-terrain vehicle itself has been modified by being mounted on half-tracks. It produces a ground pressure of only about 0.4 pounds per square inch and is easily used in wetlands or on steep or rugged terrain. The low loading makes it non-destructive, even in relatively sensitive communities. In wetlands it rides across the surface of tussocks, and when driven across prairie leaves a barely visible track.

With this machine we have been able to harvest impressive amounts of seed rapidly and inexpensively from both tallgrass prairies and wetlands. Exemplary harvesting rates include 15 lbs. (7kg) of blazing star (*Liatris cylindracea*) in an hour, and comparable quantities of such plants as *Carex velpinoidea* or *Carex normalis* in the same time.

In 1986 and 1987 we harvested seed of nearly 250 species in sufficient amounts for use in restoration projects. Most of these were harvested with the equipment described above, some species are still best harvested by hand because they occur

as isolated plants in sensitive area or in areas where access is difficult or undesirable species abundant.

The machine-harvested seed does include a considerable amount of chaff and trash. We sometimes subject this material to further processing, using hammer and fanning mills. Generally, however, we favor the use of unrefined mixtures for restoration projects, since we feel that the added time and cost of refining seed of several hundred species is prohibitive. In addition, leaving seed mixture with trash has certain advantages, since once reduced in the hammer mill, leaf and stem parts have some value as a mulch, reducing the amount of additional mulch or protective cover crop needed to establish an planting.

We do label seed lots with information about species present, and generally subject mixtures to viability tests using tetrazolium chloride or germination before using them in restoration projects.

While our production of grass seed has increased, we are especially concerned about the production of seed of the more difficult prairie and wetland species, including sedges, forbs, and the less abundant grasses. At present, our goal is to produce the equivalent of 10,000 lbs. (4,500 kg) of pure seed of these species with in five years. Some of this will be harvested from natural stands, but a large fraction will be harvested from restored communities serving as seed "orchards". At present we are planning and harvesting on several hundred acres of planted prairie on reclaimed mined lands and other restored sites, including road shoulders, and are also harvesting on nearly 45 ha under leases with landowners. We will also be increasing available seed orchard resources by planting additional acreage, and through a program for the preservation and management of prairie, wetland and savanna remnants being carried out with the assistance or organizations such as the Wisconsin Prairie Enthusiasts. Profits from the sale of seed collected on these sites will be used to finance the acquisition of additional land, another example of how restoration efforts can support and extend the preservation of natural lands.

Article Reprint from Restoration and Management Notes 6:2
Winter 1988

Appendix F

Addresses And Telephone Numbers Of Federal Government Native Seed Production And Harvesting Facilities

- 1) Natural Resources Conservation Service Plant Material Centers
 - a. Aberdeen Plant Material Center
1691 A South 2700 West
Aberdeen, ID 83210
(208) 397-4133
 - b. Tucson Plant Material Center
3241 North Romero Rd.
Tucson, AZ 85705
(520) 292-2999
 - c. Lockeford Plant Material Center
21001 N. Elliott Rd.
Lockeford, CA 95237
(209) 727-5319
- 2) United States Department of Agriculture, Agricultural Research Service
Forage and Range Research Laboratory
690 N 1100 E
Logan, UT 84322
(435) 797-3066
- 3) United States Department of Agriculture Forest Service
Rocky Mountain Research Station
Shrub Sciences Lab
735 North 500 East
Provo, UT 84606
(801) 342-5140 or (801) 377-5717

APPENDIX G

Bureau of Land Management Native Seed Bidders List

The BLM does not recommend or endorse any seed vendors

AG VISION SEEDS
P. O. BOX 550
CARROT RIVER
SK, CANADA SOEOLO

ALLIED SEED LLC
P.O. BOX 689
POWELL WY 82435

ARMENTA SEED CO
166 W. GAIL DR
GILBERT AZ 85233

BAR O RANCH
425 LOOKOUT LANE
CAMAS VALLEY OR 97416

BLACK CANYON MFG/SEEDS
1475 WEST CENTRAL RD
EMMETT ID 83617

BROWNING SEED, INC
P.O. BOX 1836
PLAINVIEW TX 79073

CENTRAL PARK CO.
10205 N 29TH COURT
OMAHA NE 68112
CIRCLE S SEEDS OF
MONTANA
P.O. BOX 130
THREE FORKS MT 59752
JIM CRANDALL
P.O. BOX 334
ELKO NV 89803

DEAN JUSTIN
1544 S. MAIN
OREM UT 84058

DLF TRIFOLIUM
P.O. BOX 216
ALBANY OR 97321-0063

DYCK FORAGES & GRASSES
LTD
P.O. BOX 275
ELIE MONITOBA ROHOHO
CANADA

EMERALD SEED
9330 NE HALSEY
PORTLAND OR 97220

AGASSIZ SEED COMPANY
445 7TH STREET N. W.
WEST FARGO ND 58078

APPLEWOOD SEED CO
5380 VIVIAN ST
ARVADA CO 80002

AWESOME SPAS
170 IDAHO ST
ELKO NV 89801

BEE SEED CO
P.O. BOX 103
COLOME SD 57528

ED BOYER
3800 S. 1900 W. #185
ROY UT 84067

BUILDERS EXCHANGE
223 SOUTH LINK LANE
FT COLLINS CO 80524

CENTRAL UTAH SEED
825 N 400 E
EPHRAIM UT 84627

COMSTOCK SEED
917 HIGHWAY 88
GARDNERVILLE NV 89410

CRISAFULLI J&J INC.
P.O. BOX 1354
GENDINE MT 59330

DEN BESTEN SEED CO
P.O. BOX 896
PLATTE SD 57369

DOMESTIC SEED AND
SUPPLY
P.O. BOX 466
MADISON SD 57042

EMERALD COMMODITIES
INC
32041 CARTNEY DRIVE
HARRISBURG OR 97446-9712

ENVIRONMENTAL SEED
PROD
P.O. BOX 2709
LOMPOC CA 93438-2709

ALLEN SHANE
1063 W 2150 N
MONROE UT 84754

ARKANSAS VALLEY SEED
CO
4625 COLORADO BLVD
DENVER CO 80216
RAMERT SEED COMPNAV
RT 3 BOX 1120
MULESHOE TX 79347-9803
BIG SKY WHOLESALE SEED
27796 HWY 2 WEST
P.O. BOX 852
SHELBY MT 59474-0852
BRETT-YOUNG SEED LTD.
BOX 99 ST. NORBERT
POSTAL STA
WINNEPEG MANITOBA R3V
1L5

CEDERA SEED INC
P.O. BOX 97
118 STATE HWY. 31
SWAN VALLEY ID 83449
CHAPMAN FARMS
17648 NORTHSIDE BLVD
NAMPA ID 83687

COVE FORT ROCK N JAM
17030 S HIGHWAY 161
COVE FORT UT 84713

CX RANCH
341 ROAD 422
CIRCLE MT 59215
DEXTER SEEDS
175 N REBEL CIRCLE ROD
P.O. BOX 175
OROVADA NV 89425

DRB CORP
10010 W 11600 N
TREMONTON UT 84337

EMERALD SEED
32041 CARTNEY DRIVE
HARRISBURG OR 97446

LAUREL ETCHEGARAY
P.O. BOX 462
EUREKA NV 89316

FALER & ASSOCIATES, P.C.
925 COMMERICAL ST. SE
STE. 220
SALEM OR 97302
FORD SEED
2918 WOODY DR
BOISE ID 83703
SHANE GETZ
317 N 100 E
TREMONTON UT 84337

GRASS SEED SERVICE INC
P.O. BOX 306
LITTLEFIELD TX 79339

HAMMOND RANCH
P.O. BOX 30504
FAYETTE UT 84630

WILLIAM HOUSE
716 B STREET
TAFT CA 93268

INTERMOUNTAIN SEED CO
BOX 62
370 W 300 N
EPHRAIM UT 84627
KATHLEEN J. KNUDON
304 2ND AVE. S.
HETTINGER ND 58639

LANDMARK SEED CO
120 NO. WALL ST, SUITE 400
SPOKANE WA 99201

GARY MAROSTICA
3021 ARLINGTON
CALDWELL ID 83605

MCCLINTICK FARMS
P.O. BOX 129
OROVADA NV 89425

DAVID & KATHY MOSMAN
RT 2 BOX 43
CRAIGMONT ID 83523

CHUCK NOBLE
12212 SE 54TH ST.
BELLVUE WA 98006-2815

NP SEED CO.
206 E. 300 S.
MANTI UT 84642

OWYHEE TRAIL SEED
737 ENTERPRISE AVE
NYSSA OR 97913

FIRST CREEK SEEDS
RURAL 179 BEAVERTON RD
P.O. BOX 48
SACO MT 59261
FREEMONT TRADING SO
450 S. 50 E.
EPHRAIM UT 84627
GOODING SEED COMPANY
P.O. BOX 57
GOODING ID 83330

GRASSLAND WEST
908 PORT DRIVE
CLARKSTON WA 99403

HARVEST MOON SEED CO
P.O. BOX 532
RICHFIELD UT 84701

DAN HOWARD
3442 E MAGIC VIEW DR
SALT LAKE CITY UT 84121

JOHNSON SEEDS
P.O. BOX 1392
ENID OK 73702

SILVER DOLLAR FARM
51 ROAD 442
LINSAY MT 59339

LAUGHLIN TADING INC.
2418 W. 2ND. AVE. #A
SPOKANE WA 99204

MAUGHAN & BARTON SEED
CO
P.O. BOX 72
MANTI UT 84642-0072

MCCORMICK SEEDS INC
P.O. BOX 590
MULESHOE TX 79347

MOUNTAIN WEST SEED CO.
19 N 100 WEST
EPHRAIM UT 84627
NORCAN SEEDS, INC
BOX 305 NE 5A-24-1 WEST
MANITOBA ROCOZO
CANADA
REUBEN NUNLEY
470 SOUTH 600 WEST
MANTI UT 84642
OREGON WHOLESALE SEED
CO
P.O. BOX 885
SILVERTON OR 97381

FLICK SEED
1781 NW 50 RD
KINGSVILLE MO 64061

GEERTSON SEED FARMS
1665 BURROUGHS RD
ADRIAN OR 97901
GRANITE SEED COMPANY
1697 WEST 2100 NORTH
LEHI UT 84043

GREAT BASIN
MANAGEMENT CO
P.O. BOX 54
MILE 10 RAWHIDE ROAD
GABBS NV 89409

HELENA CHEMICAL CO INC
P.O. BOX 629
MESQUITE NM 88048

IDAHO GRIMM GROWERS
CORP
P.O. BOX 276
BLACKFOOT ID 83221

JOHNSTON SEED COMPANY
INC
P.O. BOX 1392
ENID OK 73702

L & H SEEDS INC
4756 W HWY 260
CONNELL WA 99326

LORENZ OK SEEDS
P.O. BOX 835
101 NORTH MAIN
OKEENE OK 73763

BILL MAY
12759 OLALLA VALLEY
ROAD
OLALLA WA 98359

MONTANA PROC. TECH CTR
218 MAIN ST.
P.O. BOX 8300

KALISPELL MT 59901-1300
NATIVE SEED COMPANY
7361 PINERIDGE ROAD
PARK CITY UT 84098

NORWEST SEED LTD
ADAMS RD
#3 R.D., ASHBURTON
NEW ZEALAND

ORCO SEED INC.
P.O. BOX 189
MONMOUTH OR 97361

OUTBACK TRADING POST
385 NORTH STATE
LAVERKIN UT 84745

PAULS SEED
P.O. BOX 156
PAUL ID 83347

GREG PETERSON
6754 PARTRIDGE DR. NE
MOSES LAKE WA 98837

JAMES RENEAU SEED COM
P.O. BOX 40
SHAMROCK TX 79079

BART REYNOLDS
165E 250 NORTH
P.O. BOX 292
AURORA UT 84620
RIVER BEND SEED CO.
139 E. S. TEMPLE, STE. 110
SALT LAKE CITY UT 84111
S & S SEED LLC
P.O. BOX 947
ALBANY OR 97321
SEED MAN
586 W 300 N
CLEARFIELD UT 84015-3906
SHARP BROS SEED CO
2001 SOUTH SYCAMORE
P.O. BOX 140
HEALY KS 67850
JON SKINNER
5000 NW 1ST AVE
NEW PLYMOUTH ID 83655

SOUTHWEST SEED INC
13260 RD 29
DOLORIS CO 82323

STAR VALLEY LODGE &
HUNT
26117 312 AVE
IDEAL SD 57541

TAYLOR SEEDS
11501 CHIMMEY RANCH
TRAIL
MARYSVILLE CA 95901

TREASURE STATE SEED INC
NUMBER 6
1ST STREET SW
FAIRFIELD MT 59436

CISNEROS TRADING CO
927 E. 38TH AVE
SPOKANE WA 99203

PACIFIC COAST SEED
6144A INDUSTRIAL WAY
LIVERMORE CA 94550
PAULSON SEED COMPANY
2849 N PLEASANT VALLEY
RD
AMERICAN FALLS ID 83211
PLUMMER SEED COM., INC
228 EAST 2ND NORTH
P.O. BOX 70
EPHRAIM UT 84626

REVEGETATION SERVICES
P.O. BOX 1480
HIGLEY AZ 85236-1480

RICE ENGINEERING, INC
4300-B WATER CANYON RD.
WINNEMUCCA NV 89445
ROBERSON SEED
P.O. BOX 19651
AMARILLO TX 79114
SACO DEHY INC
P.O. BOX 268
SACO MT 59261

SEED SPECIALISTS
568 W BUCKLES AVE
HAYDEN LAKE ID 83835-7955

SILVERADO RANCH SUPPLY
439 HWY 339
YERINGTON NV 89447

DAN SMITH
1480 E. ELLANDALE AVE.
DALLAS OR 97338-1710

STAR SEED INC
P.O. BOX 504
BELOIT KS 67420

STEVENSON
INTERMOUNTAIN SEED
448 SOUTH 100 EAST
P.O. BOX 2
EPHRAIM UT 84627
TAYLOR SEEDS, INC
P.O. BOX 167
SACO MT 59261

TREASURE VALLEY FARMS
P.O. BOX 13
MOUNTAIN HOME ID 83647

PACIFIC N. W. NATIVES
1525 LAUREL HTS. DR. NW
ALBANY OR 97321
PAWNEE BUTTES SEED INC
P.O. BOX 100
605 25TH STREET
GREELEY CO 80632

RAINIER SEEDS INC
P.O. BOX 1549
FORT ORCHARD WA 98367

LANCE REY
28 CHERRY ST
TOUCHET WA 99360

RICHARDSON AGCO
P.O. BOX 206
VEGA TX 79092
ROCKY MOUNTAIN SEED CO
P.O. BOX 355
AURORA UT 84620
SCOOTNEY SPRINGS SEED
3584 KRUG ROAD
CORNELL WA 99326

SEED-RITE
P.O. BOX 496
ODESSA WA 99159

CLINT SIMPSON
P.O. BOX 325
SACO MT 59261
SOUTHERN UTAH SEED
193 W. 100 S.
P.O. BOX 124
JUNCTION UT 84740

STAR SEED INC
P.O. BOX 228
OSBORNE KS 67473

STOVER SEED
P.O. BOX 21488
1415 E 6TH STREET
LOS ANGELES CA 90021

THE REVEG EDGE
P.O. BOX 609
REDWOOD CITY CA 94064

TURNER SEED
211 CR 151, 3 MILES SOUTH
OF BRECKENRIDGE ON HWY
183
BRECKENRIDGE TX 76424

WAGSTAFF SEED COMPANY
P.O. BOX 68
WALLSBURG UT 84082-0068
GARY WELLS
P.O. BOX 346
LAKEHEAD CA 96051
WHEATLAND WEST SEED CO
P.O. BOX 513
1780 N HWY 38
BRIGHAM CITY UT 84302
WILDERNESS LANDSCAPING
INC
HC 01 BOX 6078-A
PALMER AK 99645

WIND RIVER SEED
3075 LAND 51-1/2
MANDERSON WY 82432-9604

CHRIS YOUNG
2490 EAST 500 NORTH
ST ANTHONY ID 83445

VOECHTING FARMS
718 WOODRIDGE RD
ADRIAN OR 97901
WALTON SEED COM.
P.O. BOX 307
MT PILLAR ID 83254

WESTERN PRODUCTION INC
P.O. BOX 491
WOODBURN OR 97071

WILBER-ELLIS CO
P.O. BOX L
MADRAS OR 97741

WILDLIFE HABITIT
INSTITUTE
1025 E HATTER CR ROAD
PRINCETON ID 83857
DAVID WONG
RM 1001, 10320 – 99 ST
GRAND PRAIRIE, AB
T8V 6J4 CANADA

TED VOSS JR
HC65 BOX 7443
AMADO AZ 85645
WASATCH DIXIE FARMS
P.O. BOX 128
ELBERTA UT 84626

WESTLAND SEED INC
1308 ROUND BUTTE RD
RONAN MT 59864

WILBERS (ABT-WILBERS)
800 NORTH BROADWAY
P.O. BOX 41
MILLER SD 57362-0041

WILLOW CREEK SEED
593 E 900 S. 79-16
EPHRAIM UT 84627

WS SEED
20612 CHAPARRAL CIRCLE
PENN VALLEY CA 95946

NOTE: Updated lists available from United States Department of Interior, Bureau of Land Management, Building
50 Denver Federal Center, P.O. Box 25047, Denver, CO 80225 (303) 236-9470

APPENDIX H
Average Prices (\$/lb) Paid by the
BLM for Priority Plant Species

SEED NAME	CURRENT AVERAGE UNIT PRICE
Thickspike WG-Critana	\$1.43
Thickspike WG-Bannock	\$2.42
Snakeriver WG-Secar	\$6.72
Bluebunch WG-Goldar	\$14.38
Bluebunch WG-Whitmar	\$6.34
Bluebunch WG-Anatone	\$11.55
Bluebunch WG-P7	\$13.00
Great Basin WR-Magnar	\$7.42
Great Basin WR-Trailhead	\$9.70
Bluegrass-Sandberg's	\$4.49
Bottlebrush Squirretail	\$27.26
Indian Ricegrass-Nezpar	\$5.15
Indian Ricegrass-Rimrock	\$4.92
Needle & Thread	\$43.57
Blue Flax-Appar	\$3.24
Western Yarrow	\$4.77
Globemallow	\$42.75
Fourwing Saltbush	\$7.48
Shadscale	\$5.58
Bitterbrush-Antelope	\$9.75
Big Sagebrush-Wyoming	\$7.07
Big Sagebrush-Basin	\$6.88
Big Sagebrush-Mountain	\$7.48
Winterfat	\$10.18
Cliffrose	\$42.82

Note: Updated lists available from United States Department of Interior, Bureau of Land Management, Building 50 Denver, Federal Center, P.O. Box 25047, Denver, CO 80225, (303) 236-9470

Appendix I

Pure Live Seed Conversion Chart

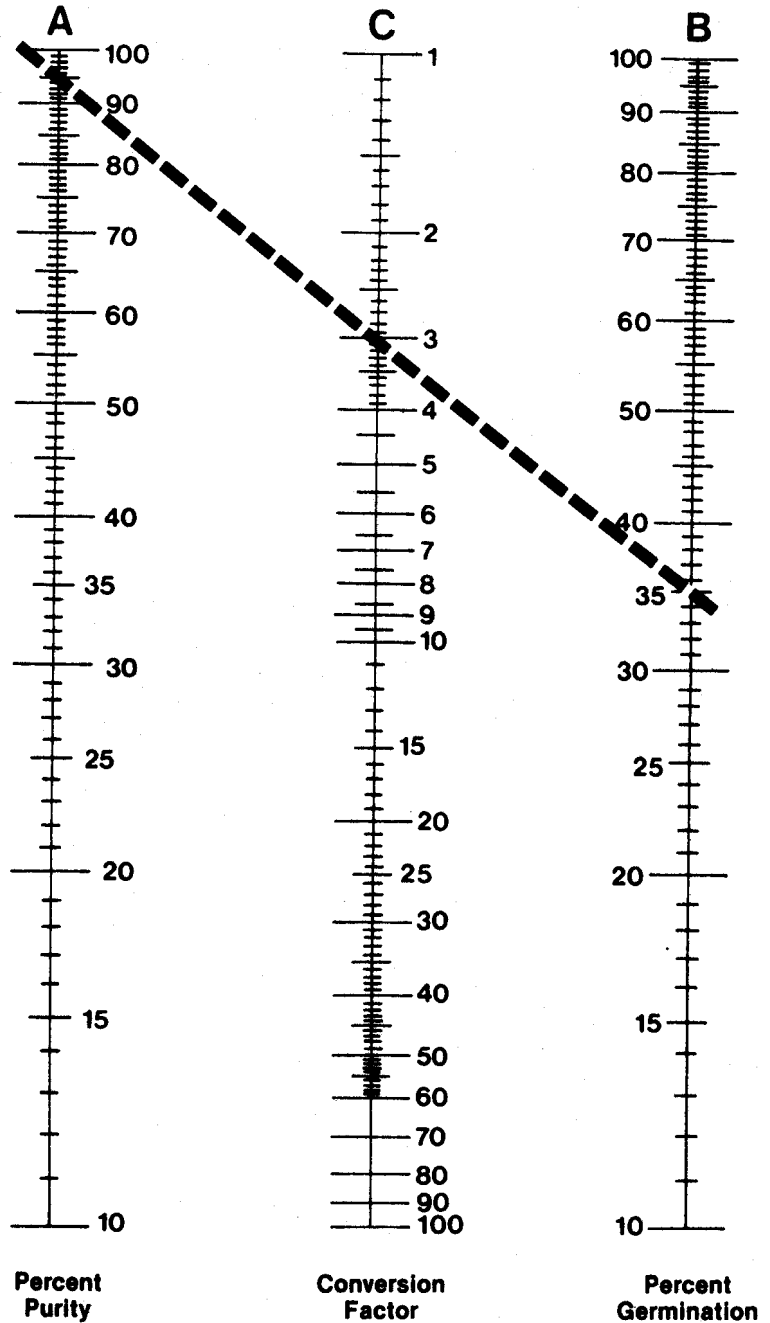
To use chart:

Locate the percent purity and percent germination of the seed on lines A and B. Lay a straight edge between these two points. The point of the intersection with line C is the conversion factor for that seed.

Example:

Purity 95 - line A
 Germination 35 - line B
 Conversion Factor 3.00 - line C

It will take 3 pounds of this seed to equal 1 pound of pure live seed. Multiply this factor by the PLS seeding rate to obtain the seeding rate for this lot of seed.



APPENDIX J

Pounds Of Grass Seed Material Required To Yield One Pound Of Pure Live Seed

% Purity	PERCENT OF GERMINATION*									
	95	90	85	80	75	70	65	60	55	50
95	1.11	1.16	1.25	1.33	1.43	1.54	1.67	1.82	2.00	2.00
90	1.16	1.25	1.33	1.43	1.43	1.54	1.67	1.82	2.00	2.22
85	1.25	1.33	1.43	1.43	1.54	1.67	1.82	2.00	2.22	2.22
80	1.33	1.43	1.43	1.54	1.67	1.82	2.00	2.00	2.22	2.50
75	1.43	1.43	1.54	1.67	1.82	1.82	2.00	2.22	2.50	2.50
70	1.54	1.54	1.67	1.82	1.82	2.00	2.22	2.50	2.50	2.86
65	1.67	1.67	1.82	2.00	2.00	2.22	2.50	2.50	2.86	2.86
60	1.82	1.82	2.00	2.00	2.22	2.50	2.50	2.86	2.86	3.33
55	2.00	2.00	2.22	2.22	2.50	2.50	2.86	2.86	3.33	3.33
50	2.00	2.22	2.22	2.50	2.86	2.86	2.86	3.33	3.33	4.00
45	2.22	2.50	2.86	2.86	2.86	3.33	3.33	4.00	4.00	4.00
40	2.50	2.86	2.86	3.33	3.33	3.33	4.00	4.00	5.00	5.00
35	2.86	3.33	3.33	3.33	4.00	4.00	4.00	5.00	5.00	5.00
30	3.33	4.00	4.00	4.00	4.00	5.00	5.00	5.00	6.67	6.67
25	4.00	4.00	5.00	5.00	5.00	5.00	6.67	6.67	6.67	6.67
20	5.00	5.00	6.67	6.67	6.67	6.67	6.67	8.33	9.90	10.00
15	6.67	6.67	6.67	8.33	9.90	9.90	10.00	11.10	12.50	12.50
10	10.00	11.10	11.10	12.50	12.50	13.35	14.30	16.70	16.70	20.00

% Purity	PERCENT OF GERMINATION								
	45	40	35	30	25	20	15	10	
	2.22	2.50	2.86	3.33	4.00	5.00	6.67	10.00	
95	2.50	2.86	3.33	4.00	4.00	5.00	6.67	11.10	
90	2.50	2.86	3.33	4.00	5.00	6.67	6.67	12.50	
85	2.86	3.33	3.33	4.00	5.00	6.67	8.33	12.50	
80	2.86	3.33	4.00	4.00	5.00	6.67	9.90	12.50	
75	3.33	3.33	4.00	5.00	5.00	6.67	9.90	14.30	
70	3.33	4.00	4.00	5.00	6.67	6.67	10.00	14.30	
65	4.00	4.00	5.00	5.00	6.67	8.33	11.10	16.70	
60	4.00	5.00	5.00	6.67	6.67	9.90	12.50	16.70	
55	4.00	5.00	5.00	6.67	6.67	10.00	12.50	20.00	
50	5.00	5.00	6.67	6.67	9.90	11.10	14.30	20.00	
45	5.00	6.67	6.67	8.33	10.00	12.50	16.70	25.00	
40	6.67	6.67	8.33	9.90	11.10	14.30	20.00	25.00	
35	6.67	8.33	9.90	11.10	12.50	16.70	20.00	33.30	
30	9.90	10.00	11.10	12.50	16.70	20.00	25.00	33.30	
25	11.10	12.50	14.30	16.70	20.00	25.00	33.00	50.00	
20	14.30	16.70	20.00	20.00	25.00	33.30	50.00	50.00	
15	20.00	25.00	25.00	33.30	33.30	50.00	50.00	100.00	

*From Seed Tag

Apply purity and germination figures from the seed tag, and read the table in the same manner as you would a road mileage chart. Where the lines cross, the poundage shows is the approximate amount of seed MATERIAL required to yield ONE POUND OF PURE-LIVE-SEED.

EXAMPLE: Purity 35%, germination 60% comes out to 5.00 pounds of material equals one pound of pure-live-seed (PLS). Seed analysis figures seldom come out to a whole number ending in a "0" or "5" but, for use with this table, use the nearest such whole number.

EXAMPLE: 47.50 to 52.49 would read as 50%; 52.50 to 57.49 would read as 55%; etc.

U.S. Department of Agriculture
Natural Resources Conservation Service

APPENDIX K
SELECTED WESTERN STATES
SEED TESTING LABORATORIES

ARIZONA

Arizona State Seed Lab
2422 W Holly
Phoenix AZ 85009
Telephone: (602) 744-4911
Fax: (602) 253-2247

TESTS PERFORMED

Purity, Germination, Noxious Weed Exam, TZ, Cotton Cool Test, Vigor, and Fluorescence Testing on all Cereal, Legume, Cotton, Turf Grass, Vegetable, Flower, and Native Species of Seed.

CALIFORNIA

California Dept. of Food and Agriculture
Plant Pest Diagnostic Center
3294 Meadowview Road
Sacramento, CA 95832-1448
Telephone: (916) 262-1100
Fax: (916) 262-1190
Web site: www.edfa.ca.gov

TESTS PERFORMED

Purity, Germination, Noxious weed Exam, Bulk Exam, Propagule, Identification, Cold Tests, Archaeological Identification, TZ, Accelerated Aging, X-Ray, Seed Count, Moisture Test Conductivity, Fluorescence Tests

IDAHO

Idaho State Seed Laboratory
2240 Kellogg Lane
Boise, ID 83712
Telephone: (208) 332-8630
Telephone: (208) 332-8635 (Purity)
Telephone: (208) 332-8633 (Germination)
FAX: (208) 334-3482

TESTS PERFORMED

Purity, Germination, Noxious weed Exams, Tetrazolium, Oven Moisture, Undesirable Grass Seed, All States Noxious weeds, Cold Tests, Fluorescence, Cut Test, Sod Quality, Quarantines

OREGON

Seed Laboratory
Oregon State University
Corvallis, OR 97331-3801
Telephone: (541) 737-4464
Fax: (541) 737-2126
E-mail: seedlab@orst.edu
Web site: www.css.oprst.edu/seedlab

TESTS PERFORMED

Purity, All States Noxious Weed, Oregon Sod Quality, UGS, Crop & Weed Exams, Bentgrass Species Identification, Pest & Disease Exams, Germination, TZ, Excised Embryo, Cold Test, Fluorescence, Ammonia Test, Vernalization and Grow-out Tests for Ryegrass Endophyte Test, X-Ray Test, Chromosome Count and Ploidy by Cytometry, Phenol Test, NaOH Test for Wheat Seed Moisture Content, Seed Weight and Number per Pound

NEVADA

Nevada State Division of Agriculture
P.O. Box 11100
Reno, NV 89510
Telephone: (775) 688-1182
Fax: (775) 688-1178

TESTS PERFORMED

Purity, Germination, Noxious Weed Exam, Identification

UTAH

Utah Department of Agriculture
State Seed Laboratory
350 North Redwood Road
P.O. Box 14650
Salt Lake City, UT 84116
Telephone: (801) 538-7181
Fax: (801) 538-7189

TESTS PERFORMED

Purity, Germination, Noxious Weed Exams, TZ, Cut Test, Embryo Analysis (Loose Smut), Seed Counts, Moisture, Identification