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Year-round Field Identification of Common

Northern Great Basin Grasses

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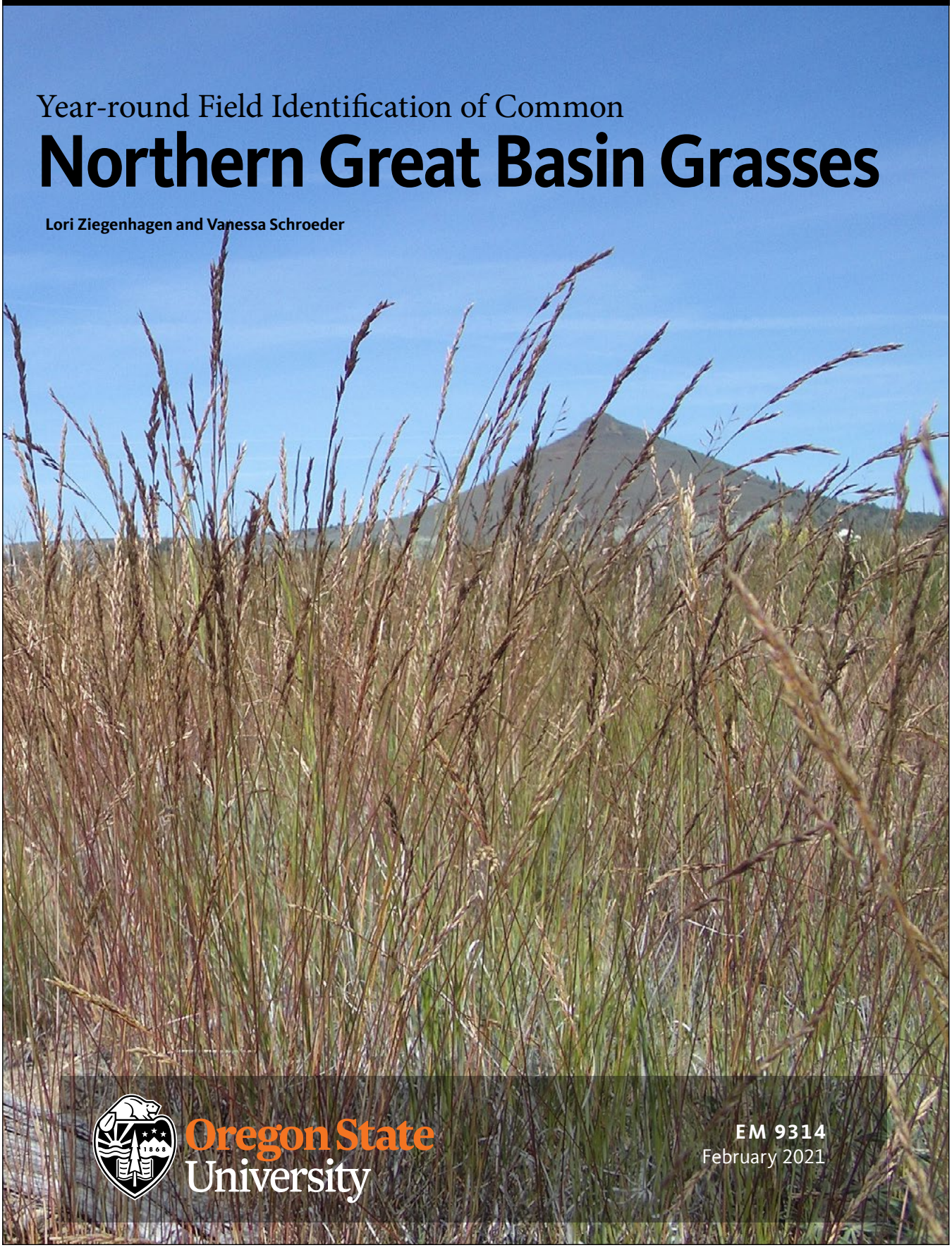

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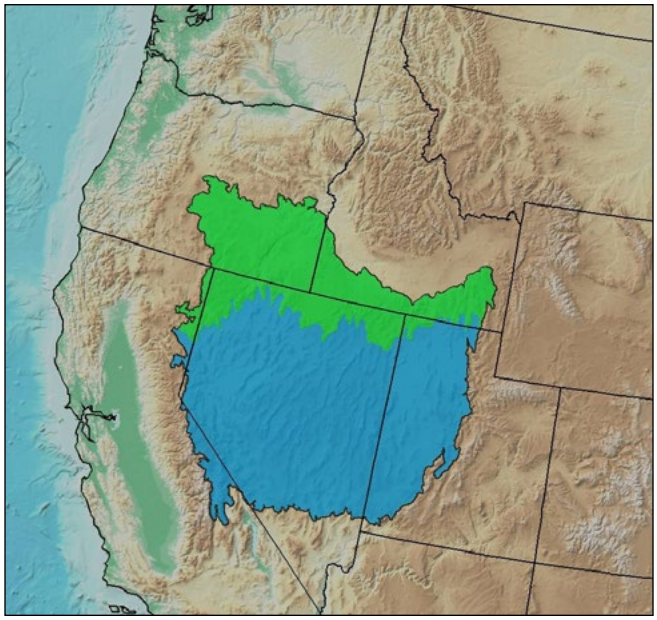
All photos by Lori Ziegenhagen, USDA-ARS, unless otherwise noted.

Plant communities

As you move across the northern Great Basin, you encounter hundreds of different plant species forming a large variety of plant communities. Plant communities are associations of plant species that are shaped by abiotic and biotic factors such as soils, climate and competition. The resulting communities are often described by listing the two or three most dominant species on a site.

To make informed decisions, land managers in the northern Great Basin must know an area's plant community and its members. Plants respond to abiotic and biotic conditions around them, and this allows you to infer what has happened on the site and what may develop in the future.

Some plants flourish after disturbances. The presence of these plants in high numbers could be a clue that there has been a recent fire or overgrazing. Other species decline with disturbance, and this may help you predict how a plant community will change when facing drought or disturbance from off-road vehicles. Some species may not be present every year, lying dormant and waiting for the perfect set of conditions to thrive. These plants give you clues to episodic climate events.



Map: Alan Dennis, Oregon State University; Source: Conservation Biology Institute through Databasin.org

Map of the Great Basin ecoregion. The northern Great Basin is in green.

This guide provides detailed identification information for common grass species found throughout the northern Great Basin, highlighted in green on the accompanying map. However, many of these grasses are found throughout the Great Basin (highlighted in blue on the map). Several can be found throughout the West.

Under ideal management conditions, you would know the genus and species of every plant on your site, some measure of its vigor (such as percent cover or above-ground biomass), and how it responds to disturbances. However, what do you do when you are new to an area or do not have the time or money to identify each and every plant in the community? What if you are unable to follow a site over several years to get a good feel for its condition? You still can learn from the plants on the ground without a genus-species identification. To do this, identify your site's plants by functional groups.

One view of the northern Great Basin from Little Glass Butte, Oregon.

Terms to know

Abiotic factor: nonliving things, such as chemical or physical factors, that affect ecosystems and the species in them. Abiotic factors affecting plants can include climate and habitat factors such as sunlight, soil type, water, temperature and many more.

Biotic factor: the living components of an ecosystem, which includes plants, animals, bacteria, fungus and all other living things. Biotic factors affecting plants can include competition with other plants, consumption by herbivores, interactions with fungus and bacteria, and other interactions of living things within an ecosystem.

Functional groups

Functional groups are categories of plants grouped together based on similar growth habits, physical features and roles within the plant community. An example of two simple and readily understood functional groups are annual and perennial plants.

Annual plants live for one year (Figure 1A, page 5). They start as a seed, sprout, grow, flower, produce more seed for next year's generation and then die. The majority of their resources are allocated to seed production to ensure the species' existence through time. Perennial plants also start from seed and are capable of living multiple years. Perennial plants invest resources into structures that allow them to survive winters, outlast droughts and exist through time, therefore perennials may not produce seed when conditions are poor.

Even without knowing the name of a plant, you can learn much about its role in a community, or its response to disturbance, by understanding whether it employs the annual or perennial strategy. You can further subdivide annual plants into grasses and forbs (broad-leafed herbaceous plants), and perennial plants into grasses, forbs, shrubs and trees (Figure 1C, page 5). Within perennial grasses, you could subdivide them further into rhizomatous or bunch-forming perennial grasses (Figure 1D, page 5).

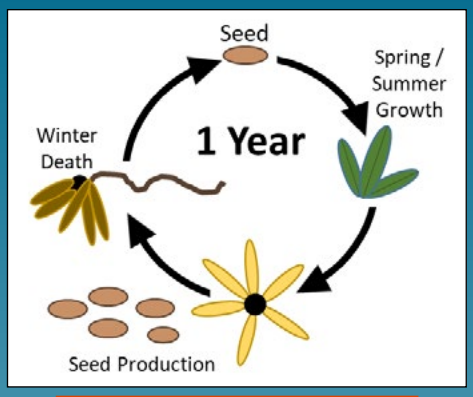
Example of a perennial-dominated plant community in the northern Great Basin.

This is the power of the functional group as a management tool. You can create a functional group specific to your needs that helps you track, monitor or answer biological questions about your site. You can define two functional groups based on a perennial shrub's response to fire (i.e., is it killed or does it resprout?). You may also choose to base functional groups on how palatable plants are to a target wildlife species, such as like browsing deer or grazing elk.

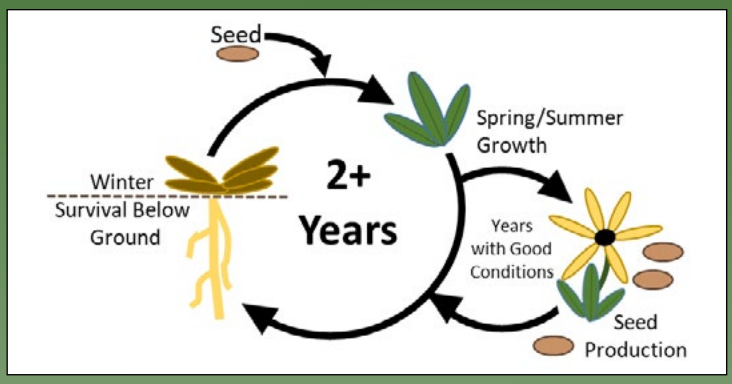
Whatever functional groups you choose, they should be biologically based and help answer the management questions you have on your site. Many land managers use Ecological Site Descriptions, also known as ESDs, which provide site information regarding soils, climate and vegetation characteristics and interpretation of that information relative to a site's management and disturbance history. Ecological site descriptions group plants by functional group, and you may choose to use the same groups as the ecological site descriptions for your site. To learn more about ecological site descriptions and how to use them as a management tool, see the publication *An Introduction to Using Ecological Site Descriptions as a Management Tool* by Dustin Johnson and Kirk Davies at http://osu-wams-blogs-uploads.s3.amazonaws.com/blogs.dir/2753/files/2016/09/598-An-Introduction-to-Using-Ecological-Site-Descriptions-as-a-Management-Tool.pdf. To access and download ecological site descriptions for your site: https://edit.jornada.nmsu.edu/.

For another example of commonly used functional groups in the sagebrush ecosystem and more background on the ecology in the northern Great Basin, see *Western Roots: Diving into a Sea of Diversity* (PNW 714) at https://catalog.extension.oregonstate.edu/pnw714.

A. Annual



B. Perennial



C.

Forbs

- Cotyledons, the first leaves to emerge from a seed, found at the base of the stem, are still present.
- Small root structures that pull up easily and no storage organs (for example, taproots or rhizomes).

Grass

- Small root structures, easily pulled from the ground.
- Emphasis on seed production.

Forbs

- Deep roots used for storage that are difficult to pull up.
- When you try to pull up roots you get leaves and only a chunk of a rhizome or taproot.

Shrub/brush

- Woody branches.
- Multistemmed canopies, rounder in form with no dominate trunk or peak.

Tree

- Woody branches.
- Usually a single dominant trunk with side branches that form a peak.

Grass

- Extensive fibrous roots, difficult to pull up or dig out the entire plant.

D.

Rhizome

- Forms a turf, sometimes loosely, forming above ground tillers from below ground rhizomes.
- Difficult to isolate individual plants. See four tillers from a single plant above.

Bunch-forming

- Individual pants form dense bunches that stand independently from its neighbors.

Figure 1. Diagrams of the annual life cycle (A) and perennial life cycle (B). In the northern Great Basin, annual and perennial functional groups can be divided into annual grasses and forbs, and perennial grasses, forbs, shrubs and trees (C). Perennial grasses are subdivided into rhizomatous (matt forming) or bunch-forming perennial grasses (D). Perennial plants are not always large. Annual plants are not always small, especially after a disturbance or when resources are plentiful. Roots help determine the functional group of a plant.

Functional groups in the field

Like all natural systems, not all plants fit neatly into functional groups. Some plants are biannual, which means that they live for two years only. These are technically perennial, but short-lived. You can group them with the annuals or the perennials, or you can create a new functional group if that serves your needs best. Many invasive weed species fall in the biannual category.

Other plants may have persistent woody bases but behave more like perennial forbs. They could be classified as perennial forbs or as a subshrub functional group created just for them. It is crucial that you define your functional groups in a plant community so that they are useful and help answer specific management questions. Plants that do not cleanly fit into the groups may or may not be important to you, and your decision-making team will need to decide if those "misfits" need more consideration. Figures 2–6 show plant communities in the northern Great Basin and the functional groups within them.

Figure 2. Perennial-dominated community. This community is a mixture of shrubs (background), perennial forbs (yellow), and perennial bunchgrasses (green).

Figure 3. Deep-rooted and shallow-rooted perennial bunchgrass community. Here, bottlebrush squirreltail (deep-rooted perennial bunchgrass, center left) is just starting to form seeds while Sandberg bluegrass (shallow-rooted bunchgrass, top) is already going dormant. Wild onion (purple), a perennial forb, is also present.

Figure 4. Perennial-dominated community. This site contains more juniper trees (background) and sagebrush shrubs (middle and foreground) but still has a strong component of perennial grasses and perennial forbs (foreground).

Figure 5. Annual /perennial mix. This site has a mixture of tap-rooted perennial forbs (yellow, purple), annual forbs (white), annual grasses (foreground), and a scattered collection of deep-rooted perennial grasses (top left). Many of the annual forbs and annual grasses increase with disturbance.

Figure 6. Annual-dominated community. This community is dominated by annual grasses. Although there may be a few surviving perennial bunchgrasses, the increased disturbance has caused a shift towards cheatgrass and medusahead.

Field identification of grasses

This guide focuses on the most common northern Great Basin species within the perennial bunchgrass functional group. It will touch on a few common examples of the annual grass functional group.

Grasses can be difficult to identify to a species level. Most grass keys and guides use reproductive features to identify species, and seed heads and seeds are only available during a short window each year. If you are trying to identify a grass during the other 10–11 months of the year, vegetative features are helpful.

Identifying grasses using only fall regrowth after a fire (Figure 7A, B), dormant bunchgrasses in the middle of winter (Figure 8A, B, page 9) or newly emerged seedlings in a restoration project (Figure 9, page 9), requires physical structures that are available year-round. This photo guide will focus on those vegetative features.

Figure 7. (A) Landscape photo of a fire that removed all dead material from past growing seasons. Visible in the foreground are the wildfire-charred patches of bunchgrasses. (B) A detailed image of bluebunch wheatgrass flush with post-fire, resprouted stalks (tillers) and devoid of any dead material from the previous year's growth. Both photos taken at the same location three months after a fire.

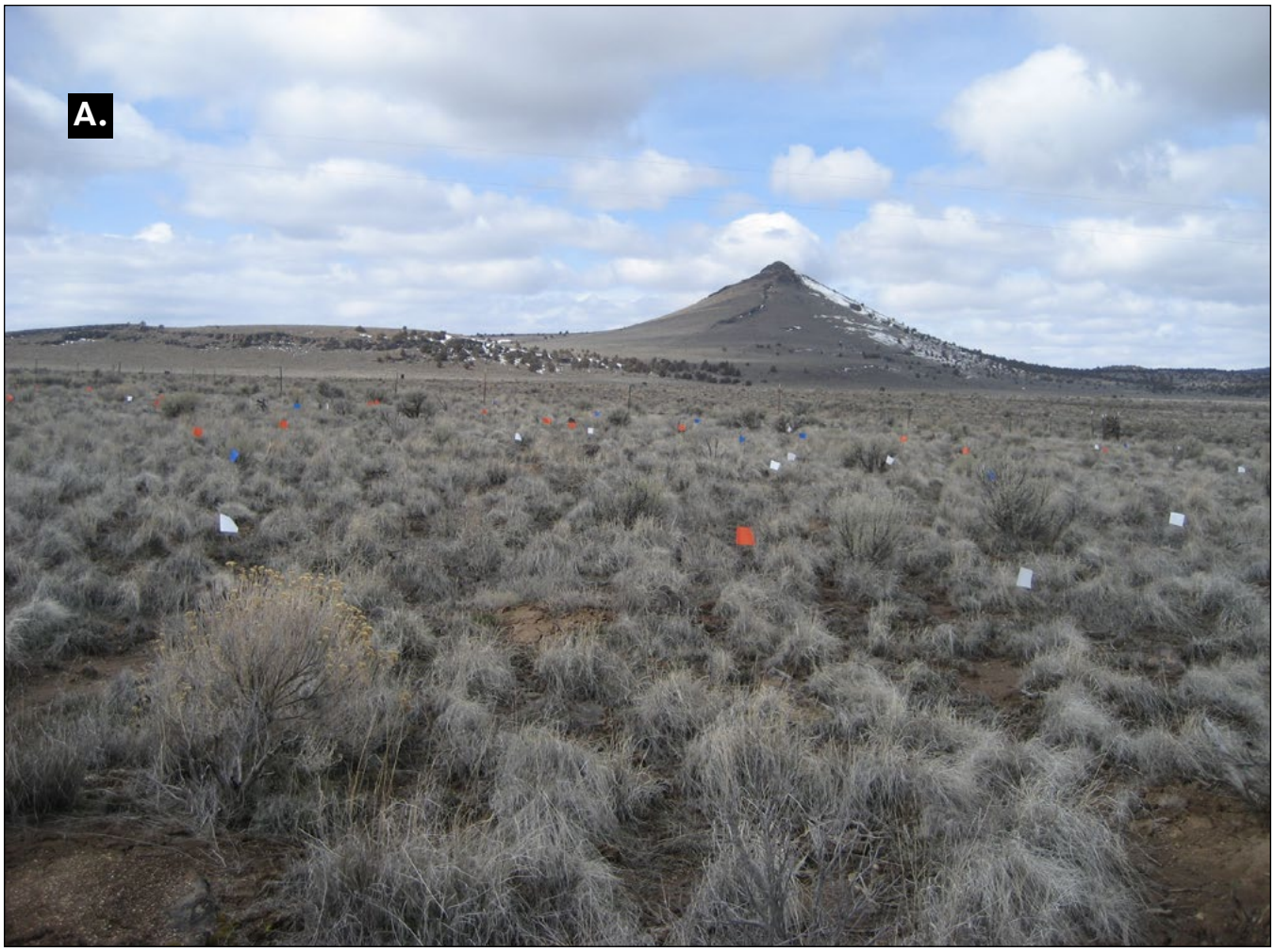


Figure 8 (A) A landscape photo taken in late winter of deep-rooted perennial bunchgrasses still in their winter dormancy. The dead material from the previous year is the only clue to identification of species. (B) A close-up image of a bluebunch wheatgrass filled with dead material from that landscape. Figure 7(B) (page 8) is the same species, but each individual presents a different identification challenge and the complete lack of physical features required by many plant keys.

Figure 9. A month-old crested wheatgrass seedling marked by a toothpick.

Vegetative characteristics of common Great Basin grass species

The individual unit of a grass plant is a tiller (Figure 10). A tiller consists of a single stalk of leaves. A tiller may form a reproductive culm. The seed head is formed at the end of the culm. A leaf sheath is leaf-like material that wraps around younger leaves or, in the case of a reproductive tiller, the culm.

You can imagine the sheath and the collar as a shirt — some shirts button right to the top and are closed around the neck. Other shirts — or even a robe — are loosely wrapped around the neck and left open. Leaf sheaths and collars can be closed, tightly wrapped, or open and loose (Figure 11, page 11). Leaf collars are one of the key physical features that you can use to identify northern Great Basin grass species year-round.

A grass leaf blade grows from the bottom up — this is why you can mow your lawn and not kill the grass. The leaf blade grows like a fingernail from the nail bed. The ligule (Figure 11) is an extra piece of tissue that forms at the growth point. You can think of the ligule as a "cuticle" that forms as the leaf blade grows. Ligules take numerous forms. For example, ligules can be smooth or shaggy, pointed or flat, white or see-through, or too small to see without a hand lens. Continuing the fingernail analogy, the auricles are little protrusions, or "hangnails," at the leaf collar's edge (Figure 11).

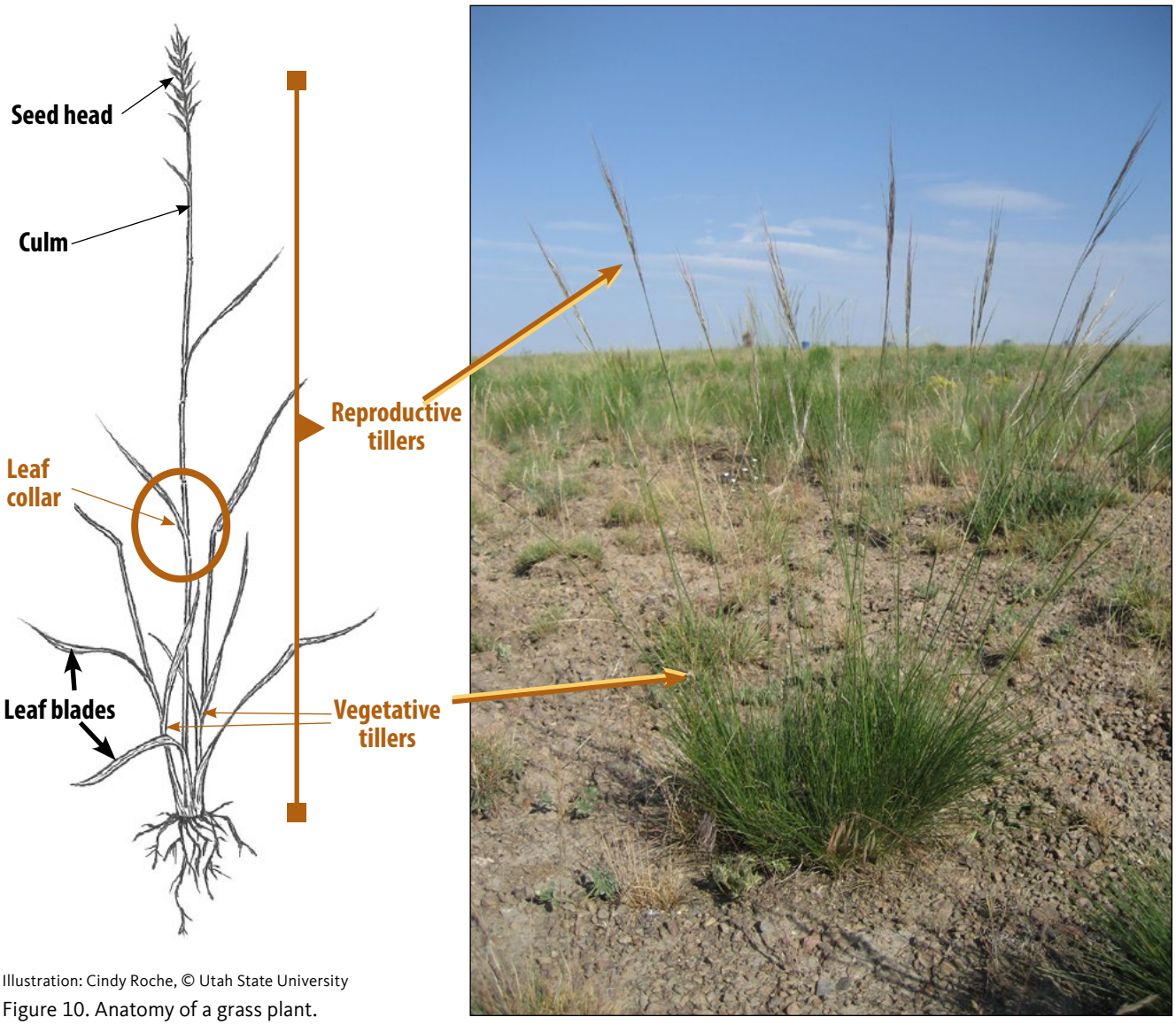
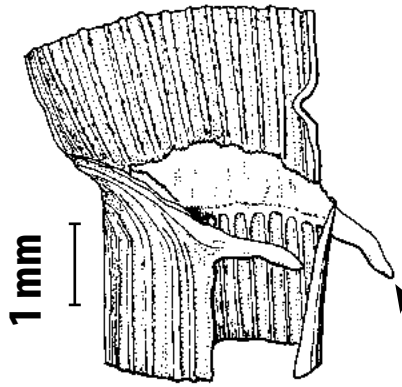


Illustration: Cindy Roche, © Utah State University

Figure 10. Anatomy of a grass plant.

The Leaf Collar



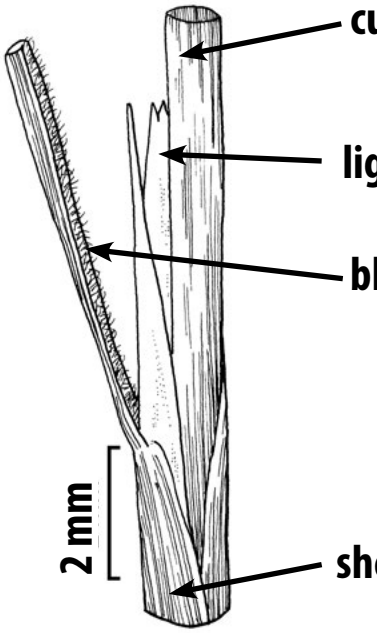


Illustration: Cindy Roche, © Utah State University

Figure 11. The details of the leaf collar, the area where the leaf blade grows from the sheath.

bluebunch wheatgrass

Pseudoroegneria spicata (Pursh) A. Löve ssp. *spicata*

Old seed heads on bluebunch wheatgrass often persist into the next growing season. They are a long, slender spike that zig-zags slightly (Figure 12A). These can be found sticking above the bulk of the bunchgrass. Bluebunch wheatgrass can grow into old, open bunches where the center has died and the new growth has formed a ring. The grass pictured in Figure 12C burned in a fire, and all that remains are the younger tillers on the outside. You can almost picture the original plant that is missing from the middle.

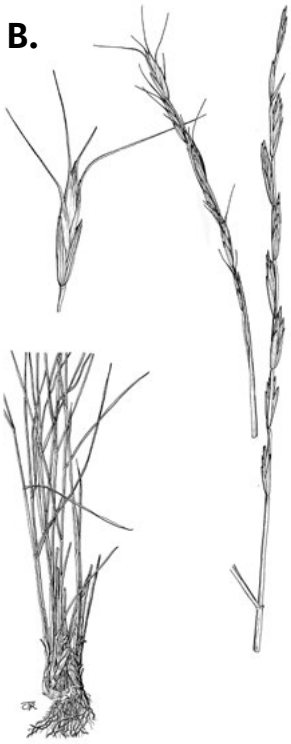


Illustration: Cindy Roché © Utah State University

Figure 12. (A) Comparison of last year's (left) and this year's (right) spikes on a bluebunch wheatgrass. A spike is a type of seed head with no side branches. (B) Botanical drawing detailing the entire plant. (C) A large, old bluebunch wheatgrass that burned in a fire the previous year. Only the outer ring of the plant resprouted with fresh tillers.

bluebunch wheatgrass

Pseudoroegneria spicata (Pursh) A. Löve ssp. *spicata* (continued)

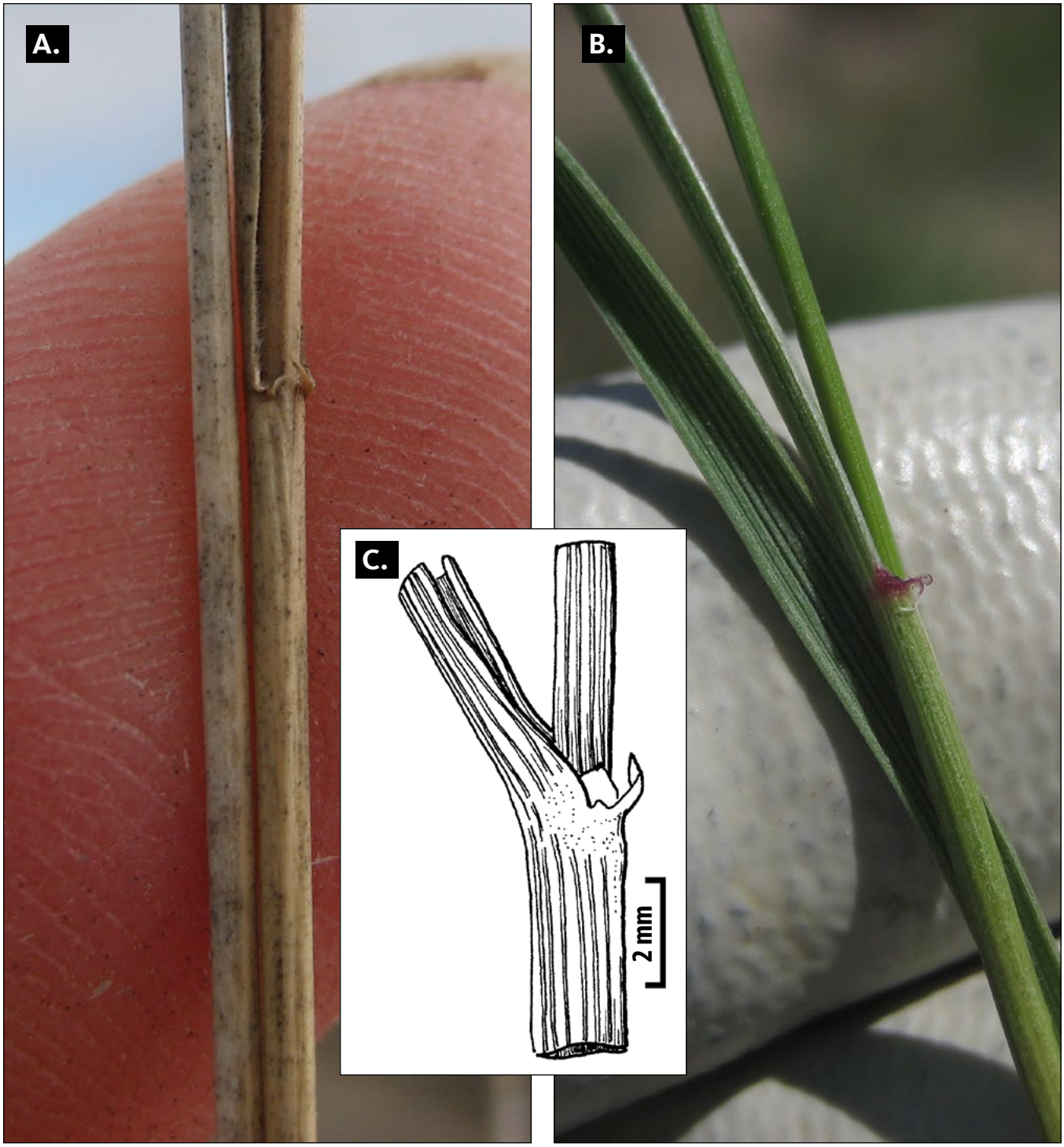


Illustration: Cindy Roché © Utah State University

Figure 13. Comparison of last year's (A) and this year's (B) culms, blades and collars for bluebunch wheatgrass. Botanical drawing (C) detailing the curly auricle.

The bluebunch wheatgrass collar is often a well-defined "purple" rust color with long, curled auricles (Figure 13). The ligule for bluebunch wheatgrass is not noticeable without a hand lens. Bluebunch wheatgrass' leaf blades are not much wider than the culm. The well-defined auricles and narrow leaf blades can even be seen in winter on dead material.

crested wheatgrass

Agropyron cristatum (L.) Gaertn

Although crested wheatgrass is not a native bunchgrass to the area, it has been used in plantings for over 100 years and is considered by many to be naturalized. Crested wheatgrass is commonly planted on public and private lands to improve available forage and to prevent invasion by annual grasses after a wildfire.

Crested wheatgrass often grows in large, dense, upright bunches. The old seed heads remain most of the year and are reminiscent of a fish bone or herringbone design (Figure 14).

Crested wheatgrass has long, slender, yellow auricles at the collar. Unlike bluebunch wheatgrass, the leaf blade is much wider than the culm and balloons out at the collar (Figure 15).

Based on physical characteristics, these two species, crested wheatgrass and bluebunch wheatgrass, were once in the same genus, *Agropyron* spp. They have since been separated, but it is helpful in the field to compare the vegetative characteristics of these two grasses.

Figure 14A. Comparison of last year's and this year's seed heads on crested wheatgrass (A).

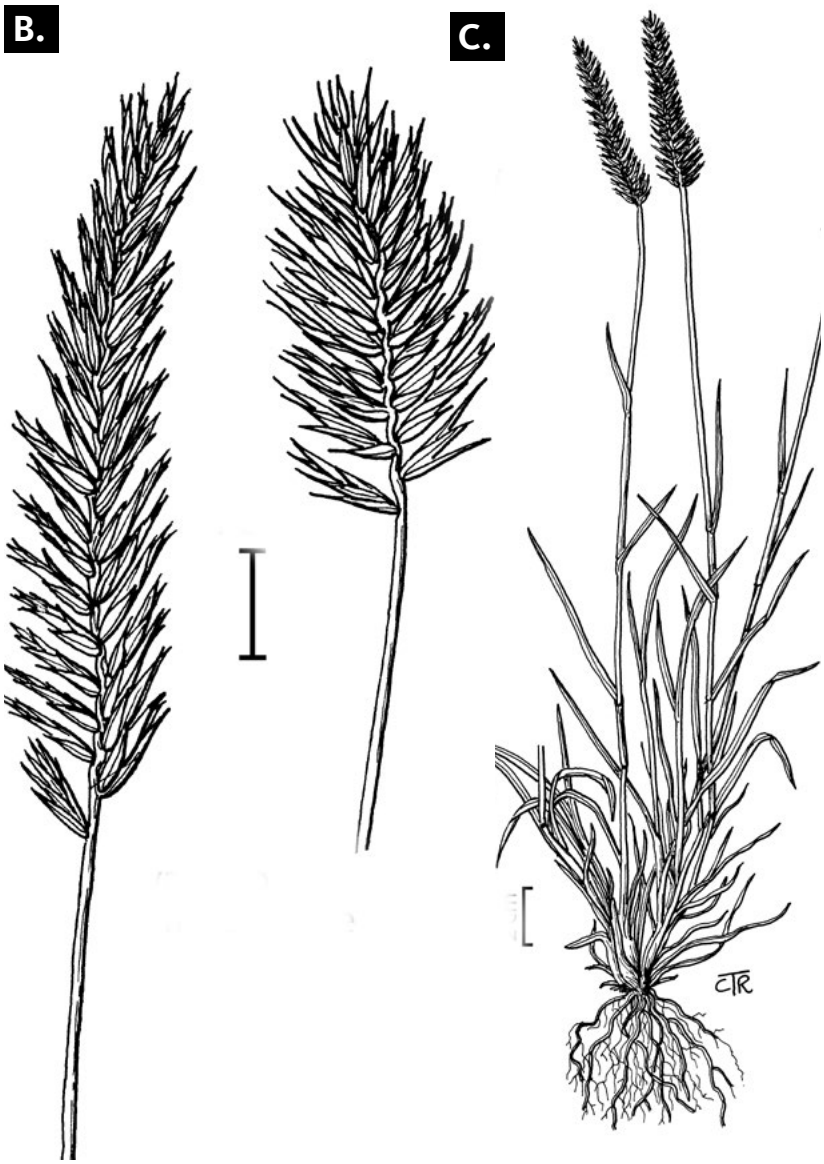


Illustration: Cindy Roché © Utah State University

Figure 14 B & C Botanical drawings detailing the fish bone design on the seed head (B) and of the entire plant (C).

crested wheatgrass

Agropyron cristatum (L.) Gaertn (continued)

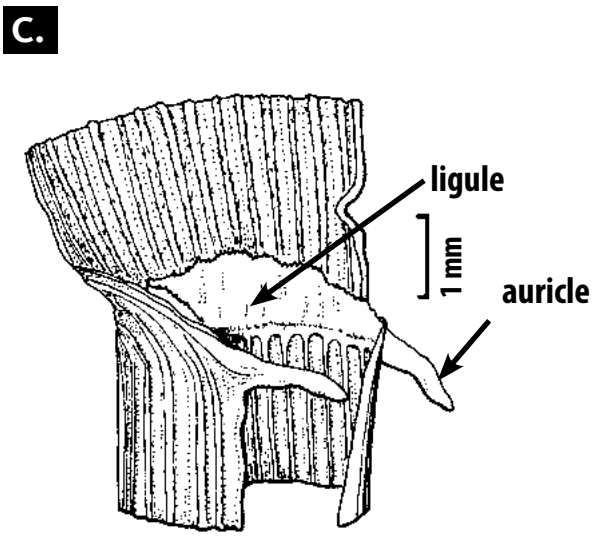


Illustration: Cindy Roché © Utah State University

Figure 15. (A) Close-up examples of crested wheatgrass' yellow auricles and wide leaf blade in comparison to the culm. (B) Photo comparing the leaf collar of bluebunch wheatgrass (left) to the leaf collar of crested wheatgrass (middle and right) (C) Botanical drawing of the leaf collar on crested wheatgrass. Although the details show a ligule, in reality it is not visible without a hand lens.

bottlebrush squirreltail

Elymus elymoides (Raf.) Swezey ssp. *elymoides*

Bottlebush squirreltail is highly variable. Its bunch can appear dark, glossy green and tall like bluebunch wheatgrasss. It can also be small, light green and with fuzzy leaf blades (Figure 16A-D). As they weather, last year's leaf blades often form white cork-screws throughout the base of the bunch. These cork-screws are visible even in winter.

Figure 16(A). Examples of the different forms bottlebrush squirreltail can take. Fuzzy and short with corkscrew leaves (A left) and tall and glossy green (A right).

Figure 16(B). Another image showing the variety of color and shape between two bottlebrush squirreltail individuals (foreground left and right). Photo: Sierra Lammi

Figure 16(C). Three different bottlebrush squirreltail collars, fuzzy and smooth/glossy green.

Figure 16(D). A comparison of bluebunch wheatgrass and bottlebrush squirreltail leaf collars. Note: bottlebrush squirreltail's auricles are never purple.

bottlebrush squirreltail

Elymus elymoides (Raf.) Swezey ssp. *elymoides* (continued)

Auricles can be present or completely absent (Figure 16C) on bottlebrush squirreltail. The young seed heads look like a squirrel's tail and the ripe seed heads spread out like a bottlebrush (Figure 17A). After the seeds ripen, the entire seed head will break off and blow away like a small tumbleweed, leaving behind a pinwheel of glumes (Figure 17 B and C). Before these seed heads ripen, they can be easily confused with a robust medusahead (Figure 35).

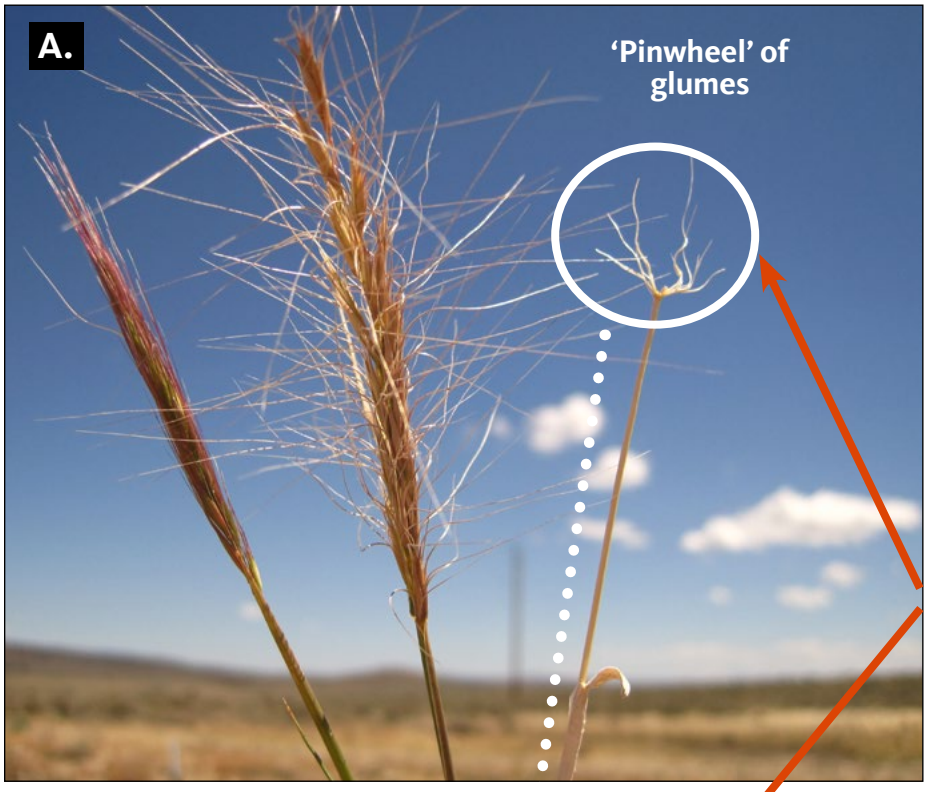


Figure 17(A). Comparison of different stages of a bottlebrush squirreltail seed head: young seed head on the left, ripe seed head beginning to break apart in the middle, and last year's seed head, a pinwheel of glumes on the right.

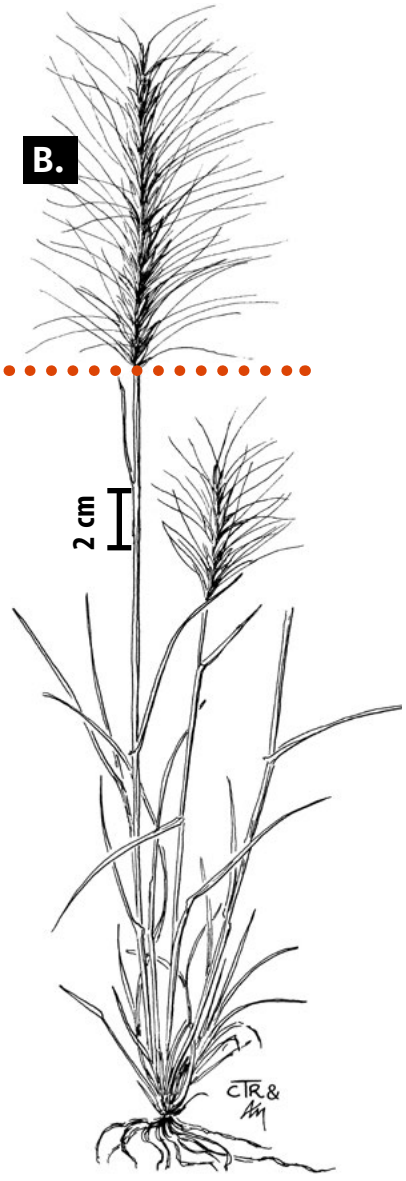


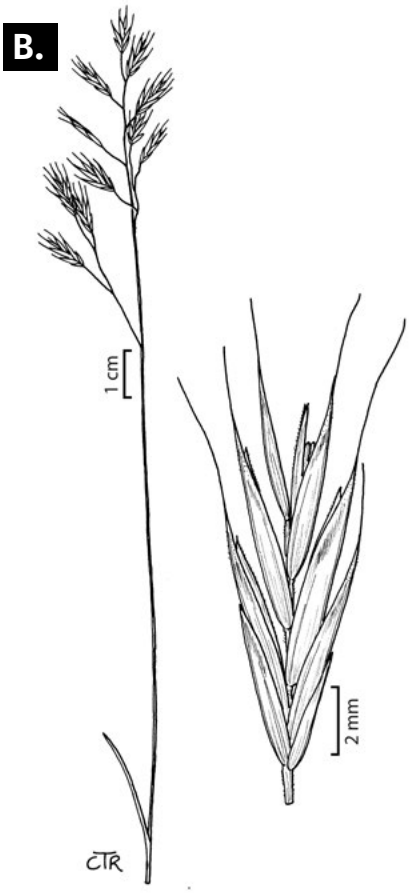
Illustration: Cindy Roché and Annaliese Miller© Utah State University

Figure 17 (B & C). A botanical drawing of a ripe bottlebrush squirreltail, the dashed red line indicates a break-point on the seed head (B) and the top view of what is left after the ripe seed heads break apart (C).

Idaho fescue

Festuca idahoensis Elmer

Idaho fescue is a fine-leafed, dense bunchgrass with open, lacy seed heads. The leaves are fine, tightly rolled and smooth (Figure 18A, B). This is the only species in the northern Great Basin with black roots (Figure 18C). Clumps of Idaho fescue can be pulled out of the ground with a good tug, but be sure to grasp tightly at the very base of the tillers. The leaves are fine and break off easily as you try to pull, especially in winter. In the northern Great Basin, black roots on a bunchgrass mean it is Idaho fescue. However, finding a few white roots in spring does not rule it out as Idaho fescue, because newly grown roots can be white and fleshy (Figure 22B).



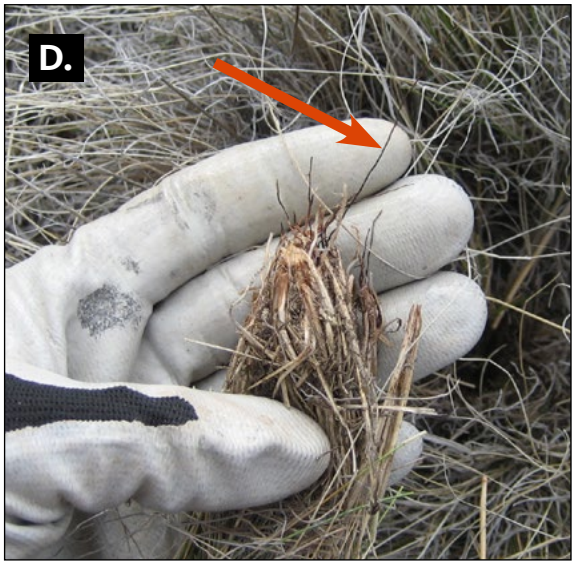


Illustration: Cindy Roché ©Utah State University

Figure 18. (A) Photo of an Idaho fescue bunchgrass (in foreground). (B) Botanical drawing of Idaho fescue. (C) Photo detailing a handful of Idaho fescue seed heads. See Figure 22C (page 21) for a photo of what remains of a seed head in winter. (D) Idaho fescue's black roots as seen in winter.

Idaho fescue

Festuca idahoensis Elmer (continued)

Idaho fescue leaf blades are at a strong right angle, standing straight up like the back of a wooden chair when viewed from the side. (Figure 19A, B). Northern Great Basin species' collars look less upright and more reclined, like an easy chair. This leaf collar shape is also helpful in winter when it is difficult to pull the black roots out of the ground. The ligule is green, translucent and hard to distinguish from the rest of the collar. You will want to compare these traits to Thurber's needlegrass (Figure 22, page 21).

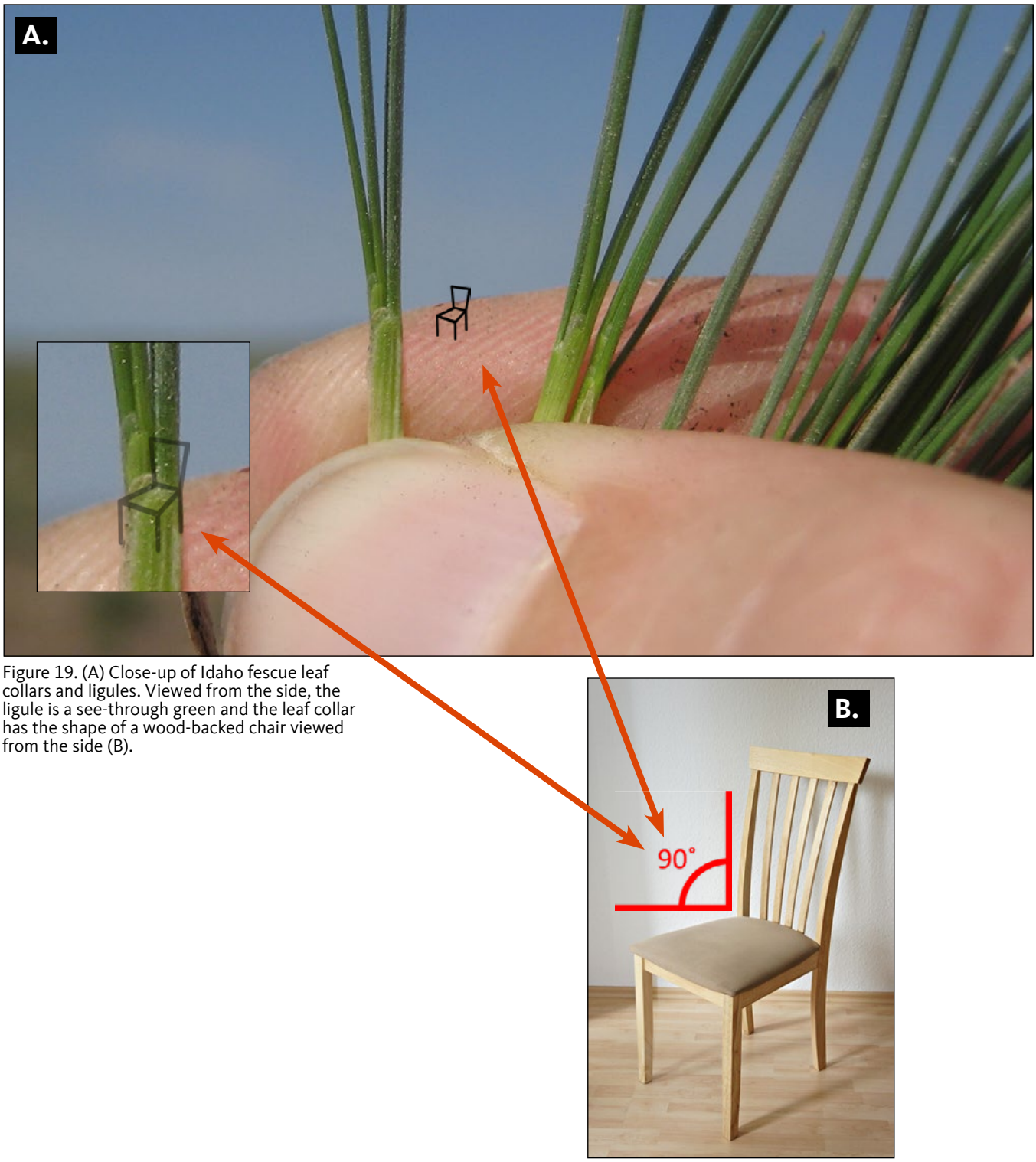


Figure 19. (A) Close-up of Idaho fescue leaf collars and ligules. Viewed from the side, the ligule is a see-through green and the leaf collar has the shape of a wood-backed chair viewed from the side (B).

Thurber's needlegrass

Achnatherum thurberianum (Piper) Barkworth

Thurber's needlegrass has a distinct seed (Figure 20B). But without seed heads, Thurber's needlegrass can be easily confused with Idaho fescue. Like Idaho fescue, Thurber's needlegrass forms a short, compact bunch (Figure 20A) with fine, tightly rolled leaf blades. However, these leaves are typically stiffer than Idaho fescue and feel like sandpaper when you stroke them from top to bottom. Thurber's needlegrass bunches form upright tufts, whereas the Idaho fescue bunches form softer, rounded mounds. Thurber's needlegrass seems to stay green later into the summer than other bunchgrasses.

The ligule on Thurber's needlegrass is a long, nearly transparent flag that extends down the leaf sheath. The example in Figure 21 is nearly a centimeter long. This ligule is easy to find on early spring growth, flowering plants, and even dead tillers in the middle of winter.

Thurber's needlegrass has thick, buff-colored roots, while Idaho fescue has black roots (Figure 22B, page 21). These samples were pulled in early spring. Notice that the Idaho fescue does have some new white roots that will blacken with time. The glumes on the Thurber's needlegrass are longer and wider than those of Idaho fescue. This feature is even visible on old seed heads in winter (Figure 22C, page 21).

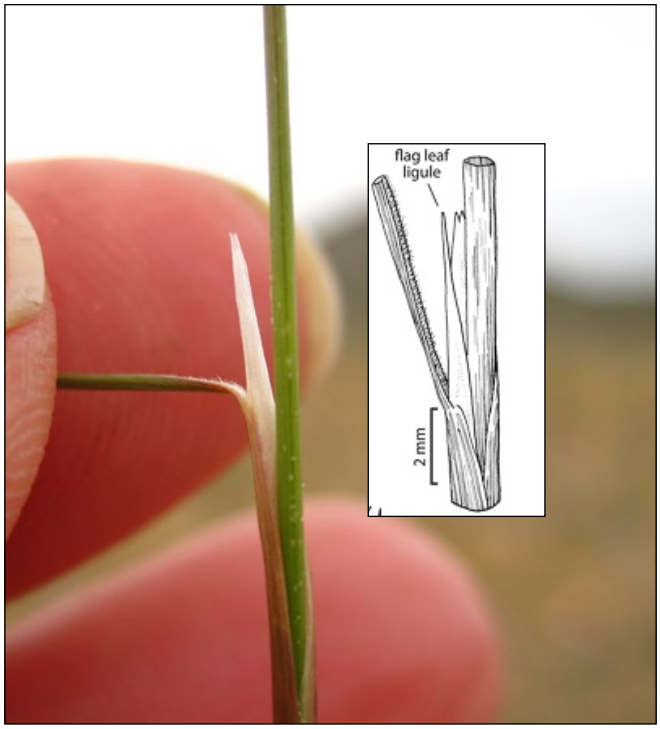
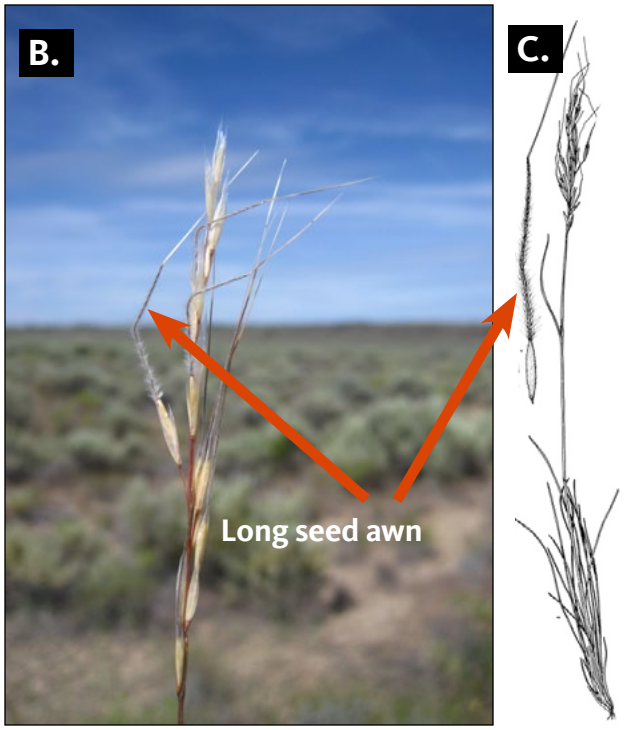


Illustration: Cindy Roché ©Utah State University

Figure 21. Photo and drawing highlighting the almost centimeter-long, see-through ligule. Inset: botanical illustration highlighting the long ligule.

Illustration: Cindy Roché ©Utah State University

Figure 20. (A) A mature Thurber's needlegrass with ripe seeds. (B) A close-up of the ripe seed head. (C, marked with arrows) Notice the twice bent long awns (red arrows). The first segment of the awns is fuzzy (pilose), and the tips are hair-free (glabrous).



Thurber's needlegrass *Achnatherum thurberianum* (Piper) Barkworth (continued)

Figure 22A. Side-by-side comparison of Idaho fescue's "wooden-backed chair"-like leaf collars and Thurber's needlegrass ligule, which is nearly translucent when the collars are not pulled away from the culm.

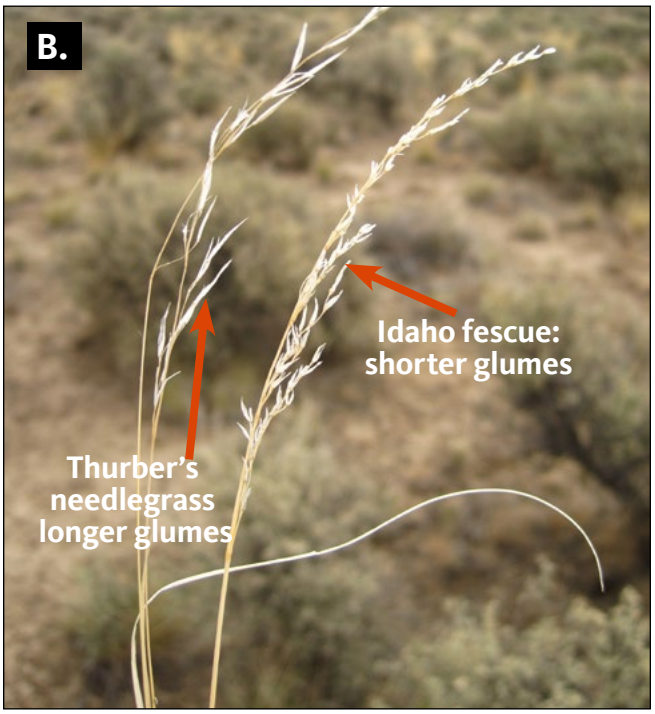


Figure 22B. The longer glumes on Thurber's needlegrass are visible on winter seed-head materials. In this photo, it is compared to the more petite and more numerous Idaho fescue glumes.

What to look for

Thurber's needlegrass has four characteristics that distinguish it from Idaho fescue:

- It has distinctive, long ligules that appear nearly translucent until gently pulled back (Figure 21, page 20).
- Its leaf collars are not at a right angle (Figure 22A) like Idaho fescue's "wooden-back chair" leaf collars.
- It does not have black roots. Thurber's needlegrass roots are thick, fleshy and buff-colored (Figure 22C).
- The fine, tightly rolled leaves are stiff and sandpaper-like when rubbed tip to base.

Figure 22C. Comparison of Idaho fescue roots, a mixture of black, older roots and newer, creamy-white roots, and Thurber's needlegrass' buff-colored roots.

needle-and-thread grass

Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. *comata*

Needle-and-thread grass is a less common grass species in the northern Great Basin, but appears on many sites with bluebunch wheatgrass and Idaho fescue. It often indicates that the site has sandier soils. This plant may have growth habits similar to bluebunch wheatgrass, but the bunches tend to be looser, its leaves broader (Figure 24C), and the long ligules are distinct even in winter (Figure 23A). The seed awns are very long (4–8 inches), straight and often mature to a dark black (Figure 24A, B).

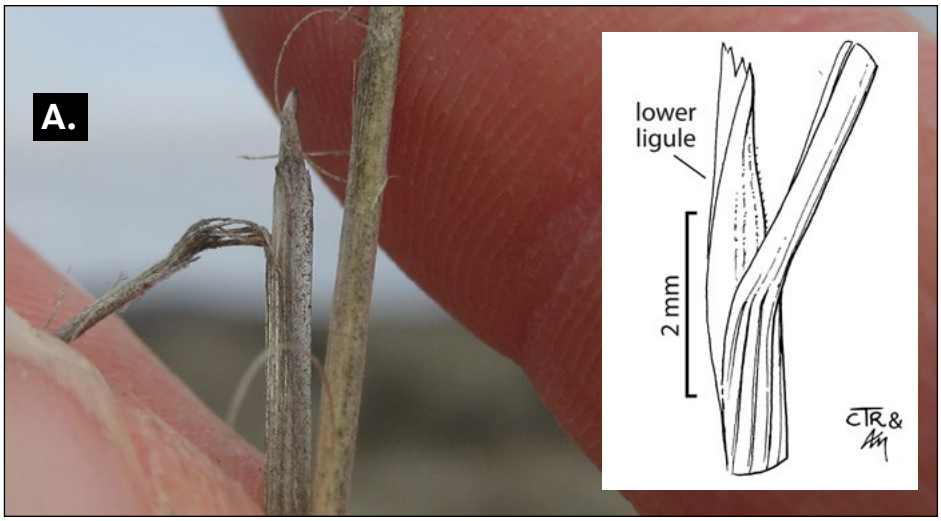


Illustration: Cindy Roché and Annaliese Miller © Utah State University.

Figure 23. (A) Needle-and-thread grass ligule on dead winter material and a botanical drawing of a large ligule. (B) Needle-and-thread grass leaf collars are on the left and Thurber's needlegrass is on the right.

Needle-and-thread grass compared to Thurber's needlegrass

Needle-and-thread grass has:

- Broader, flatter leaf — larger looser bunch
- Wider ligule — still very long, generally a bigger culm and leaf (Figure 23B).
- Seed awns are straight and longer by several inches.

Needle-and-thread grass compared to bluebunch wheatgrass

Needle-and-thread grass has:

- Longer, wider ligule, visible even in winter.
- No auricles at leaf collar.
- Seed heads are a loose panicle (not a spike like bluebunch wheatgrass, Figure 12A, page 12)

These differences would be evident even with dead winter materials.

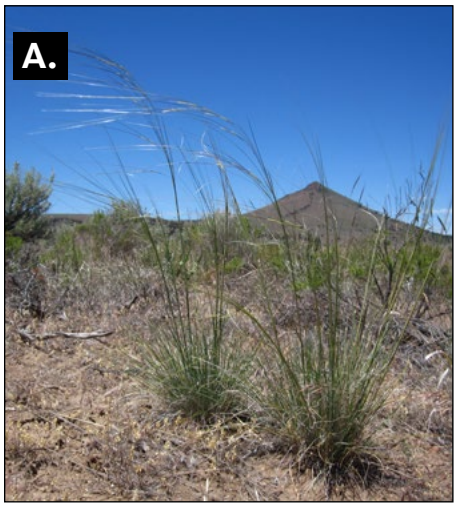


Illustration: Cindy Roché and Annaliese Miller, © Utah State University.

Figure 24. (A) Photo of needle-and-thread grass with ripe seed heads. Notice the loose panicle, which has open, repeated branching along the seed head. (B) A handful of seeds with very long black awns. (C) A botanical illustration of the entire plant with seed heads.

prairie Junegrass

Koeleria macrantha (Ledeb.) J.A. Schultes

Prairie Junegrass has distinctive seed heads evident through much of the year (Figure 25). New seed heads have a shimmery, reflective quality when held angled to the sun. This plant, without seed heads present, may be confused with bottlebrush squirreltail at first glance. However, the leaves and culms are thicker, fleshier and often have a yellow-orange tint near the tiller's base

The prairie Junegrass ligule is large, white, thick and rounded; the edges are scalloped and a bit ragged (Figure 26A). The dead material does not form corkscrews like bottlebrush squirreltail, and old, dense seed heads can be found most of the year. Be sure to look on the ground for old materials or on nearby plants for comparison.

Illustration of prairie Junegrass: Linda Ann Vorobik and Hana Pazdírková, © Utah State University

Figure 25. A photo of dormant prairie Junegrass with seed heads still evident and a lack of corkscrew old growth.

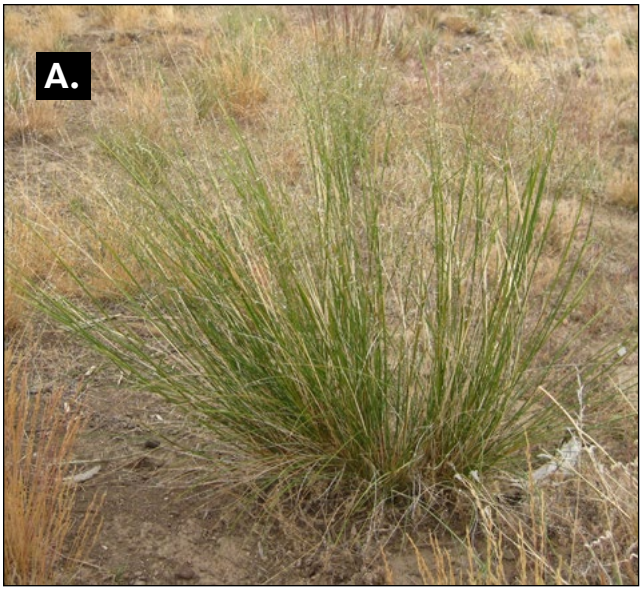
Figure 26. Close-up photos detailing the thick, white ligule, which is rounded with scalloped edges (A). Last year's seed head (B right) and a new seed head (B left).

Indian ricegrass

Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth

Indian ricegrass has a large, round, open bunch with stiff, round culms (Figure 27A). The leaves tend to roll into a tight round tube (Figure 28). The seed heads are distinctive, open, lacey panicles that can be found year-round (Figure 27B, C). The panicle's branched, tree-like seed-head structure is in sharp contrast to the spike structure found on bluebunch wheatgrass in Figure 12A, page 12. If the Indian ricegrass does not have seed heads, check the base of the plant for old seed heads knocked down by snow or wind.

Without any seed heads present, Indian ricegrass may look similar to prairie Junegrass. However, the leaves, sheaths and culms of Indian ricegrass are smoother, stiffer and rounder than prairie Junegrass. The ligule on Indian ricegrass is white, smooth-edged and half-moon-shaped (Figure 28). Prairie Junegrass's ligule is shorter and ragged (see also Figure 26A, page 23).



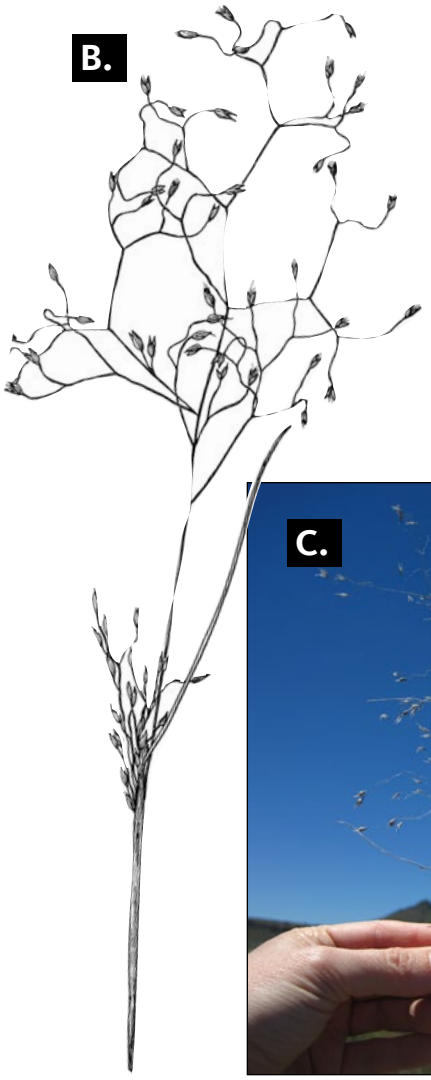


Illustration: Cindy Roche © Utah State University

Figure 27. (A) A large bunch of Indian ricegrass with last year's seed heads present. Both a botanical drawing (B) with seeds still intact and a photo of an old, weathered panicle found in early spring (C) show the details of the distinctive open panicle on the Indian ricegrass.

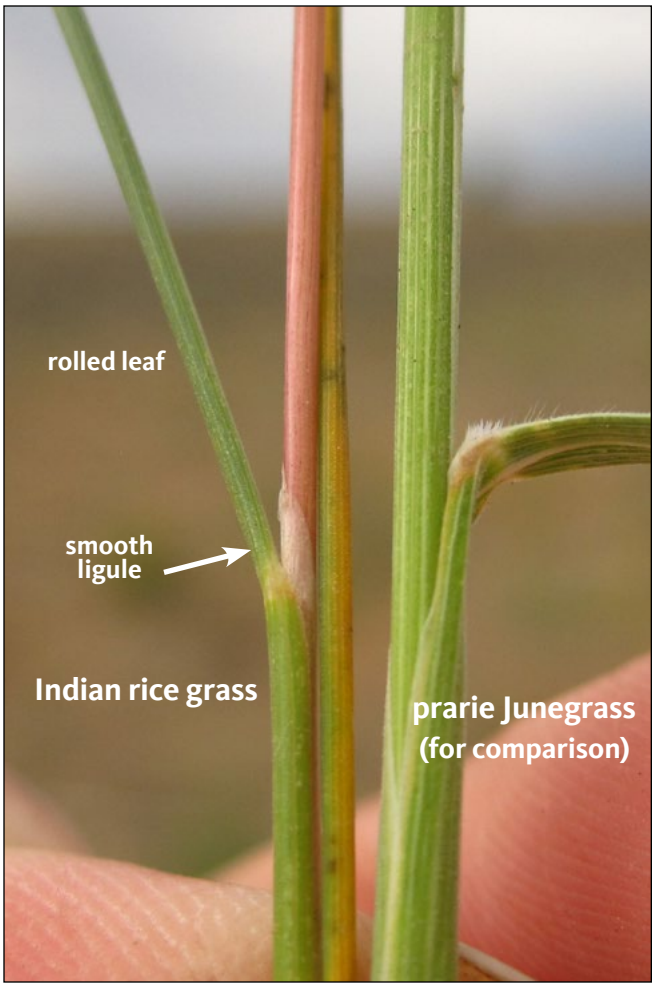
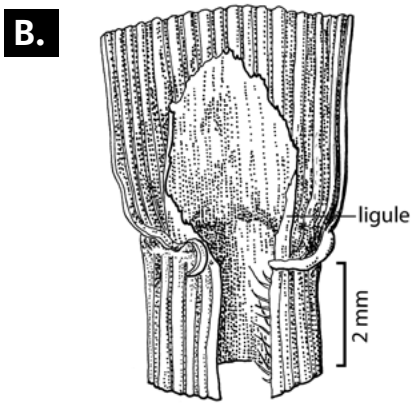


Figure 28. Close up of Indian ricegrass (left) and prairie Junegrass (right) ligules. Indian ricegrass is longer, smoother and rounder than prairie Junegrass. This photo also illustrates how the leaves on Indian ricegrass are often tightly rolled into tubes.

basin wildrye *Leymus cinereus* (Scribn. & Merr.) A. Löve

Figure 29. Example of a typical basin wildrye adult bunchgrass (A) with hand-long seed heads (B).

Basin wildrye is a large bunchgrass. The example in Figure 29A is 5 feet or taller. The seed heads are hand-length (Figure 29B). When size cannot be used as an identifying factor, such as when it is a seedling or after fire, then the nodes and ligule can help identify it. The ligule, like everything else on basin wildrye, is large (Figure 30A,B), and the leaves are much wider than the culm (Figure 30C). The area beneath the nodes (joints/knuckles found along the culm) are constricted and narrower than the culm (Figure 30D).



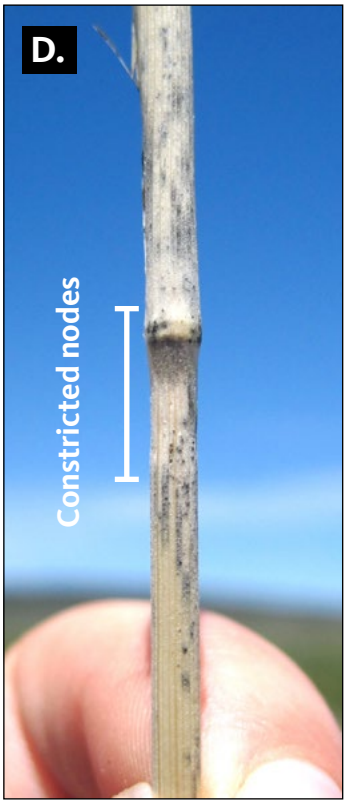


Illustration: Cindy Roche © Utah State University.

Figure 30. When you are unable to use the overall size as an identification factor, basin wildrye has a large, prominent ligule (A-C), leaf blades that balloon much wider than the culm (C) and culms with constricted regions below the nodes (D). It is shown here on a winter culm.

Sandberg bluegrass *Poa secunda* J. Presl

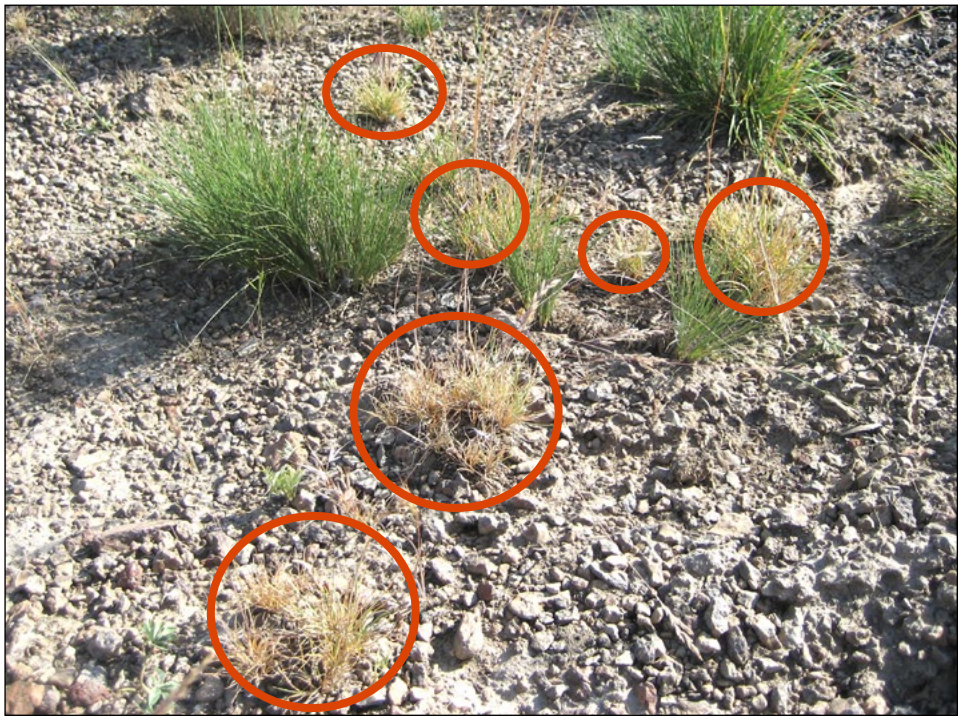


Illustration: Sandy Long © Utah State University

Figure 31. Sandberg bluegrass (circled) usually goes dormant for the summer just as other deep-rooted bunchgrasses are starting to form seed heads. The illustration details Sandberg bluegrass.

Sandberg bluegrass is the most common shallow-rooted perennial grass in the northern Great Basin. It grows in short (2- to 4-inch tall), tight bunches that often form pedestals. It is the first perennial bunchgrass to grow in spring and the first to turn brown and drop seed in summer (Figure 31, see also Figure 3, page 6). Their leaf blades are typically flexible, smooth and folded down the center. You should look for the "railroad tracks" that are formed by two prominent veins at the center of each unfolded leaf (Figure 32A). The ligule is white, tent-shaped and easily visible without a hand lens. (Figure 32B).

In the northern Great Basin, this plant is famous for growing into and around the bases of larger, deep-rooted perennial grasses. It is common to see ripe Sandberg bluegrass seed heads emerging from the edge or center of a bottlebrush squirreltail or bluebunch wheatgrass that has just begun to green-up in spring.

Although not deep-rooted, these plants have extensive lateral roots that are effective at capturing rainfall from brief rain events. These spreading roots allow Sandberg bluegrass to stiffly compete with emerging native grass seedlings. In the northern Great Basin, Sandberg bluegrass is often separated from the deep-rooted bunchgrasses into a shallow-rooted bunchgrass functional group of its own.

Figure 32. (A) Two prominent midveins form "railroad tracks" down the center of the unfolded leaf. (B) White, tent-shaped ligule at the leaf collar. This image is of a small tuft of tillers removed from a larger bunch.

Annual grasses

Invasive annual cheatgrass, medusahead and ventenata, or North Africa grass, are increasingly common in the northern Great Basin and can be detrimental to native species. While many can identify them when seed heads are present, here are several ways to recognize these grass species throughout the year. See the Extension publication *Recognizing and Identifying Three Invasive Annual Grasses in the Great Basin Desert* (EM 9188) at catalog.extension.oregonstate.edu/em9188 for more information about identification and control of these species.

cheatgrass *Bromus tectorum* L.

These annual grasses can be as small as a single tiller, can form tight mats, or can be as large as some perennial grasses when resources are plentiful. Seed heads, both fresh and dead, are easily identifiable. As an annual, cheatgrass invests heavily in reproduction, and the heavy seed heads will bow over under the weight (Figure 33E). Notice even the tiny individual in Figure 33D has a seed head.

Cheatgrass has a long, shaggy ligule that is noticeably larger than bluebunch wheatgrass, crested wheatgrass or bottlebrush squirreltail (Figure 33A, B). The leaf sheath is pubescent, meaning it has sporadic, long, thin hairs that are especially visible on adult plants. An entire plant may be covered in long hairs or may even appear velvety (Figure 33C). As cheatgrass enters the dormant stage, it often turns a purplish color, as seen in Figure 36A, page 29.

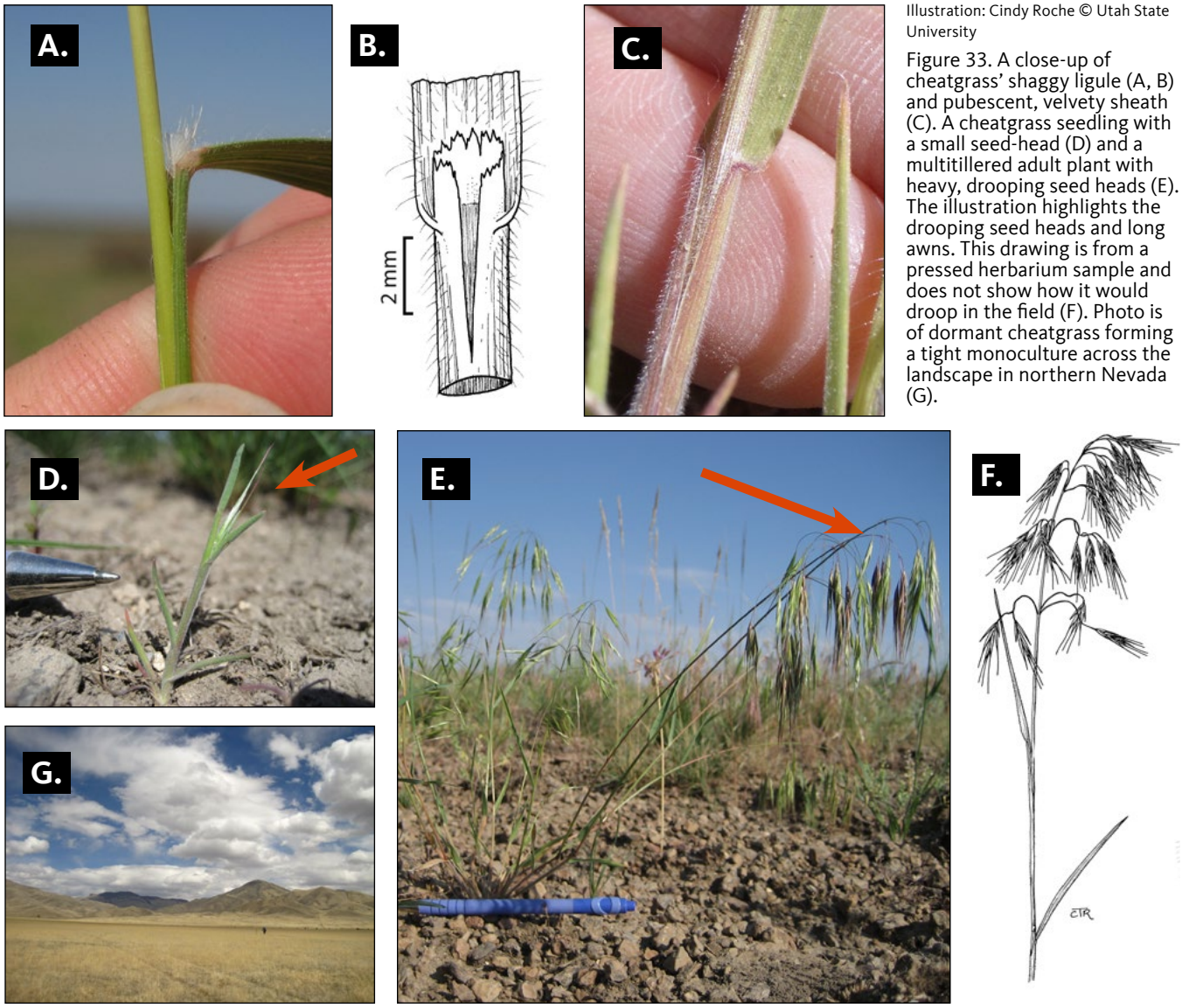


Illustration: Cindy Roche © Utah State University

Figure 33. A close-up of cheatgrass' shaggy ligule (A, B) and pubescent, velvety sheath (C). A cheatgrass seedling with a small seed-head (D) and a multitillered adult plant with heavy, drooping seed heads (E). The illustration highlights the drooping seed heads and long awns. This drawing is from a pressed herbarium sample and does not show how it would droop in the field (F). Photo is of dormant cheatgrass forming a tight monoculture across the landscape in northern Nevada (G).

medusahead

Taeniatherum caput-medusae (L.) Nevski

Medusahead is an aggressive invasive grass that thrives in disturbed sites. Like cheatgrass, medusahead is easy to identify when in large patches or when the seed heads are fully formed (Figure 34, 36. page 29). Seed heads form quickly and persist throughout the growing season, aiding identification. Medusahead can form large individuals with many tillers (Figure 34C) or solid mats that dominate a landscape (Figure 36B). In spring, these larger plants may be confused with bottlebrush squirreltail. But unlike bottlebrush squirreltail, medusahead seed heads do not break apart and tumble away (Figure 17, page 17, and Figure 35, page 29). Furthermore, medusahead seed heads have awn-like glumes that remain even after the seed has shattered. These empty seed heads remain into the winter.

When distinguishing bottlebrush squirreltail from medusahead, consider that bottlebrush squirreltail is a perennial with a deep root system and many generations of tillers. You would need a shovel to dig up a flowering/reproductive bottlebrush squirreltail bunch.

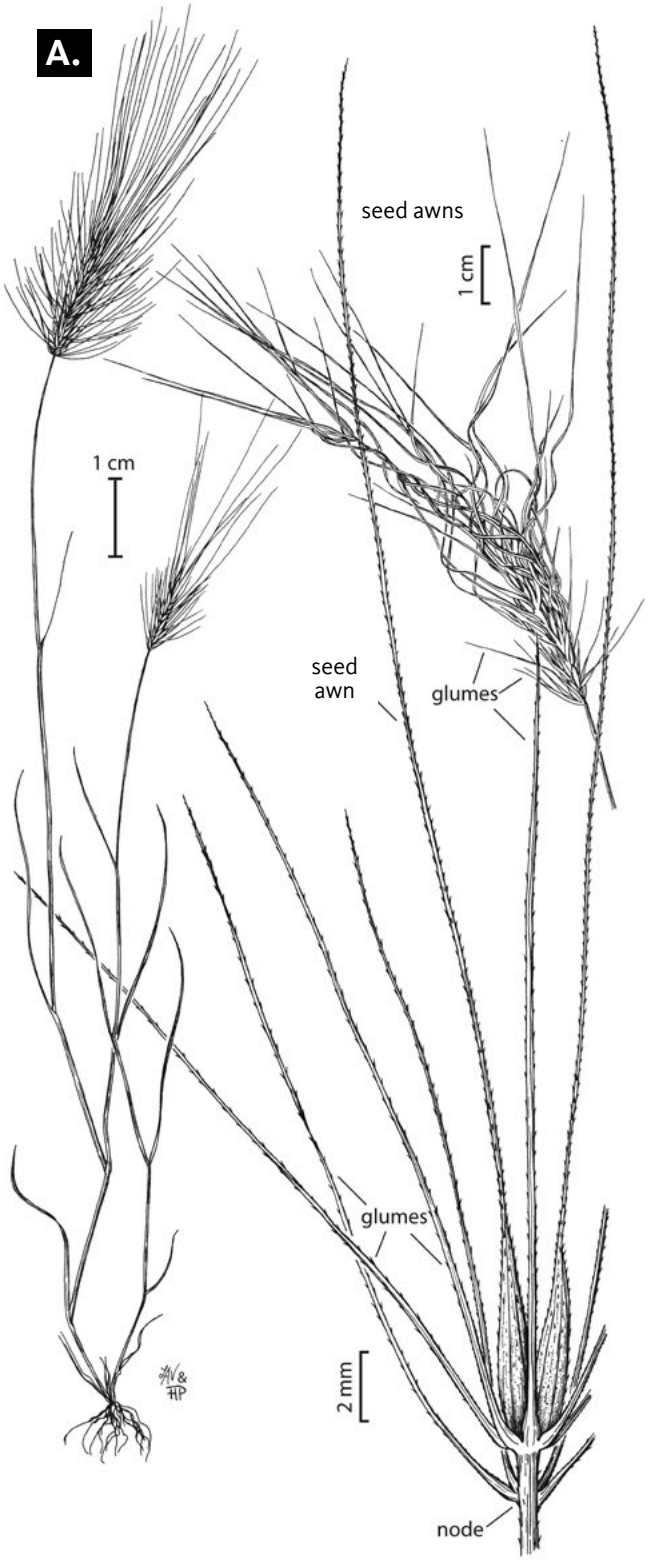


Illustration: Linda Ann Vorobik and Hana Pazdírková © Utah State University.

Figure 34. An illustration of medusahead's key identifying features (A). Notice the long, tangled seed awns (drawing on right) and the persistent, long glumes that remain after seeds have dried out and fallen from the plant, also known as seed "shatter" (bottom). Example of a very small individual with a single seed head (B), and a single plant with many tillers (C).

medusahead

Taeniatherum caput-medusae (L.) Nevski (continued)

Medusahead, however, is an annual that can be easily pulled from the ground by hand.

Large monocultures of medusahead plants forming a solid mat have a distinct light green color when growing and a pale straw color when dormant (Figure 36 A, B).

If you are trying to identify medusahead seedlings before they have produced seed heads, you can dig them up and look for the remainders of the seed coat and seed awn. This material will stay attached to the seedling for most of the year (Figure 36C). See the Extension publication *Recognizing and Identifying Three Invasive Annual Grasses in the Great Basin Desert* (EM 9188) at catalog.extension.oregonstate.edu/em9188 for more information about and control of this species.

Figure 35. Side-by-side comparisons of the spring seed heads from medusahead and bottlebrush squirreltail. The medusahead is more bristly and stiff because of the long, persistent glumes.

Figure 36. Photo of a monoculture of green, growing medusahead. There are a few purple, bowing/dropping seed heads from cheatgrass (A). A landscape is marked by reflective, straw-colored mats of dormant medusahead (B). A dug-up seedling shows remnants of seed coat and awn (red arrow) (C).

ventenata (North Africa grass) *Ventenata dubia* (Leers) Coss.

Ventenata is one of the newer invasive annual grasses in the northern Great Basin. Like medusahead, this invasive annual grass also has a bright green color in the spring (Figure 37D). If ripe seed heads are present, it can be identified by its open panicle and bent awns (Figure 37A). Notice how the early spring panicles have yet to mature and remain constricted (Figure 37B). As the seed heads flower and ripen, the panicle will open and more closely resemble the illustration.

Before seed head emergence, the visible, clear ligule helps with identification (Figure 37C). See also the Extension publication *Recognizing and Identifying Three Invasive Annual Grasses in the Great Basin Desert* (EM 9188) at catalog.extension.oregonstate.edu/em9188 for more information on and control of this species.

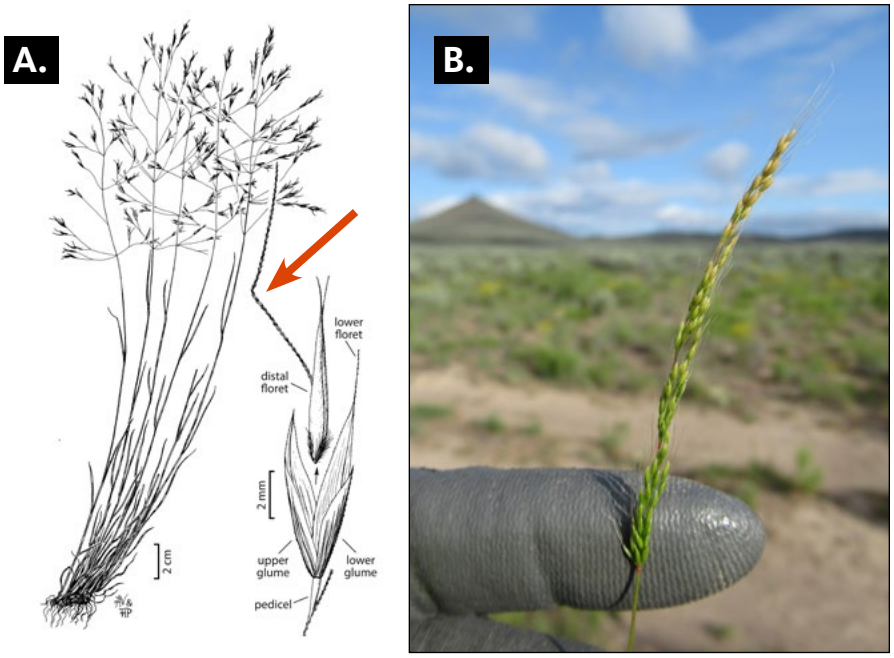
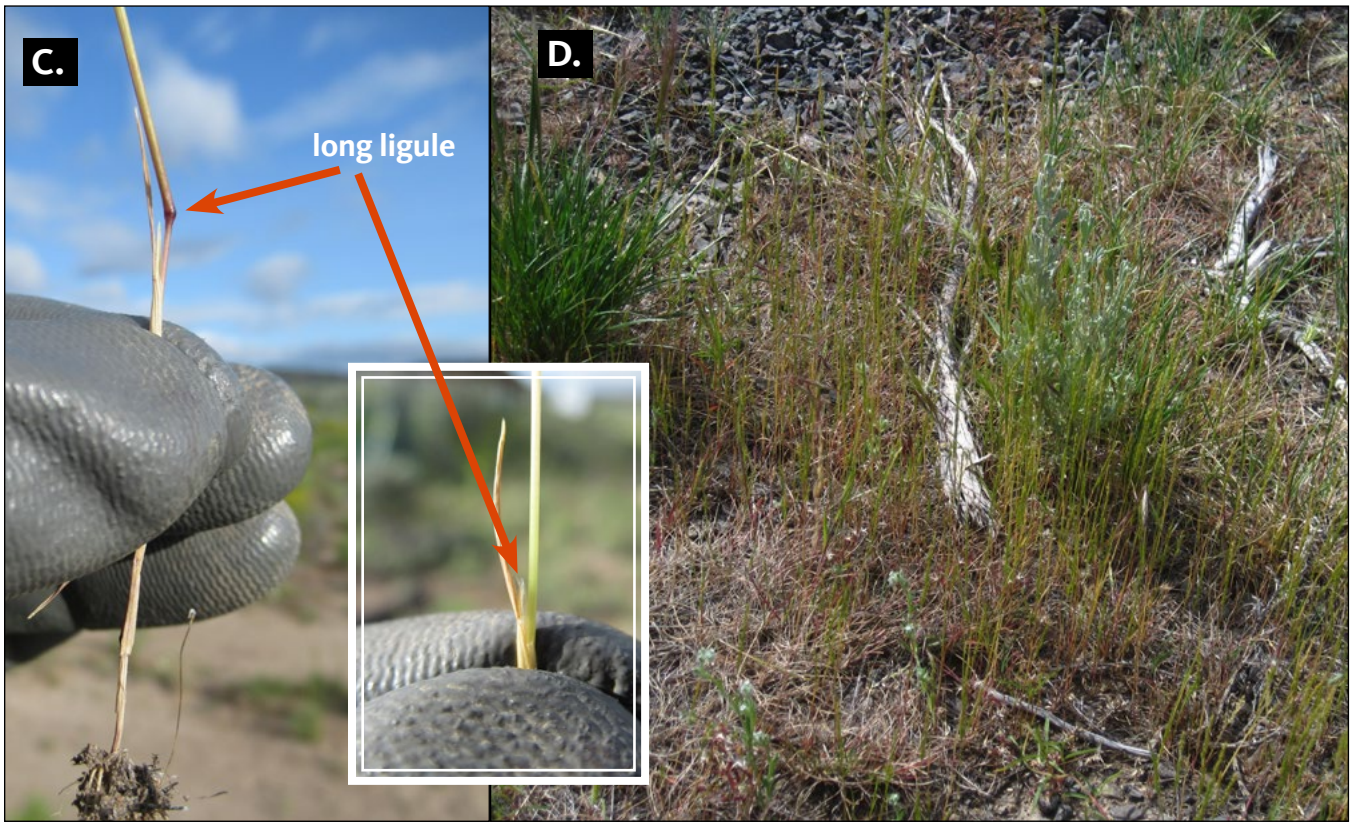


Illustration: Linda Ann Vorobik and Hana Pazdírková © Utah State University

Figure 37. (A) The illustration of ventenata highlights the bent awns (red arrow) and the seed head's open panicle structure. (B) The immature seed head is constricted and will open as it ripens. (C) The long ligule is visible in spring, as is the distinctive green color of the tillers. (D) This image shows bright green, newly formed seed heads dispersed among native vegetation. The bright green color of the ventenata is evident even when not in monoculture.



Tips: texture, shape and color

While you should never use color alone as the identifying characteristic, color, shape and texture can be used to quickly survey a site. Here you can see the different colors and textures of medusahead (bright green) and cheatgrass (purplish) growing together (top). Below are three patches (left to right) of bottlebrush squirreltail, bluebunch wheatgrass and crested wheatgrass. Each bunchgrass has its own distinct shape, texture and color that will be characteristic to each area surveyed.

Tips: seedling identification

Land managers who evaluate the success of restoration or drill-seeding project require accurate identification of grass seedlings. Seedlings with three or more leaves produce a leaf collar that has the same characteristics as the adult plants (Figure 38A).

If you can dig up a few sample plants, the seeds are often still attached to the seedlings. Figure 38B illustrates two excavated seedlings with the seed still intact. This technique is especially useful with cheatgrass and medusahead. These two annual grasses have distinct seeds and awns that lend themselves to quick identification. Sometimes you can see medusahead's long black awn sticking out of the dirt right next to the newly emerged seedling (Figure 36C, page 29).

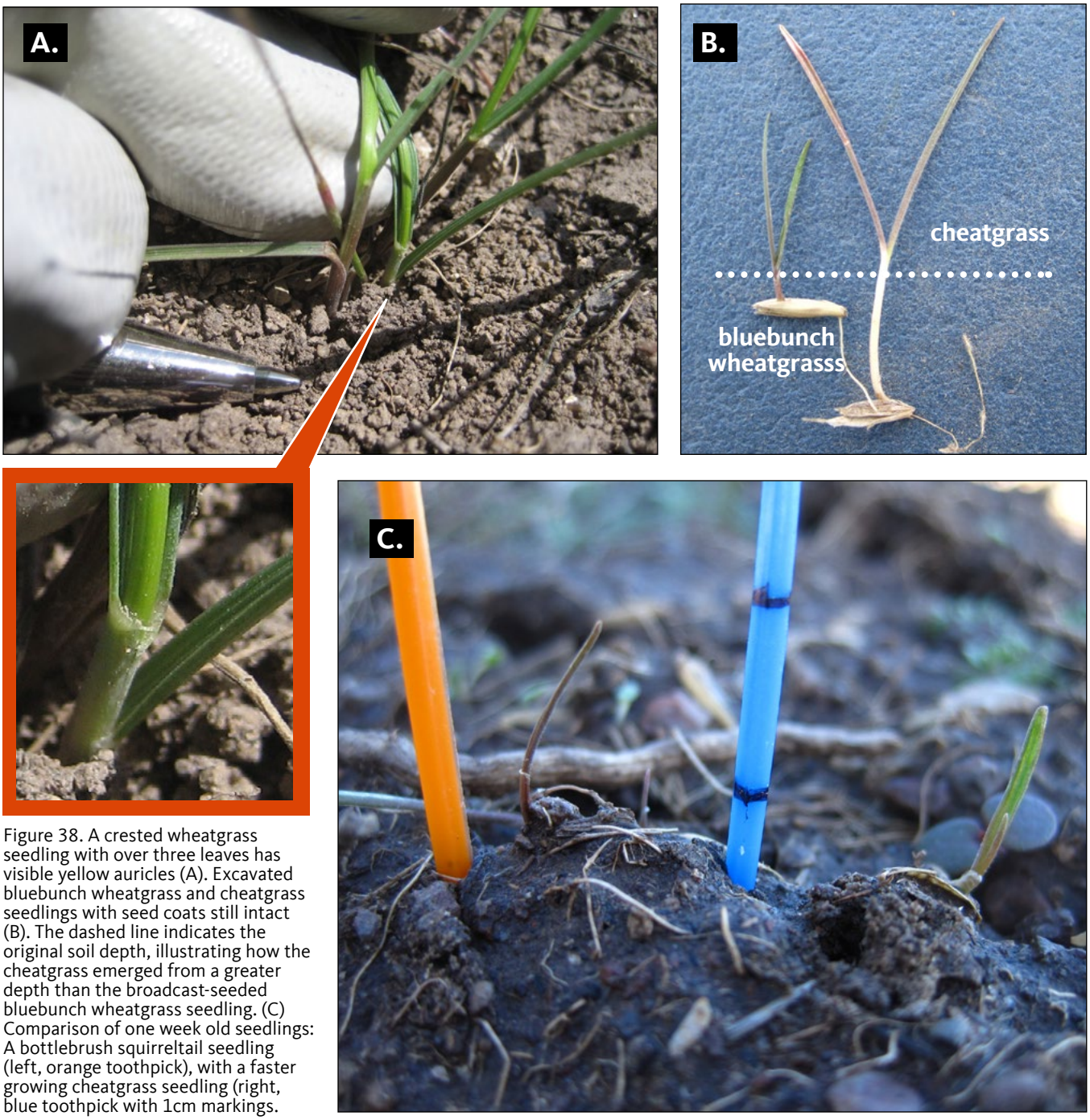


Figure 38. A crested wheatgrass seedling with over three leaves has visible yellow auricles (A). Excavated bluebunch wheatgrass and cheatgrass seedlings with seed coats still intact (B). The dashed line indicates the original soil depth, illustrating how the cheatgrass emerged from a greater depth than the broadcast-seeded bluebunch wheatgrass seedling. (C) Comparison of one week old seedlings: A bottlebrush squirreltail seedling (left, orange toothpick), with a faster growing cheatgrass seedling (right, blue toothpick with 1cm markings.

Growth rates and phenology (life stages, such as timing of flowering) can also be used to distinguish species. See the Extension publication *Bunchgrass Phenology: Using Growth Stages of Grasses as Adaptive Grazing Management Tools* (EM 9276) at catalog.extension.oregonstate.edu/em9276 for more information on the phenology of several common bunchgrasses native to the Great Basin.

Figure 39 shows two examples where growth rates can help with identification. In the top photo (Figure 39A), the circled seedling on the left is cheatgrass, which grows faster and is more robust than the bluebunch wheatgrass seedling on the right. The bottom photograph illustrates how crested wheatgrass often grows faster and more robustly than the bluebunch wheatgrass seedlings on the left (Figure 39B). Once you are familiar with the species in your seeding project, you will begin to recognize these differences in the field.

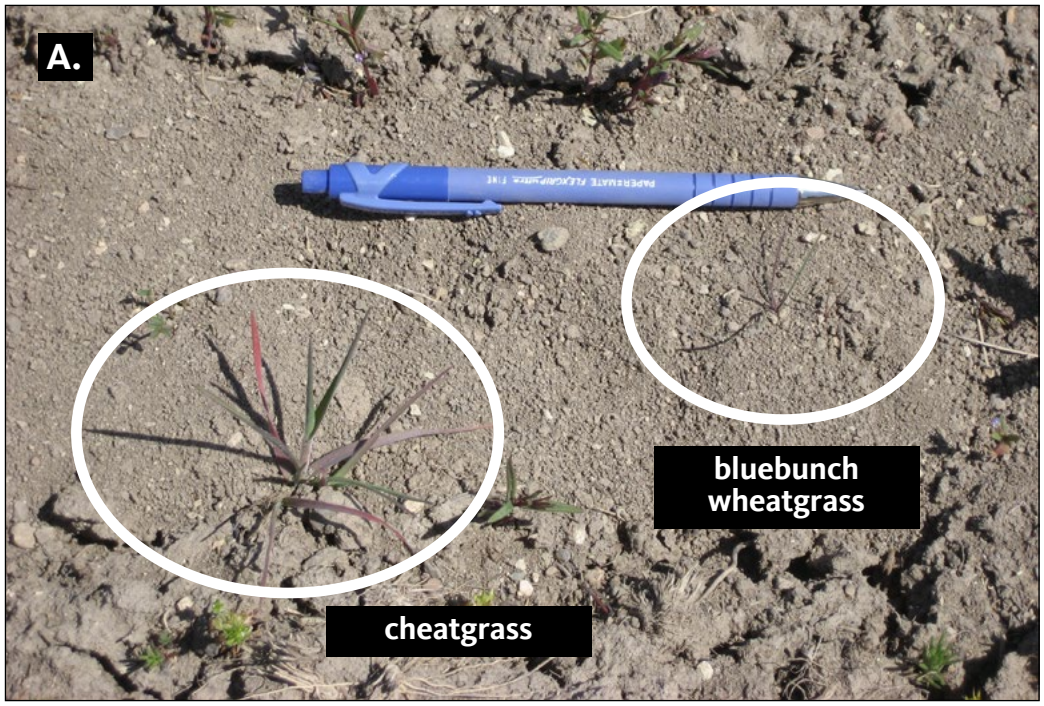


Figure 39. Two photographs illustrate the difference in growth rates and size of seedlings experiencing the same abiotic and biotic conditions on a site. In Figure 39A, cheatgrass emerges earlier and grows faster than the bluebunch wheatgrass seedling on the right. In Figure 39B, the crested wheatgrass on the right was drill-seeded at the same time as the bluebunch wheatgrass seedling. However, there is a noticeable difference in size and color that can aid in identification of the two species.

Tips: plant collection and working with a botanist

Whether you are collecting plant materials for a botanist to identify for a permanent collection at your agency or just to record the species found at a given site, you should follow several steps:

1. COLLECTION: Collect the entire plant, including roots, leaves and flowers (Figure 40). More than one example of a plant is helpful. If you're taking photos, try to anticipate what features a plant key will ask for and document those as clearly as possible. Take detailed photos, front and back, of any flowering structures or seeds if present. Photograph the entire plant, including roots, and take close-up photos of leaves, nodes, ligules, collars and other distinguishing features. Have a ruler or other known object to help with scale (Figure 40B). Most plant keys ask for size ranges of key features.
2. PRESERVING FOR LATER IDENTIFICATION: When collecting fresh plants, you should press your plants while in the field using a "cardboard-blotter paper-newspaper" sandwich (Figure 41). If you do not have one with you, place delicate samples between the pages of a glossy magazine, and store in a large resealable plastic bag. If possible, store the sample in a cooler until you can more permanently preserve it.

Helpful hints:

- Newspaper has antifungal properties and allows you to change the blotter papers without disturbing the plant.
- Sticky-note pads are helpful when arranging a plant for pressing. They can hold a plant in place and still allow the papers to breathe. It is also a handy place to write notes.

3. LOCATION, LOCATION, LOCATION: Plants are an expression of a site's history, soil and climate, but a plant sample is useless without a location description, date and habitat information. This data helps a consulting botanist identify the plant and makes the specimen more useful in a permanent collection. Figure 42 is an example of a herbarium label used around the world. Record your location with GPS if possible. If you are photo documenting, take a habitat photo at each collection site.

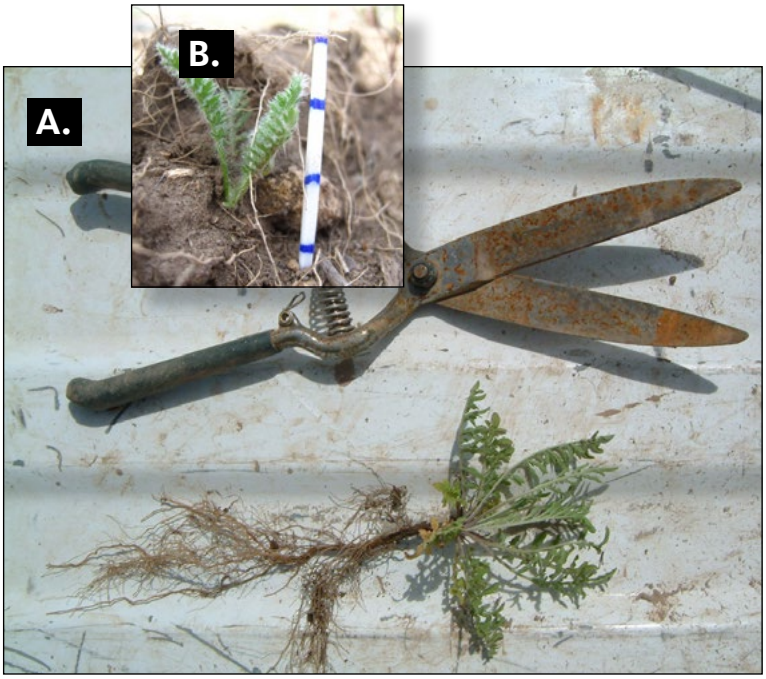


Figure 40. Photo of a plant collected with an intact root system (A) and a forb seedling with a toothpick marked with 1-centimeter increments (B). Both photos are examples of using known objects for scale.

Figure 41. Plant press using layers of cardboard (sometimes called spacers), blotter paper (reusable heavy-rag paper) and newspaper.

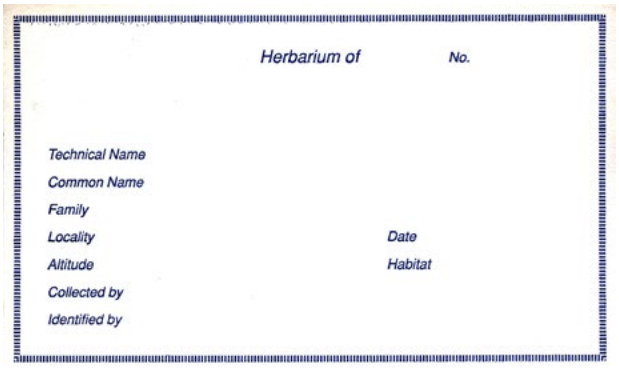
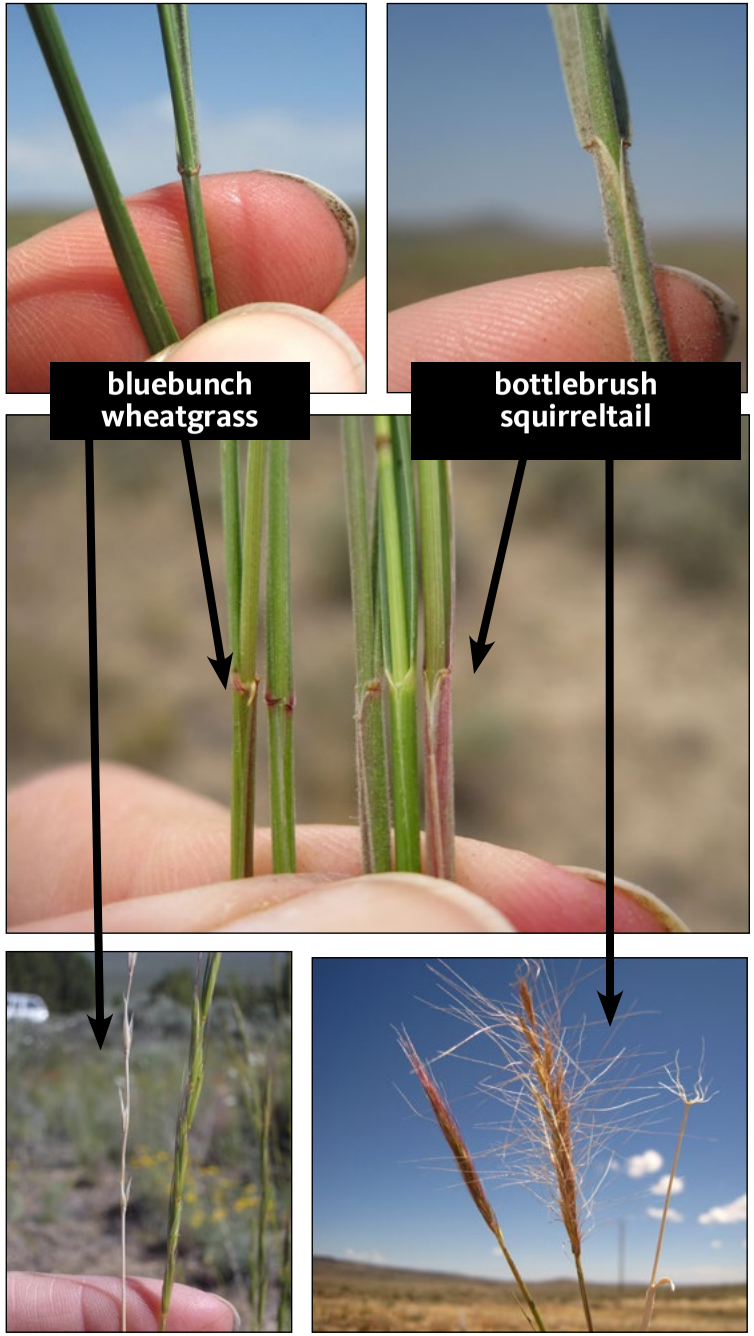
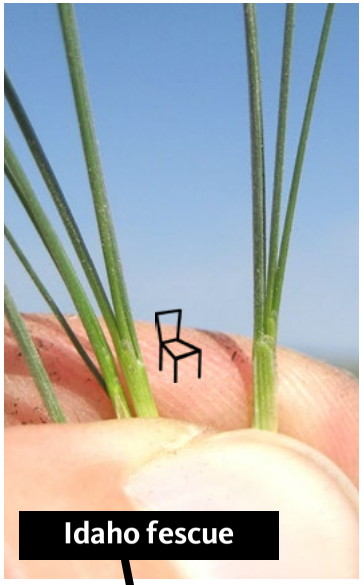


Figure 42: Photo of a standard herbarium label. Recording the date, location and habitat data helps place a collection in a larger context and on a changing landscape.

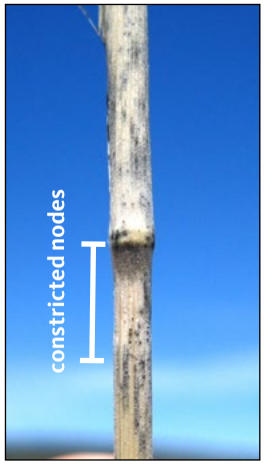
Perennial bunchgrass cheat sheet

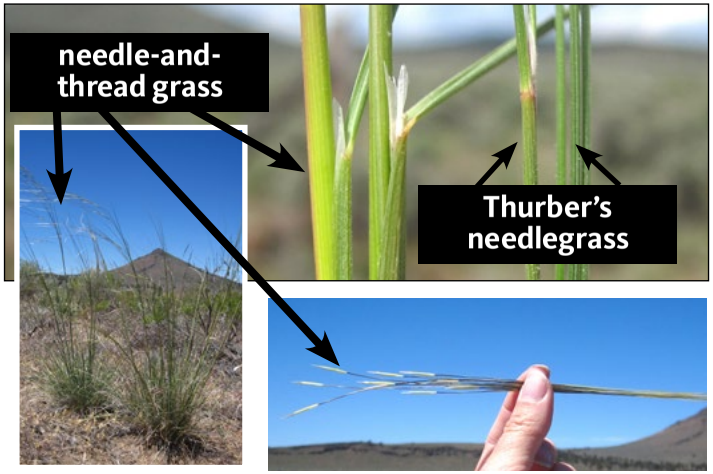




Photos by Lori L. Ziegenhagen, USDA-ARS

Perennial bunchgrass cheat sheet

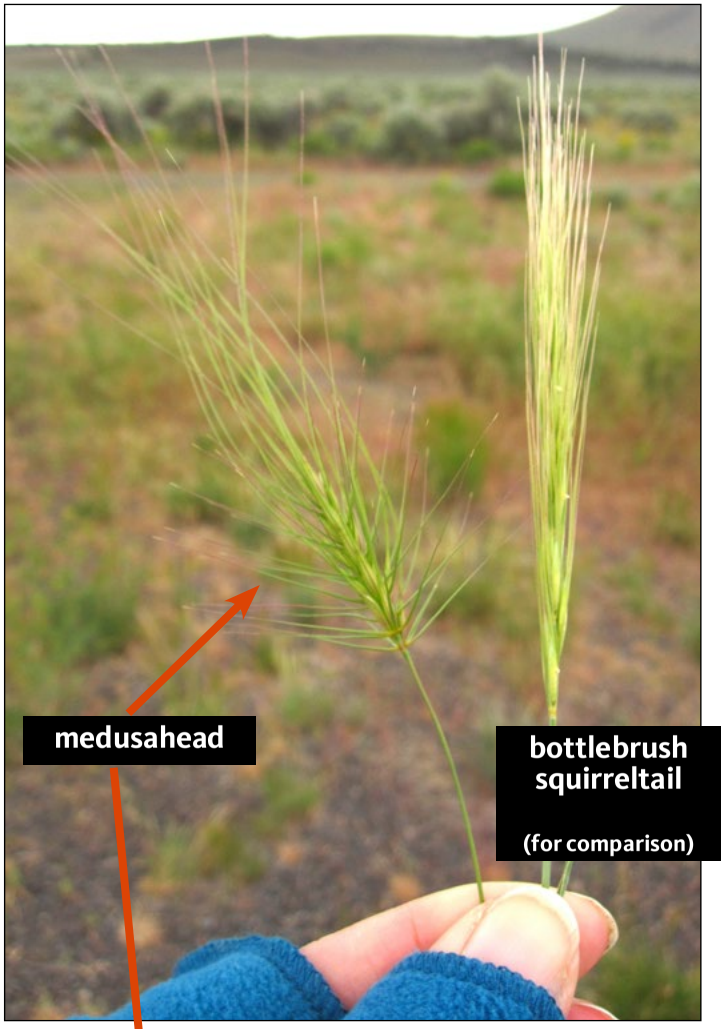




Photos by Lori L. Ziegenhagen,

USDA-ARS

Annual grass cheat sheet



Photos by Lori L. Ziegenhagen, USDA-ARS

Table of current and historic synonyms

Common name	Most current synonyms	Code	Historic synonyms	Historic code
basin wildrye	*Leymus cinereus* (Scribn. & Merr.) A. Löve	LECI4	*Elymus cinereus* Schibn. & Merr.	ELCI2
bluebunch wheatgrass	*Pseudoroegneria spicata* (Pursh) A. Löve ssp. *spicata*	PSSPS	*Agropyron spicatum* (Pursh) Scribn. & J.G. Sm.	AGSP
bottlebrush squirreltail	E*lymus elymoides* (Raf.) Swezey ssp. *elymoides*	ELELE	*Sitanion hystrix* (Nutt.) J.G. Sm.	SIHY
cheatgrass	*Bromus tectorum* L.	BRTE		
crested wheatgrass	*Agropyron cristatum* (L.) Gaertn.	AGCR		
Idaho fescue	*Festuca idahoensis* Elmer	FEID		
Indian ricegrass	*Achnatherum hymenoides* (Roemer & J.A. Schultes) Barkworth	ACHY	*Oryzopsis hymenoides* (Roemer & J.A. Schultes) Ricker ex Piper	ORHY
medusahead	*Taeniatherum caput-medusae* (L.) Nevski	TACA8	*Taeniatherum asperum* auct. non (Simonkai) Nevski	TAAS2
needle-and-thread grass	*Hesperostipa comata* (Trin. & Rupr.) Barkworth ssp. *comata*	HECOC8	*Stipa comata* Trin. & Rupr.	STCO4
prairie Junegrass	*Koeleria macrantha* (Ledeb.) J.A. Schultes	KOMA	*Koeleria cristata* auct. p.p. non Pers	KOCR
Sandberg bluegrass	*Poa secunda* J. Presl	POSE	*Poa sandbergii* Vasey	POSA12
Thurber needlegrass	*Achnatherum thurberianum* (Piper) Barkworth	ACTH7	*Stipa thurberiana* Piper	STTH2
ventenata, (North Africa grass)	*Ventenata dubia* (Leers) Coss.	VEDU		

Source: National PLANTS Database. USDA, NRCS. 2016. The PLANTS Database (http://plants.usda.gov, 3 February 2021). National Plant Data Team, Greensboro, NC 27401-4901 USA.

Glossary of terms

Annuals: plants that grow from seed and then die, completing their life cycle within a year.

Auricle: protrusions at the leaf collar's edge — similar to "hangnails" (Figure 11, page 11)

Bunchgrass: a grass that grows in a single bunch from one root system. Different growth form than a turf. (Figure 1, page 5).

Cotyledons: the first leaves to emerge from a seed, found at the base of the stem or tiller. Only visible on annual plants or perennial plants newly emerged from a seed (Figure 1, page 5).

Culm: the portion of a reproductive grass tiller that is the stiffer, stalk portion that supports the seed head.

Forbs: broad-leafed plants without significant woody tissue but which often have showy flowers.

Functional groups: categories of plants grouped together based on similar growth habits, physical features and roles within the plant community.

Glabrous: smooth, free from hairs or "fuzz."

Glumes: two modified leaves that surround the base of individual flowers on a grass seed head. (e.g., Figure 17, page 17, and Figure 22C, page 18).

Invasive species: a non-native species that spreads quickly or "invades" an area, causing harm or damage to the environment.

Leaf collar: the area where the leaf blade separates from the leaf sheath and the blade starts to grow. Key parts of the leaf collar are the sheath, the blade, the auricles and the ligule (Figure 11, page 11).

Leaf sheath: the leaf material that wraps around the stiff culms on reproductive tillers and other younger leaves on vegetative tillers. Leaf blades grow from the collar of the leaf sheath.

Ligule: an extra piece of tissue that forms at the junction of the leaf collar and the leaf blade, similar to a "cuticle" on a fingernail. Ligules take numerous forms, and can be smooth or shaggy, pointed or flat (Figure 11, page 11).

Nodes: joints or knuckles found along the culm (e.g., Figure 30D, page 25).

Pedestaled bunchgrass: a bunchgrass raised above the soil surface, sitting on an elevated platform held in place by its root system.

Perennials: plants that use energy stores to come back year after year.

Pilose: covered with many hairs, can appear "fuzzy" or "velvety."

Seed shatter (seed ripe): the plant stage following the reproductive stage in which seeds have fully developed, ripened and dried out, "shattering" and falling from the plant.

Reproductive stage: during the reproductive, or flowering, stage of the grass plant, culms and seed heads emerge from leaf sheaths, beginning reproduction. This is followed by seed development, and this stage ends once the seeds ripen and dry out.

Rhizome: a stem located underground that grows horizontally and periodically sends out aboveground tillers from nodes. It is this structure that gives some grass plants a "turf" growth form.

Seed awn: a stiff, hair-like strand that grows from the end of modified leaves that surround a grass seed (e.g., Figure 20C, page 20).

Seed head: the reproductive portion of a grass plant that develops seeds following flowering (Figure 10, page 10).

Seed head structure: panicle vs spike: panicle seed heads are open and branching, with a central stalk and seeds growing off of branches from the main stem (for exammple, Figure 22A). Spike-type seed heads have seeds that grow directly on the main stem of the seed head (for example, Figure 12A, page 12).

Spike Panicle

Tap root: a large root that grows straight down and is usually longer, thicker and straighter than other roots that grow laterally outward.

Tiller: the individual unit of a grass plant (Figure 10, page 10).

Turf: a mat consisting of grass tillers, rhizomes and roots. Different growth form than a bunchgrass.

Vegetative tiller: a grass tiller that will not produce a seed head, consists of only leaf sheaths and blades.

Vigor: the expression of a plant's vitality in response to its environment, including its size, growth rate and health.

Additional resources

Extension publications

Brummer, F., P. Schreder, G. Haskins, and J. Jaeger. 2018. *Recognizing and Identifying Three Invasive Annual Grasses in the Great Basin Desert*. EM 9188. catalog.extension.oregonstate.edu/em9188. Corvallis, OR: Oregon State University Extension Service.

Schroeder, V., and D. Johnson. 2019. *Bunchgrass Phenology: Using Growth Stages of Grasses as Adaptive Grazing Management Tools*. EM 9276, catalog.extension.oregonstate.edu/em9276. Corvallis, OR: Oregon State University Extension Service.

Schroeder, V., and D. Johnson. 2018. *Western Roots: Diving into a sagebrush sea of diversity*. PNW 714. catalog.extension.oregonstate.edu/pnw714. Pacific Northwest Extension, Oregon State University, University of Idaho, Washington State University.

Johnson, D. D. and K. W. Davies. 2012. *An introduction to using ecological site descriptions as a management tool*. CL598. In: J. R. Adams (Ed.). Cattle Producer's Library (3rd edition). University of Idaho, Moscow.

Dichotomous keys

Baldwin, B. G., Goldman, D. H., Keil, D. J., Patterson, R., and Rosatti, T. J. (Eds.). 2012. *The Jepson manual: vascular plants of California*. University of California Press.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. 1977. Intermountain flora: vascular plants of the Intermountain West. Academic Press, New York, New York, USA.

Harris, J. G., and M.W. Harris. 1994. *Plant identification terminology: an illustrated glossary*. Utah: Spring Lake Publishing.

Hitchcock, C. L., and A. Cronquist. 2018. *Flora of the Pacific Northwest: an illustrated manual*. University of Washington Press.

Mansfield, D. H. 2000. *Flora of Steens Mountain*. Oregon State University Press.

Meyers, S.C., T. Jaster, K. E. Mitchell, and L.K. Hardison, editors. 2015. *Flora of Oregon. Volume 1: Pteridophytes, Gymnosperms, and Monocots*. Botanical Research Institute of Texas Press.

Perryman, B. L., and Q.D. Skinner. 2007. *A Field Guide to Nevada Grasses*. Indigenous Rangeland Management Press.

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