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Plant Identification Guide for Natural Systems

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Proper plant identification is critical to successfully manage and/or restore natural and pasture systems. Natural systems include range, grasslands, wetlands, riparian areas and forest. Plant identification is important for the management of native plant species found on natural areas; forage species planted for pasture; and noxious, troublesome and common weeds. Plant identification is important to livestock producers for knowing the quality of forage species and to determine if potentially toxic plants are present. However, plant identification can be challenging. This publication will help you accurately identify plants using a field guide or by submitting a description of a plant for identification.

Plant Types

The first step in plant identification is determining the plant type. Plants are divided into groups that can be distinguished by specific characteristics. These groups are grasses, grass-like (sedges and rushes), forbs (broadleaf plants) and woody plants (shrubs and trees). See Figure 1.

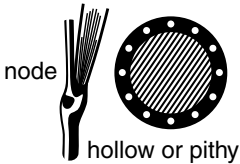

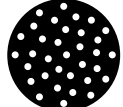
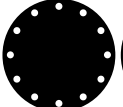

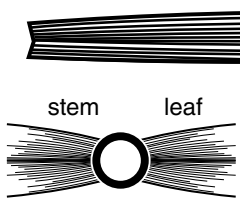
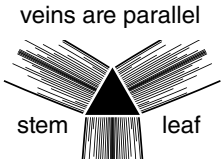
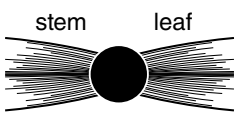
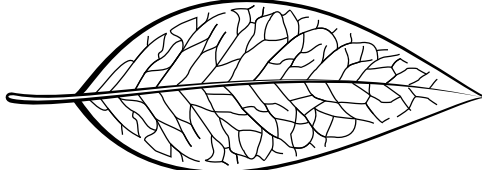




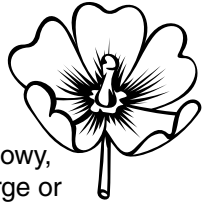
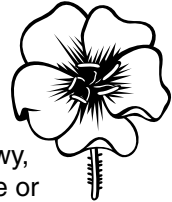
	Grasses	Grass-like		Forbs	Shrubs
Stems Cross-section	 <p>node hollow or pithy</p>	Sedges  <p>solid or pithy, not jointed</p>	Rushes  <p>solid or pithy</p>	 <p>solid or pithy</p>	 <p>growth rings solid</p>
Leaves and Leaf Ranking	 <p>stem leaf leaves on 2 sides</p>	 <p>veins are parallel stem leaf leaves on 3 sides</p>	 <p>stem leaf leaves on 2 sides</p>	 <p>veins are netted</p>	
Florets and Flowers	 <p>floret</p>	Sedges  <p>female flower</p>  <p>male flower</p>	 <p>modified flowers</p>	 <p>showy, large or small</p>	 <p>showy, large or small</p>

Figure 1. Distinguishing features of plant groups: grasses, grass-like, forbs and shrubs. Adapted from North American Wildland Plants: A Field Guide by James Stubbendieck, Stephan L. Hatch, and L.M. Landholt, by permission of the University of Nebraska Press. Copyright 2003 by the Board of Regents of the University of Nebraska.

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Grass stems are hollow or solid with nodes or joints. Leaf blades (the part of the leaf going away from the stem) have parallel veins and are opposite each other on two sides of the stem. The leaf blade is attached to the sheath wrapping around the stem starting at the node and working upward on the stem until it meets the leaf blade at the collar. Flowers are small and in spikelets and arranged in different patterns in the inflorescence (seed head).

Grass-like resemble grasses, but the stems of grass-like plants are typically solid or pithy. Grass-like include sedges and rushes. The stems of sedges are triangular, whereas the stems of rushes are round and do not have nodes. Sedge leaves have parallel veins and are on all three sides of the stem, creating a three-ranked leaf arrangement. The leaves of rushes have parallel veins and are attached opposite each other on two sides of the stem. Flowers are small and inconspicuous.

Forbs are herbaceous plants typically having solid stems and wide or broad leaves that typically have netted venation. Leaves are simple or compound and can be attached to the stem alternate, opposite or whorled. Flowers tend to be large with showy petals. Forbs include leguminous (nitrogen-fixing plants) and non-leguminous herbaceous plants.

The woody plant group is comprised of trees and shrubs. Woody plants have portions of the plant that are alive throughout the year, though they may be dormant. Leaves are typically broad with netted venation. Leaves are simple or compound and can be attached to the stem alternate, opposite or whorled. Flowers tend to be large with showy petals, but not all woody species have showy flowers, particularly coniferous species that reproduce by spores, not flowers.

Plant features

Being able to correctly identify and describe the various features of a plant is critical to accurately identifying a plant. All flowering (not conifers or Equisetum species) plants have stems, leaves and flowers. However, some features of the plant vary depending on the plant type and species.

Leaf structure

The leaves of all plant types are comprised of the blade, midrib and margin (Figure 2). The blade is the flattened part of the leaf. The midrib is the center of the leaf, and the margin is the edge of the leaf. The leaves of forbs, shrubs and trees may also have petioles, buds and stipules. The petiole is the stalk that attaches the leaf to the stem. Buds occur near the petiole and are where a new leaf begins. Stipules are spines or leaf-like growths at the base of the leaf. Not all plants have stipules, making them an identifying feature of some plants.

Leaf type

Leaves can be simple or compound (Figure 3). A simple leaf has an undivided leaf blade. All grasses and grass-like have simple leaves. A compound leaf is divided into small leaves called leaflets that each connect to the leaf axis (center). Pinnately compound leaves have two to many leaflets that are positioned opposite each other along the leaf axis. A pinnately compound leaf may or may not have a leaflet at the end of the leaf. Palmately compound leaves radiate from a central point, like the fingers off the palm of the hand.

Figure 2. Leaf structure¹

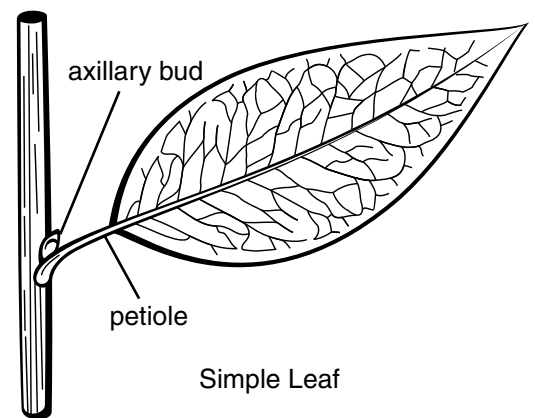


Figure 3. Leaf types¹

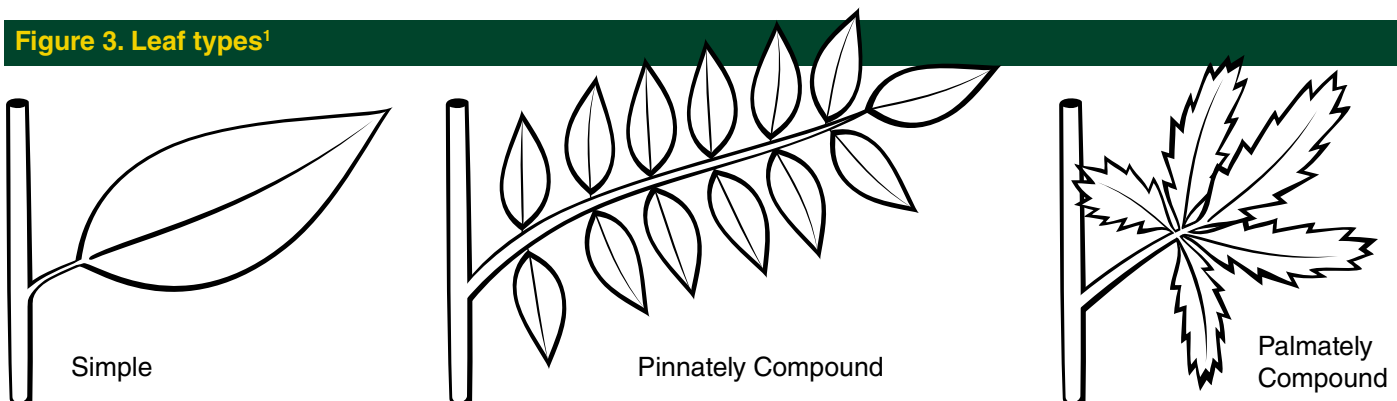
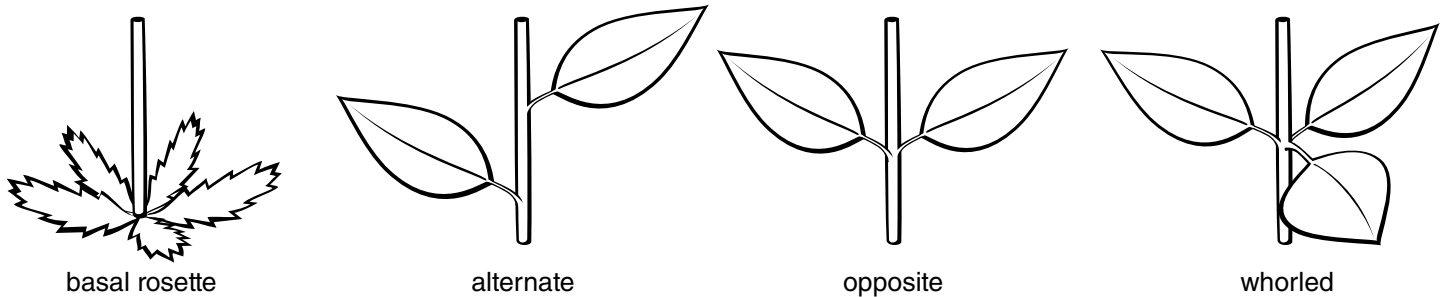


Figure 4. Leaf arrangements¹



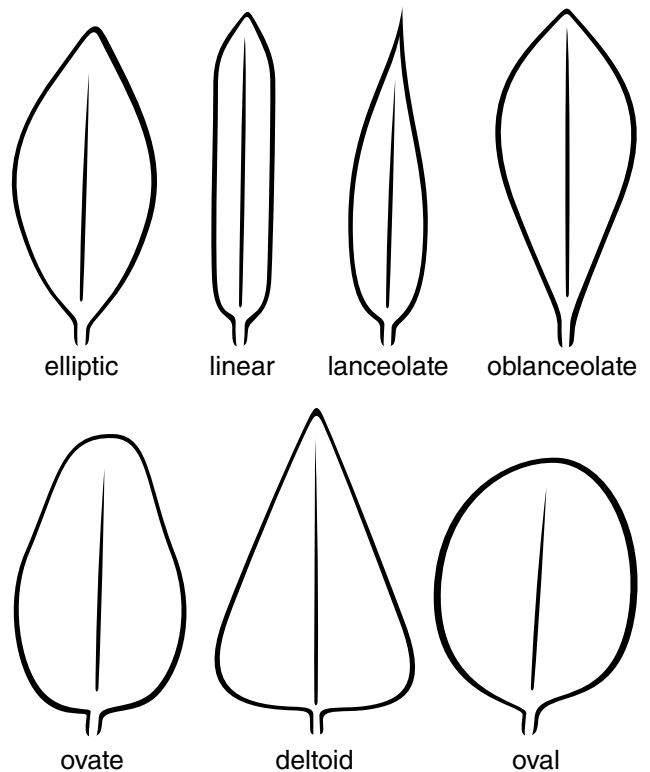
Leaf arrangement

Leaf arrangement refers to the position of the leaf on the stem. There are five basic leaf arrangements: alternate, opposite, whorled, basal (rosette) and fascicled (Figure 4). Alternate leaves alternate on each side of the stem in a flat plane. Opposite leaves grow from the same node on opposite sides of the stem in pairs. Three or more leaves connected to the same node are classified as whorled. Leaves occurring at ground level are called basal leaves. A group of basal leaves is called a basal rosette. Fascicled leaves are grouped in small, tight bundles, such as pine needles. Generally, a plant will have only one type of leaf arrangement; however, some forb and woody species may have two different leaf arrangements at different positions on the stem. For example, thistles support both basal and alternately arranged leaves.

Leaf shape

Leaf shape is another distinguishing feature of plants. There are many different leaf shapes. This guide only includes seven of the most common leaf shapes found in North Dakota (Figure 5). Elliptic leaves are broadest at the middle and narrow toward the ends. Linear leaves are long and narrow. Lanceolate leaves are lance-shaped, being broad at the end near the stem and coming to a point at the other end. Oblanceolate or spatulate are the opposite of lanceolate, being narrowest near the stem and broadening away from the stem. Ovate leaves are egg-shaped, being rounded but slightly broader at the end near the stem. Oval leaves are round to oval-shaped and do not come to a tip. Deltoid or cordate leaves are triangular with the broadest part near the stem and coming to a point at the leaf tip.

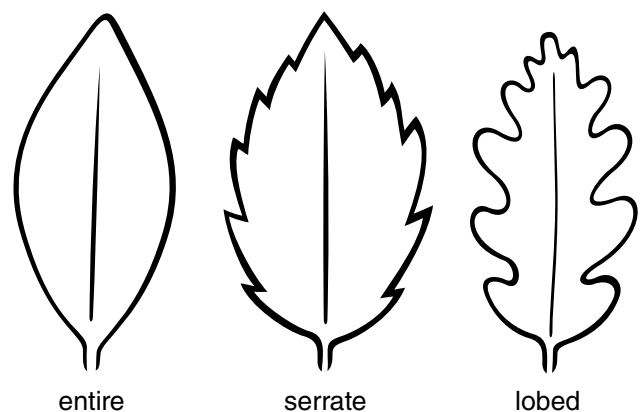
Figure 5. Common leaf shapes¹



Leaf margin

The leaf margin or edge is another feature aiding in plant identification. There are many types of leaf margins. This guide only includes three of the most common leaf margins (Figure 6). Entire margins are smooth. Margins that are toothed are either serrate (teeth pointing toward the tip of the leaf) or dentate (teeth squarish and pointing outward from the margin) and can extend the complete margin or just a portion. For example, the leaf margin of alfalfa is serrated at the tip, whereas, the leaf margin of sweet clover is serrated around the entire margin. Leaves with lobed margins have indentations that cut inward toward the midvein of the leaf. Leaves with lobed margins can be slightly to deeply lobed (going to the midvein of the leaf blade, occasionally referred to as "dissected").

Figure 6. Common leaf margins¹



Flowering Forbs, Shrubs and Trees

When present, the flowers of forbs, shrubs and trees can greatly aid in identification. However, flowers are only present during a portion of the growing season, causing plants to be identified in the vegetative stage, which depends on the plant features described above. See Figure 7.

The outermost and lowest whorl of a flower is comprised of leaf-like structures called sepals. Together the individual sepals form the calyx, protecting the bud. Generally, sepals are green but can be colorful. The next whorl includes the petals, which together form the corolla and usually have the most color. Some plants don't have petals or sepals but just one undifferentiated whorl. These unidentifiable petal-like structures are called tepals. The shape, size, color and number of petals are different for each species.

The stamen is the male reproductive organ consisting of an anther that bears the pollen and a filament, the thread-like structure supporting the anther. The number and shape of stamens can help identify plant species. The pistil is the female reproductive organ consisting of the stigma, style and ovary. Some flowers have multiple stigmas. Thus, the number of stigmas can aid in identification. Some flowers have leaf or scale-like structures surrounding the base of the flower called bracts.

A single flower having male and female parts is considered a perfect flower. Flowers can have just male parts while flowers on the same plant may have only female parts. These plants are called monoecious. It is also possible for the entire plant to have just male parts and other plants have just female parts. These types of flowers are called dioecious. Knowing this can be extremely helpful in identifying some plant species.

Flower shapes

Flower shape is another distinguishing feature of plants. There are many different flower shapes, and this guide includes five of the most common flower shapes found in North Dakota (Figure 8).

Figure 8. Flower shapes¹

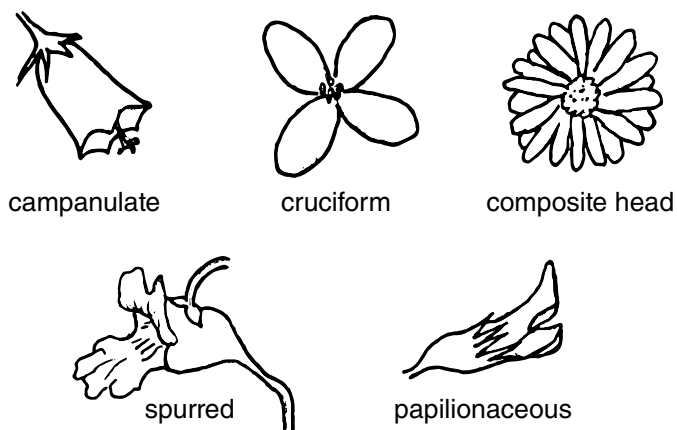
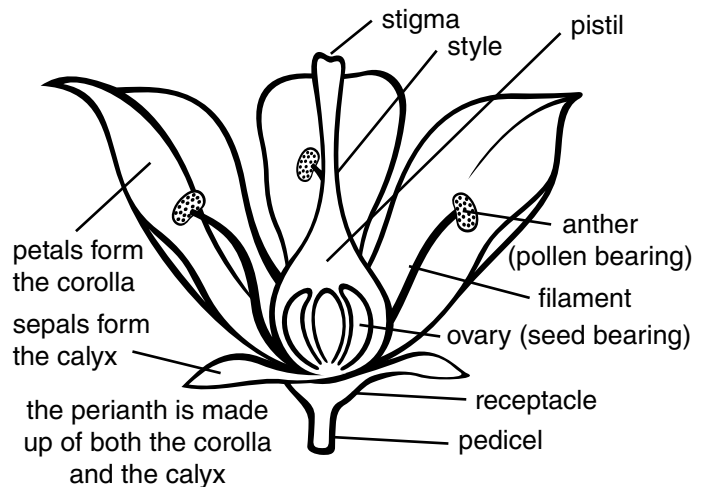


Figure 7. The flower (NDSU illustration)

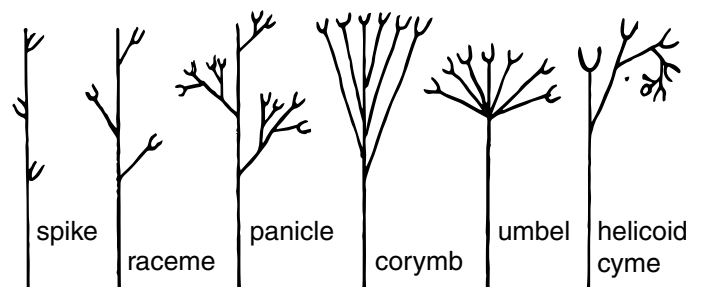


Inflorescence

The specific arrangement of flowers is called the inflorescence. The shape of the inflorescence can vary. Some of the most common shapes include spike, raceme, panicle, corymb, simple or compound umbel, and helicoid cyme (Figure 9). On a spike, the flower is attached directly to the rachis (flower stem). On a raceme, the flower is attached to the stem by a pedicel (short stalk). A panicle is when a pedicel is attached to another pedicel before it's attached to the rachis. On a corymb, the pedicels are different lengths, giving the flower a flat or rounded top. The pedicels of an umbel connect to a central point. An umbel has a flat or rounded top. A compound umbel has flower pedicels originating from one central point with a pedicel attaching that umbel to another central point. A cyme has a flat or rounded top. A helicoid cyme is coiled.

The flowers of spikes, racemes and panicles mature from the base upward, whereas the terminal flowers of a cyme are the first to mature.

Figure 9. Common flower inflorescences¹



Grasses

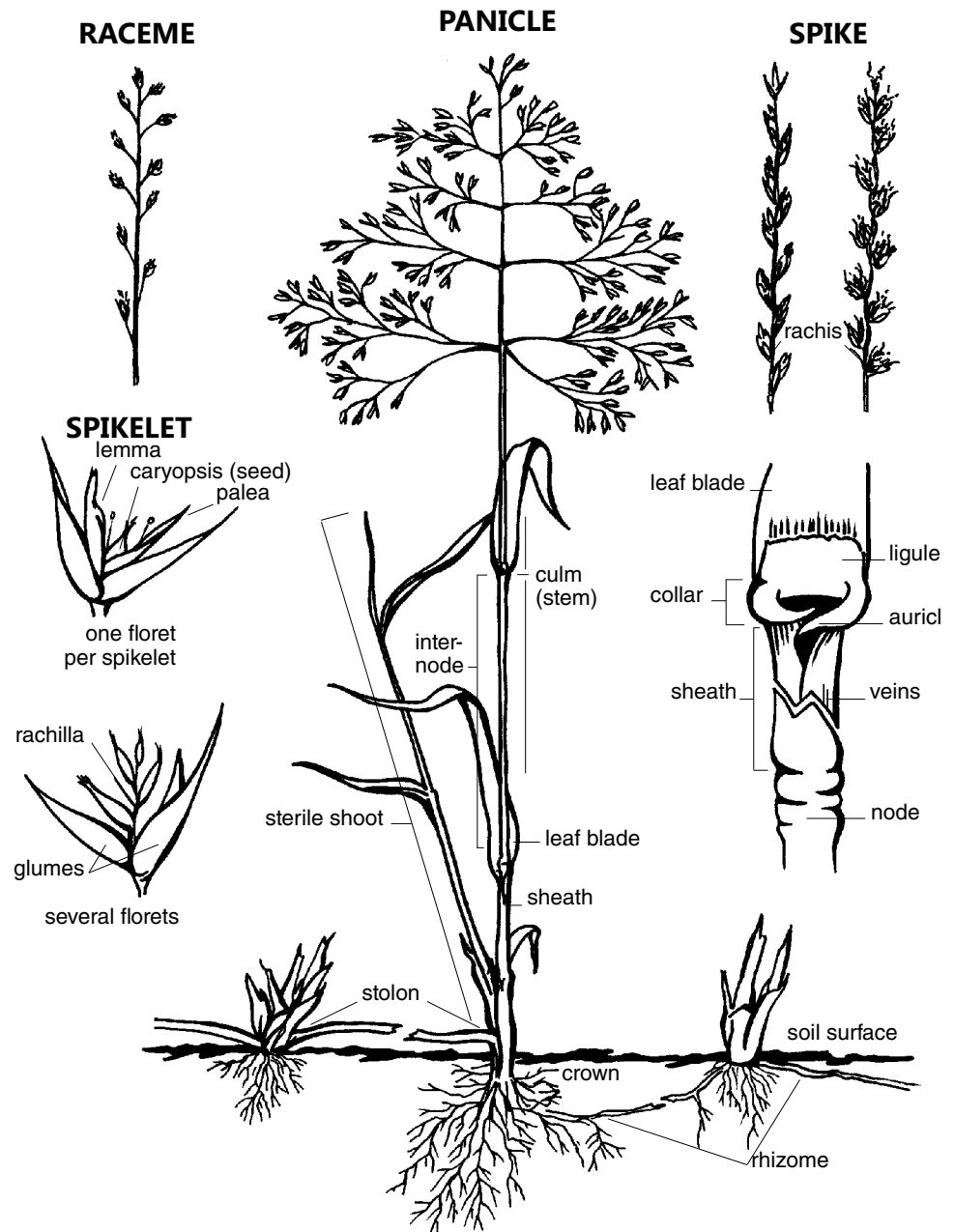
Grass identification is critical for assessing the condition of grassland ecosystems, including range and pasture. Grass identification is challenging, as the identifying characteristics are often small and generally not showy (Figure 10).

The leaf includes the sheath (wrapped around the stem) and the leaf blade. The sheath arises from a node. The blade diverges from the plant at the upper end of the sheath called the collar. Features associated with the sheath and blade, particularly the presence or absence of hairs, often are used to distinguish grass species. Stem growth can be described as a series of cylinders or tubes, one nested within the next. The stem (also known as the culm) elongates and the grass matures as a new internode extends from the node. The last internode is a flowering stem, which gives rise to the inflorescence that matures into the seed head. The basic unit of the inflorescence is the spikelet that includes two glumes and one or more florets. Because the inflorescence develops in the later stages of growth, leaves and associated structures are used for grass identification.

Leaf blade

The leaf blades of grasses have characteristics that can aid identification. Features to note are venation and prominence of the midrib. Western wheatgrass has veins that are prominent, and Indiangrass has a prominent midrib. The presence and absence of hairs on the leaf blade, length, density and location of hairs also can aid in grass identification. Some species, like sideoats grama, have hairs just on the leaf margin, while a different grass, switchgrass, has just a tuft of short hairs at the base of the leaf blade or hairs may be present only on the upper side of the leaf blade or on the upper and lower side of the leaf blade.

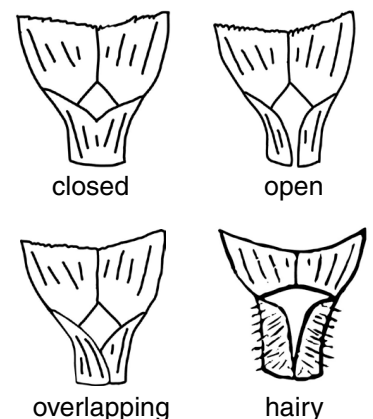
Figure 10. The grass plant (NDSU illustration)



Sheath

The sheath is the lower part of the grass leaf. Sheaths can be closed, open or overlapping (Figure 11). The margins of a closed sheath meet equally like a zipper on a coat and do not show the underlying stem. The margins of an open sheath do not meet and have a slit showing the underlying stem. The margins of an overlapping sheath create a V shape, similar to a shirt that is not buttoned to the top, showing the underlying stem. Another feature of the sheath is the presence or absence of hair.

Figure 11. Grass sheaths¹



Auricles

Auricles are the small growth that can occur on the sides of the junction between the leaf blade and sheath. Not all grasses have auricles. Auricles can be clasping, where they appear to be hugging the stem, or rounded (Figure 12).

Ligules

A ligule is a thin membrane or line of hairs on the interior of the collar (junction between the leaf blade and sheath) that is often important for identifying grasses (Figure 13). The size and shape of membranous ligules is variable and can be used to identifying grasses. For example, green needlegrass has a very short, blunt ligule, and needle-and-thread grass has a long, split ligule. Hairy ligules can have different lengths and density of hairs. Some grasses, such as green needlegrass, have both a membranous and hairy ligule.

Inflorescence

The shape of the inflorescence is another diagnostic feature that is useful for identification. The three most common types of inflorescence are the spike, raceme and panicle (Figure 10). A spike is unbranched with the spikelets attached directly to the rachis (inflorescence stem). A raceme is tightly branched with the spikelets attached to the rachis by a short stalk (pedicel). A panicle is organized with the spikelet attached with a stalk that is attached to another stalk that is then attached to the rachis. Panicles can have short stalks creating a tight panicle or long stalks with a very open and wide panicle.

The presence or absence of awns and the length and shape of awns can be helpful in identifying several grass species (Figure 14). An awn is a slender bristle that is attached to a part of the floret.

Figure 12. Grass auricles¹

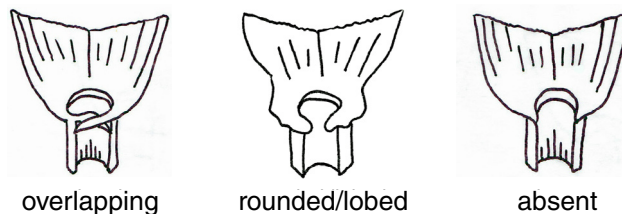


Figure 13. Grass ligules¹

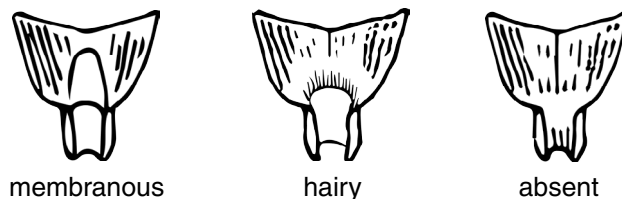
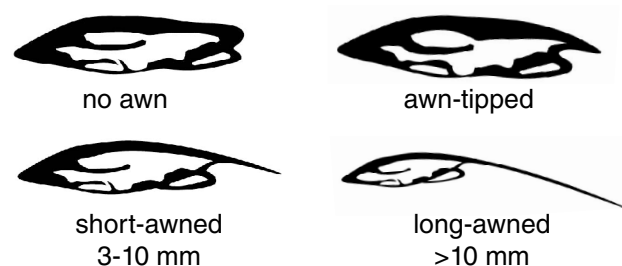


Figure 14. Grass seeds with and without awns¹



Documentation

Documentation of plant habitats, types and the features described above can aid in accurate plant identification. Document these features using the appropriate plant identification form.

Good quality photographs greatly aid in plant identification. Photographs must be in focus. When taking photographs, check your camera or phone settings to make sure you're using the highest resolution setting. Some phones may have a camera mode specifically for taking pictures of plants. Try to keep steady and take multiple shots at different angles of all the plant structures. Use the macro setting on your camera or phone for close-up photographs of plants and plant parts. Most phones have auto macro, so select the part of the plant that is to be the focus of the photograph.

These photographs should be collected to aid in identification.

1. Photograph of the plant showing habitat and site conditions.
2. Photograph of the whole plant. Try to isolate the photo to a single plant. It may be helpful to place a paper, cloth, or white or black board behind the plant to help isolate it from the surrounding plants. Add an item for scale, such as a coin or ruler.
3. Close-up photographs of plant parts, including leaves, stems, buds, bark, fruit and flowers. For grasses, this would include the sheath, ligule, auricles and inflorescence, if present.

If you need assistance with plant identification, submit the completed plant identification forms and corresponding photographs to your local NDSU Extension office. Providing this information makes the identification process easier and ensures you get a timely and accurately identified response.

Plant Identification Form for Grasses and Grass-like

Specimen # _____ Date Collected _____

Specimen Photographs _____

Name of person requesting ID _____

Phone number _____ Email _____

City _____ State _____ County _____

Specimen Information

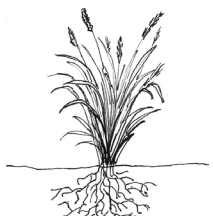
Growth Location/Habitat Type _____

(e.g., grassland, wetland, shelterbelt, roadside)

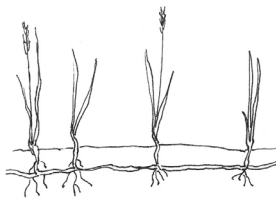
Land Use _____

(e.g., grazed, hayed, idle)

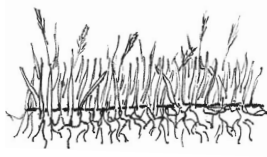
Plant height _____ **Growth form** (circle one)



bunch

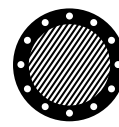


rhizomatous

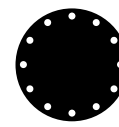


stoloniferous

Stem Type (circle one)



Round, hollow



Round, solid

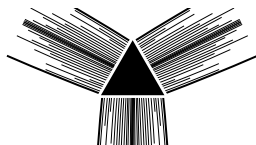


Triangle, solid

Leaf Position on Stem (circle one)



2-sides



3-sides

Sheath Type (circle one)



closed



open



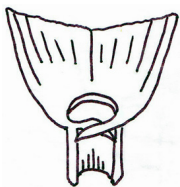
overlapping



hairy

Sheath Hairy (circle one) yes, no

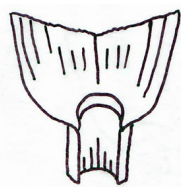
Auricles (circle one)



overlapping

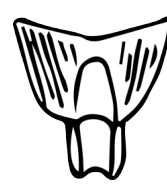


rounded/lobed

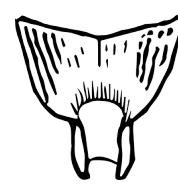


absent

Ligule (circle those that apply)



membranous



hairy



absent

Other notes about the auricles _____

Other notes about the ligule _____

Leaf and Stem Description (appearance, nodes, hairs) _____

Inflorescence and Floret Description (shape, color, presence of awns) _____

Additional Remarks _____

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Plant Identification Form for Forbs, Shrubs and Trees

Specimen # _____ Date Collected _____

Specimen Photographs _____

Name of person requesting ID _____

Phone number _____ Email _____

City _____ State _____ County _____

Specimen Information

Growth Location/Habitat Type _____

(e.g., grassland, wetland, shelterbelt, roadside)

Land Use _____

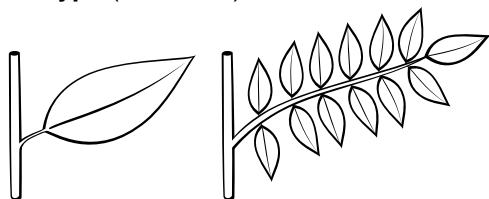
(e.g., grazed, hayed, idle)

Plant height _____ **Growth form** (circle one) herbaceous, shrub, tree, vine

Stem shape (circle one) round, square, flat

Leaf Type (circle one)

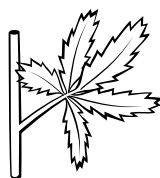
Leaf Arrangement (circle one)



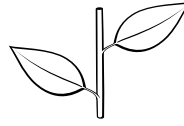
Simple

Pinnately Compound

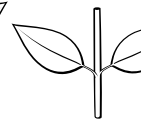
Palmately Compound



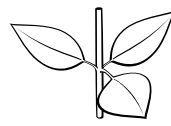
basal rosette



alternate



opposite



whorled

Leaf and Stem Description (leaf shape, leaf margins, hairs, color) _____

Flower and Inflorescence Description (shape, color, presence of bracts, type of inflorescence) _____

Additional Remarks _____

¹ All figures not credited previously are adapted from or used from Plant Identification Basics and Grass Identification Basics by Jane Mangold, Hilary Parkinson and Matt Lavin with permission from Montana State University Extension.

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