# Plants

**Chapter Goals**:
After completing this chapter, volunteers should be able to:

- Explain why it is important to be familiar with plant names.
- Describe the four major growth forms of plants.
- Describe the parts of a plant and a flower.
- Name the placements and arrangements of leaves and flowers.
- Explain what a noxious weed is and give some examples.

## Why Study the Natural History of Plants?

Humans have relied on plants for survival and pleasure for many centuries. Today, either directly or indirectly, our dependence on plants persists as almost everything we do is influenced by plants. The plant is the foundation of range, forest and aquatic ecosystems and the primary producer of foodstuffs for consumers - including range livestock industry and natural occurring wildlife or animal species. Knowledge of plants is fundamental to the Master Naturalist. This knowledge, when united with knowledge of soils and climatic conditions, forms the basis for the fundamental principles of ecological systems. Knowledge of plants is important, as plants provide a tool for monitoring the effects of environmental change.

The Clark's nutcracker and the white bark pine have evolved together and formed a symbiotic relationship. The bird gets food from the pine and the pine gets seed dispersal. Photo courtesy of Nadine Hergenrider, USFS.

Idaho is large, with extreme variation in environmental conditions. This variety provides growing conditions for about over 3,000 species of flowering plants that have been named. Idaho is diverse, both in elevation and in latitude, with northern boreal forests to southern sagebrush deserts. There are 56 plant species that are endemic, only growing in Idaho!

Wildlife and plants belong together. However, animals and plants do not necessarily exist for each other's convenience. In fact, it appears that plants will adapt in many different ways to avoid being

eaten. Plants will crawl under rocks, grow thorns, give off obnoxious odors, taste bad, grow inaccessibly high in the air or low to the ground, become unpalatable, change from high nutrient quality to low and produce toxic or poisonous chemicals.

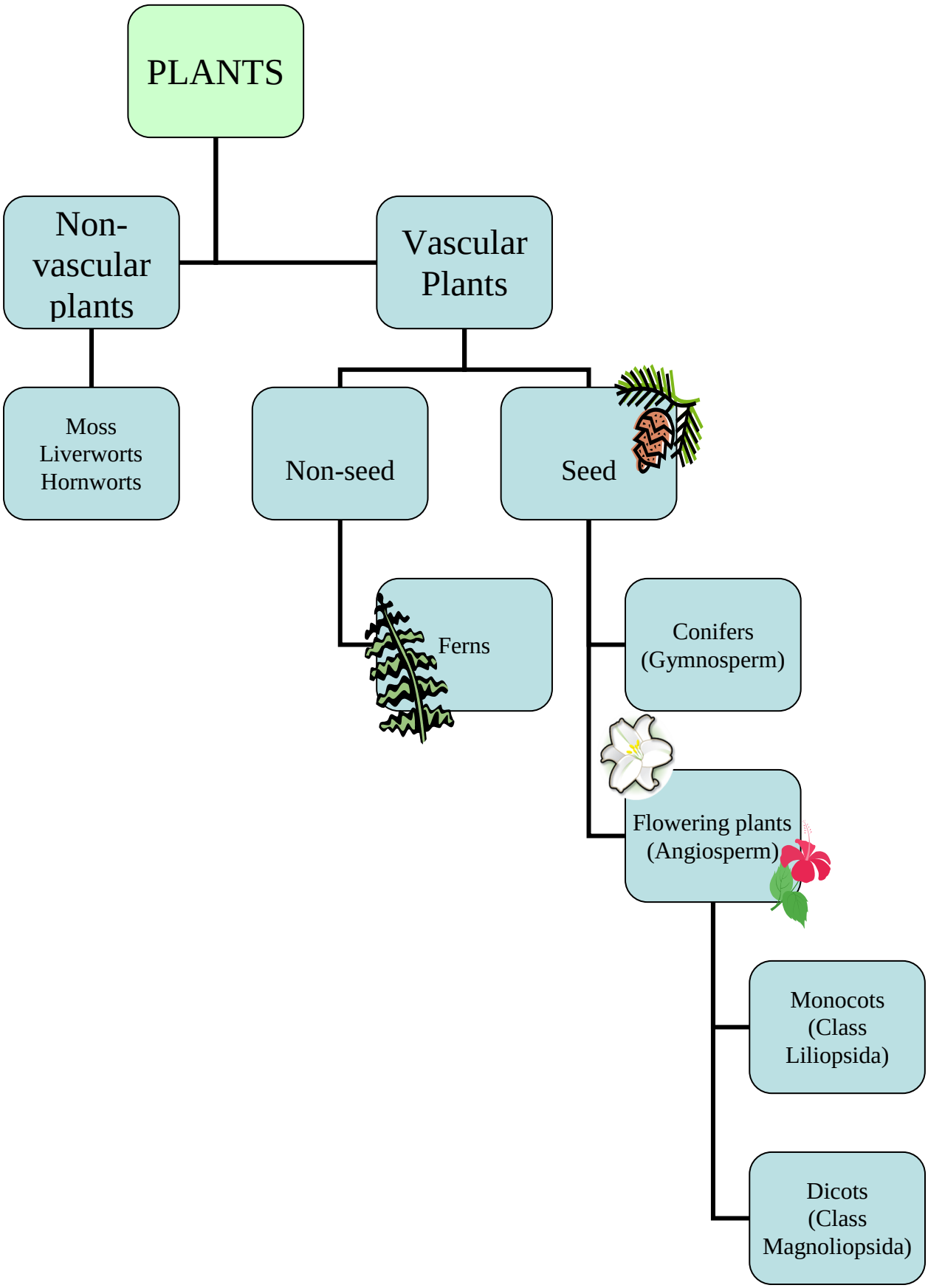
## Why Know the Names of plants?

"Aster" photo by Collen Moulton, IDFG

Some people know plants by sight or general appearance when encountered on the land. Many people have lived close to plants for a long time and have come to recognized, consciously or unconsciously, the many points that make plant species different from each other. Others have learned the value of a plat through experience with that plant. However, some plants are easier to distinguish than others are. Anyone can learn to identify a number of things, people, dogs, guns, cow breeds, or plants. It has always been one of our human characteristics to name things and organize them in some orderly fashion.

For example, take the experience of Farmer Brown had as he was watching "Ole Bessie," the cow eat. One day, he saw here take a bite of a plant and start to chew it. After about 30 seconds of chewing, "Ole Bessie" became very sick and died there in front of Farmer Brown. Farmer Brown became very excited over this event. He raced to the house to call his local veterinarian. He explained to the vet what had happened. The vet asked Farmer Brown what the name of the plant was and said he would look it up in his poisonous plant book. Farmer Brown scratched his head and admitted that he did not know the name of the plant. The vet, highly educated at the university and with lots of experience, asked him what the plant looked like. Farmer Brown told the vet that the plant was green, about a foot tall and had a yellow flower. The vet laughed and stated that Farmer Brown had just given the description of about 300 species of plants in Idaho. The moral of the story has emerged. We name plants to communicate with one another. We find the plant name becomes the communication medium whereby all information about the plant is attached. Without a name, we cannot look it up in a book and find all the information that others have written and discovered. Without the name and the attached information, we can only learn about plants through experience. This could be costly and detrimental.

Elephant Head (Pedicularis Groenlandica) is a common wildflower (herbaceous plan) in wet meadows in Idaho.


PLANTS
Non-vascular plants
Vascular Plants
Moss
Liverworts
Hornworts
Non-seed
Seed
Ferns
Conifers (Gymnosperm)
Flowering plants (Angiosperm)
Monocots (Class Liliopsida)
Dicots (Class Magnoliopsida)

# Plant Classification

Kingdom (plants)
Division (seed plants, non-seed plants)
Sub-division (angiosperms, gymnosperms)
Class (monocot, dicot)
Order
Family
Genus
Species
Variety

You will most likely be working with angiosperms and gymno sperms at the Family level or below. Some common families of angiosperms include:

- Rose family (Rosaceae) - Bitterbrush, cinquefoil, chokecherry, and strawberry.
- Sunflower family (Asteraceae)-Arrowleaf balsamroot, sagebrush, arnica, yarrow, and knapweed (weed).
- Lily Family (Liliaceae)-Camas lily, yellow bell, sego lily, wild onion.
- Pea Family (Fabaceae)-Lupine, milkvetch, clover.
- Buttercup family (Ranunculaceae) - Columbine, larkspur, buttercup, globeflower.
- Figwort family (Schrophulariaceae) - Penstamens, Indian paintbrush, elephant head.
- Willow family (Salicaceae) - Poplars, cottonwood trees, aspen.

The most common family of gymnosperms in Idaho is the Pine Family (Pinaceae) - Lodgepole pine, larch, ponderosa, spruces and firs.

A classic member of the lily family, this avalanche lily has three petals, three sepals and parallel leaf veins. Photo courtesy, Sara Focht, IDFG

All paintbrush species belong to the Schrophulariaceae family whose members have bilaterally symmetrical flowers, usually 4 stamens and produce a capsule fruit. Photo courtesy, Joshua Olson

## Plant Classification According to Structure

Another way to classify plants is to use growth structure or life cycle. There are two main categories of terrestrial plants based on their growth structures: 1) **herbaceous plants**, those that generally die back to the ground level at the end of every growing season; 2) **woody plants**, those that persist above the ground level during the winter season and have significant secondary woody growth in their stems. The herbaceous plants include:

- *Annuals* - plants that sprout, grow, go to seed, and die all in a single year.
- *Biennials* - plants that grow for two years before going to seed and dying).
- *Perennials* - plants that live for many years, generally flowering and seeding every year. The woody plants are all perennials.
- Herbaceous and woody plants are often subdivided into four general growth forms:
    - *Graminoids* are herbaceous grasses and grass-like plants, including the grasses (Poaceae), sedges (Cyperaceae), and rushes (Juncaceae). The graminoids have generally narrow leaves with parallel veins (blades) and flowers that are much reduced and possess chaffy bracts rather than the usual petals and sepals.
    - *Forbs* are non-graminoid herbaceous plants and include many flowering plants and ferns.
    - *Shrubs* are woody plants that are usually less than 5 meters (16 feet) tall and generally have multiple stems arising from or near the ground.
    - *Trees* are woody plants that are usually greater than 5 meters tall and have a single main stem (trunk).

## Structure of Plants

Plants are like people, each is an individual. Some may look alike; others do not. Each plant species has some part or parts which are different from all other plants. The majority of plants have some basic structures in common; those structures being roots, stems, leaves, and reproductive structures. The variations in those common structures are nearly endless.

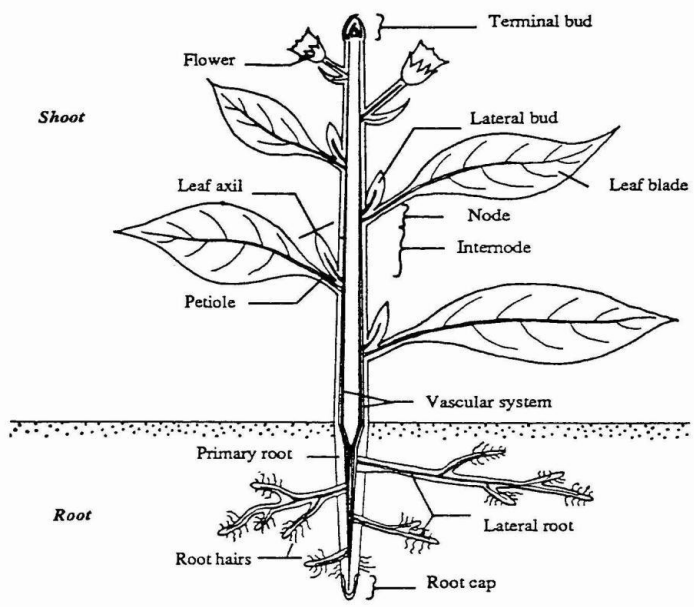



**Fig. 18. Parts of a vascular plant.**

## Roots

Roots often are not fully appreciated by those who study plants. Roots are under ground and go unnoticed, but they are as important as the showy above ground parts. Roots serve a variety of functions for plants. The most obvious function is to absorb water and minerals from the soil. The plant would die very quickly if it did not have these vital resources. Roots also secure the plant in place and provide structural strength to hold the above ground portions of the plant. Think of the strength that to roots must provide to hold up a massive tree during a wind storm. Roots are storage organs that store food and water for the plant. This is especially true for biennial and perennial forbs and grasses. Carrots and turnips specialized and enlarged fleshy root that store large amounts of reserve food and water in their tissues.

Roots anchor the plant using a fibrous or tap root system or sometimes a combination of both. A "fibrous root system" is made of many long, slender, branched roots of the same diameter. This type of root system is typical of grasses. Most forbs have a "tap root system" that develops from a prominent structure called the primary root. Offshoots from the primary root are called secondary roots. If the primary root remains prominent during the growing season, as occurs in beats and carrots, it is known as a "tap root."

## Stems

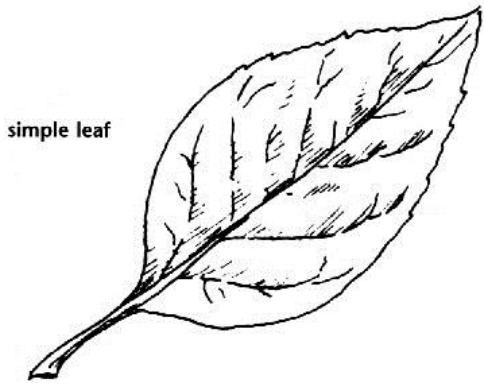
One of the major above ground vegetative structures of a plant is the stem. The stem's main function is to transport water and minerals from roots to leaves and manufactured food from leaves to roots. Stems also give rigid structure to a plant, providing a platform for suspending leaves where they can get sunlight. The stems also provide a means to raise the reproductive parts of the plant off of the ground where insects or the wind can enhance pollination and seed dispersal.

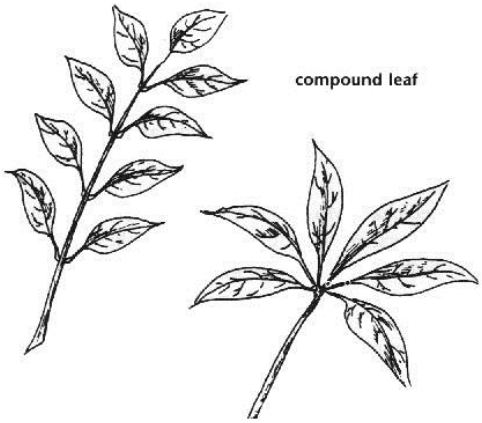
**Fritillaria pudica**
**Yellow bell is a common member of the lily family.**

Stems of grasses are made up of nodes (joints) where the leaves are attached and internodes (length of stems between nodes). Stems of forbs, like grasses, have nodes and internodes. Branches of stems and new leaves arise from buds at the nodes of the stems. Many species of forbs, such as the common dandelion, have a modified stem without leaves known as a scape. The purpose of the scape is to support the flower. Some forbs, such as the dwarf onion (*Allium simillimum*) have virtually no stem at all. Their leaves and flowers emerge directly from the ground.

Not all stems are aboveground. Some plants have creeping, underground stems with joints and leaf-like scales. These are known as "rhizomes." Rhizomes permit the plant to spread over an

area asexually (by vegetative means) producing clones of itself, occasionally, over the length of the rhizomes. Canada thistle (*Cirsium arvense*), quackgrass (*Elymus repens*), and aspen (Populus tremuloides) are three examples of plants that spread with rhizomes. Rhizomes are also used to store food that is manufactured in leaves. The potato is an example of a plant that uses underground stems to store food. The enlarged underground stem is called a "tuber." "Stolons" are similar to rhizomes, except they are aboveground, prostrate stems. Runners of strawberry plants are stolons. Stolons vegetatively produce new plants and store food. Stolons may bear normal leaves or the leave may be highly reduced.



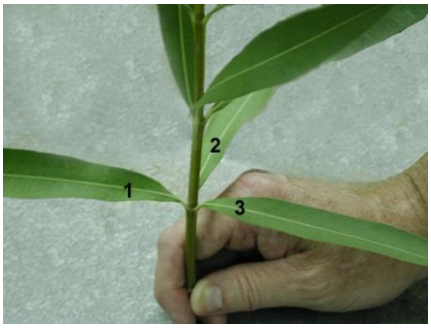



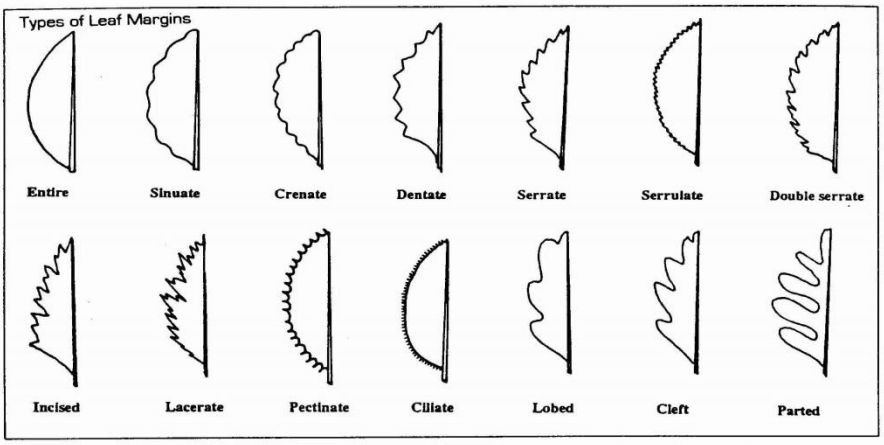

## Leaves

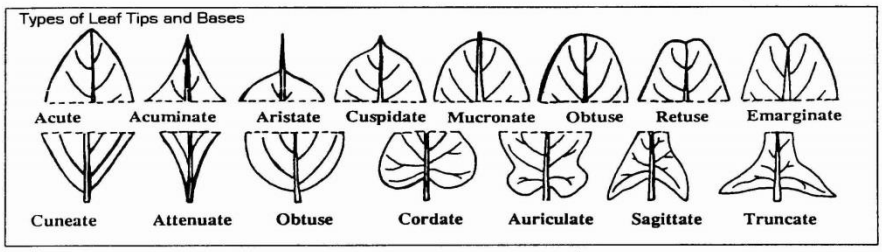
The leaf is the primary organ of plants responsible for photosynthesis (making food). Leaves are generally flat and broad to the maximum area for gathering light for photosynthesis. Leaves vary considerably and consist of several parts. Leaves commonly have three main parts: 1) *blade* - expanded part of the leaf; 2) *petiole* - stalk that connects the blade to the stem; 3) *stipules* - a pair of small appendages situated at the base of the petiole. Often the stipules are absent. Occasionally, other leaf parts, such as the petiole, are also missing. Leaves are classified as being either simple or compound. Simple leaves are those with a single blade and petiole, while compound leaves have several blades or leaflets. Compound leaves are either pinnately or palmately compound.

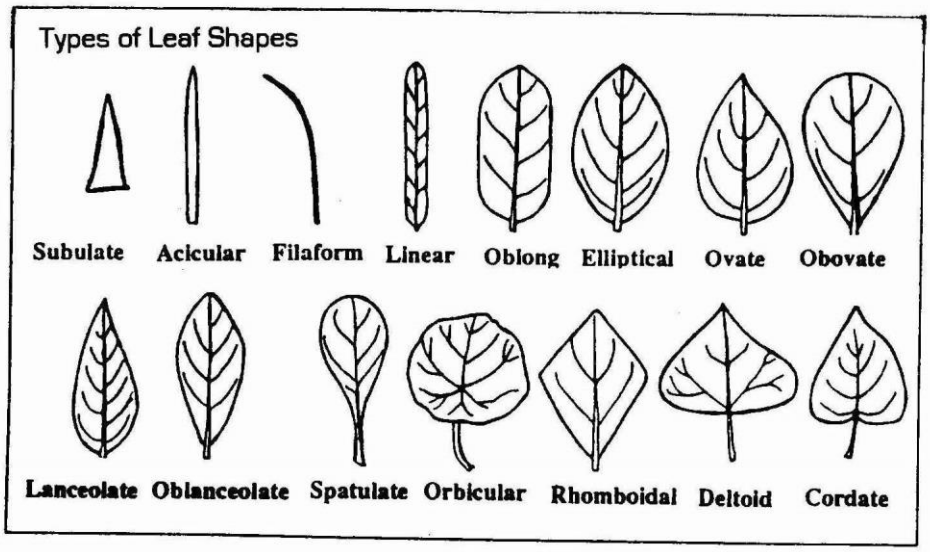
Leaves arranged alternately (top), opposite (middle), and whorled (bottom photo).

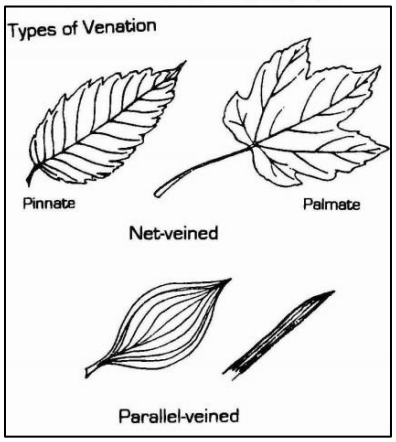
The arrangement of leaves on the stem also varies greatly. The three basic patterns are "alternate, opposite, and whorled." In the "alternate" leaf arrangement pattern, a single leaf arises from each node. The leaf at next node arises in the other direction from the previous leaf. The single leaves alternate directions up the stem. In the "opposite" leaf arrangement pattern, a pair of leaves arises from each node on opposite sides of the stem. The "whorled" leaf arrangement pattern has multiple (3 or more) leaves arise at each node. These leaves are spaced evenly around the stem.






**Leaf margins, shapes and venation are all attributes that can be used when attempting to identify a plant. These diagrams are used here with permission from University of Idaho Extension's Master Gardener Program.**

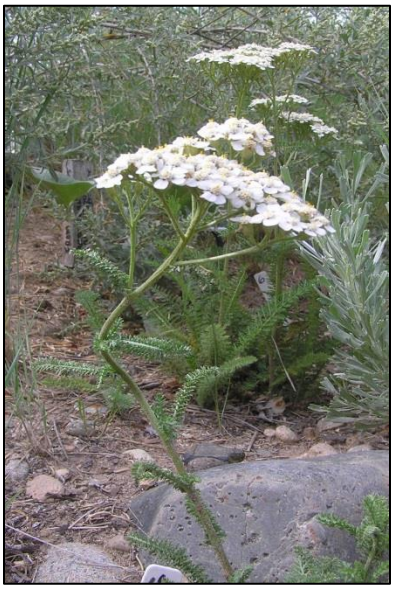
## Reproductive Structures

Ferns, horsetails, clubmosses, and their allies reproduce by spores (non-seed vascular plants). The remainder of the vascular plants reproduce by seeds and are referred to as the seed plants. One type of seed plants is the gymnosperms (such as pines and junipers) that produce seeds that are borne naked on the scales of cones. These are often referred to as the conifers. Another type of seed plant produces its seeds enclosed in an ovary. These are the flowering plants. The remainder of this section will concentrate on the flowering plants.

On the underside of the fern leaf are sori, clusters of reproductive spores. These plants must live near water to reproduce. Photo by Ian Shackleford, USFS.

Variations in flower parts are almost limitless in arrangement and design. Floral parts are the major characteristic used to identify flowering plant species. The parts of the basic flower are as follows. The basic flower parts are: 1) *receptacle* - the expanded part of the stem to which other floral parts are attached; 2) *sepals* - (collectively known as the calyx) are usually green and make up the outer row of the floral bracts; 3) *petals* - (collectively known as the corolla) are usually showy or brightly colored and positioned just inside the sepals; 4) *stamens* - male portion of the flower located inside the petals. Each stamen consists of a "filament" or slender stalk and an "anther" or pollen sac attached to the end of the filament; 5) *pistil* - innermost part of the flower. This is the female part of the flower and is composed of the stigma, style, and ovary. The "stigma" is the tip of the pistil where pollen grains are received and germinate. The "style" is the slender central portion of the pistil that connects the stigma with the ovary. The "ovary" is the basal portion of the pistil and contains one or more ovules, which mature into seeds.

Ponderosa pine cone. Seeds are found resting on the bracts of the cones. Photo © Susan McDougnal @ USDA-NRCS PLANTS Database



Yarrow Achillea millefolium. Photo courtesy, Sara Focht, IDFG.

Plants many produce flowers singly, but often they produce flowers in an "inflorescence." The flowers in the inflorescence

can be arranged in a variety of patterns. There common patterns are spike, raceme, and panicle. In a "spike," all flowers are sessile (attached directly) on the un-branched main inflorescence axis. Common mullein (*Verbascum thapsus*) is an example of a spike flower arrangement. In a "raceme," all flowers are borne on individual flower stalks (pedicels) attached to un-branched main inflorescence. The inflorescence of chokecherry (*Prunus virginiana*) would be an example of a raceme. A "panicle" is a branched inflorescence. The inflorescence of common yarrow (*Achillea millefolium*) would be an example of a panicle.

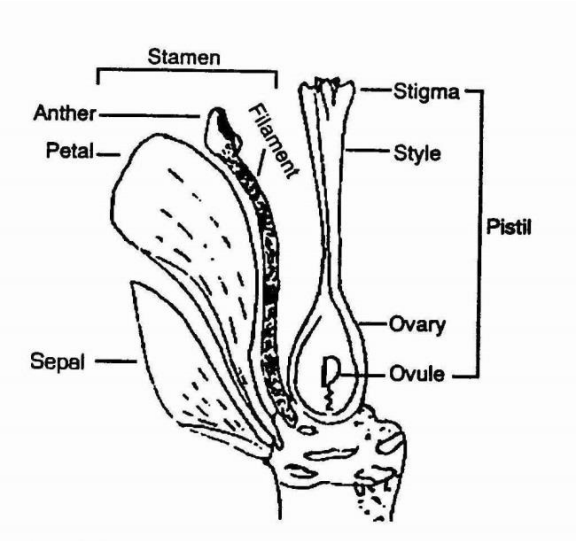



Diagram courtesy of University of Idaho Extension's Idaho Master Gardner Program.

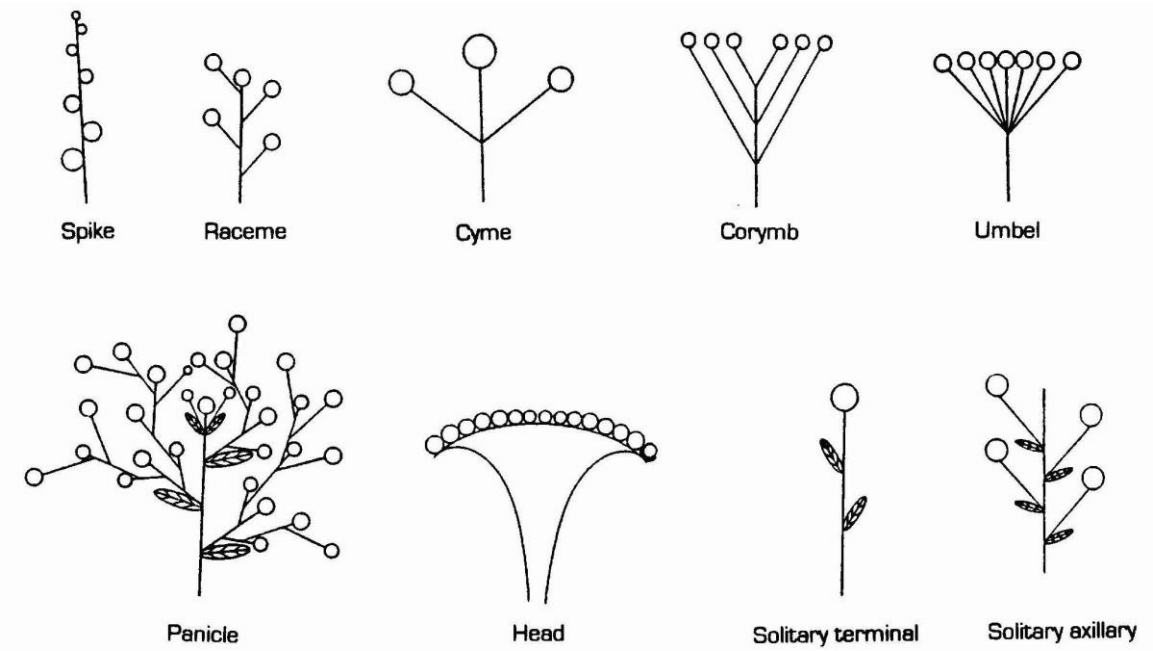



**Fig. 13. Types of inflorescences.**

# Invasive and Noxious Weeds

The following information comes from the Idaho Weed Awareness Campaign Strategic Plan. http://www.idahoweedawareness.net/background/pdfsdocs/StrategicPlan.pdf

Most weeds are non-native plants that have characteristics that make them troublesome, such as adaptation to a wide latitudinal range in the native habitat. Reproductive mechanisms that provide an advantage over native or desirable plants may include high seed production, the ability to reproduce without specialized pollinators, self-fertility, the ability to reproduce vegetatively, and/or the production of small seeds or seeds with appendages that facilitate transport.

Orange Hawkweed. It may look beautiful, but it is a noxious weed in Idaho. Photo courtesy of the Idaho Weed Awareness Campaign

These plants are considered to be invasive if they are able to move into and dominate native or managed systems and disrupt the ability of those systems to function normally. Invasive plants often initially establish after soil disturbance, particularly following human activities such as road construction, non-intensive farming, poorly managed grazing or logging, urban development, and high impact recreation.

Weeds are designated as noxious by state law or county ordinance because they cause, or can cause, negative economic and ecological impacts and because control is usually difficult and expensive. Idaho's Noxious Weed Law (Chapter 24, Title 22, Idaho Code) specifies responsibilities of landowners, counties, and state agencies concerning management of noxious weeds.

Canada Thistle. Photo courtesy, Idaho Weed Awareness Campaign http://www.idahoweedawareness.net

Invasive species have been introduced into Idaho in a variety of ways. For most invasive plant species in Idaho, little is currently known as to how most made their way into the state. Many times the knowledge of who brought the plant to the state or why is now lost and forgotten. Initially, these kinds of plants could have been those whose seed stuck on the clothing of early pioneers or were contaminants in feedstuffs brought from Europe, Asia, or Africa. This type of introduction occurred long before we had "weed seed free hay," the Idaho Noxious Weed List or regulations regarding imports and exports. Many times these plants were introduced intentionally, for beneficial purposes, but later turned out to be

invasive and did not stay where they were planted. Humans seldom knew the biology of an introduced plant or speculated on where a plant might be in the next 30 years. Plants from foreign countries are often planted without humans having knowledge of what the plant might do in the future or in the environment once established. Idaho specific examples of grasses/other plants introduced.

"Butter and eggs" used as an ornamental before listed as a noxious weed in Idaho. This snapdragon-like flower is lovely, but invasive! Al Schneider, www.swcoloradowildflowers.com and USDA Plants Database

To be successful in land management, and to maintain a healthy functioning ecosystem in the 21st century, it is paramount that public land managers, visitors to public land, private land owners, and all Idahoans understands the impact of non-native plants on wildlife, fisheries, scenery, crops and economics of Idaho. It is everyone's responsibility to fight noxious weeds in Idaho.

Recreationists can follow recommendations and regulations regarding washing/rinsing motorized equipment before and after recreating on public land. Livestock owners can abide by the National Forest Service's "weed seed free" certified hay program. Reporting weeds and their locations to land management agencies is everyone's responsibility.

Noxious weeds are, very simply, plants that have been placed on the official state noxious weed list. State law requires landowners and land managers to take action to control these plants. The official list is maintained by the Idaho Department of Agriculture and can be found on their website (www.agri.state.id.us). The counties can augment the state noxious weed list by designating additional plants as noxious within their jurisdiction. Plants can be designated as noxious because they cause negative economic or ecological impacts. The state list currently contains 57 different species including weeds such as Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea stoebe*), and Johnsongrass (*Sorghum halpense*). Not all invasive plants are noxious weeds. For instance, cheatgrass (*Bromus tectorum*) is a serious invasive plant but it is not on the state noxious weed list (though it may be on some county lists). Homeowners should be careful not to plant noxious ornamentals such as butter and eggs (Linaria vulgaris) also known as

Yellow toadflax used to be planted as an ornamental. This weed is now on Idaho's noxious weed list. Photo courtesy, Idaho Weed Awareness Campaign. http://www.idahoweedawareness.net

yellow toadflax. These weeds cannot be sold legally in Idaho, but they are still available in some areas.

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