Nature of Naming

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

- Demonstrate an understanding of the classification system.
- Discuss the uses and importance of the classification system.
- Identify the main parts of a scientific name.
- Understand the importance of the binomial classification system.
- Discuss the pitfalls of using common names.
- Discuss changes that genetics research has had on plant and animal classification (lumping and splitting species).
- Demonstrate the ability to use a dichotomous key to identify a species.

Knowledge of the earth and the living things on it is of great importance to us. We are not the independent, free-living humans we often regard ourselves to be. Our life and existence on earth is controlled by many factors such as the earth on which we live, the air we breathe, the plants and animals we depend on as our constant associates. It is true that, through the process of becoming civilized, we have acquired a wide variety of skills enabling us to modify and use our environment, in a limited number of ways, to meet our needs and ambitions. Regardless, we have found that new skills and technology have not reduced our dependence on the earth and the living things around us. Actually, technology, progress, and change have made us more dependent. The very technologies that appear to give us greater freedom tie us more and more closely to the environment. As technologies improve, and demands on natural resources increase, the trend toward more intensive and extensive processing of “natural” materials is progressively increasing.

Early humans satisfied their needs by taking nature’s offerings as they found them. Their food requirements met by the animals they hunted and by the edible fruits, seeds, roots, and other plant parts gathered in the forest and grassland prairies. Early humans lived a wandering existence, constantly in search of food. Eventually, humans learned to domesticate certain useful food animals. In doing so, humans probably came to realize even more fully the importance of the natural vegetation. Seasonal changes in the vegetation make it necessary to move flocks from place to place in search of abundant forage. Later, humans discovered, by planting seeds of useful plants in prepared soils, that they could produce foods for both animals and themselves. This technology relieved humans of the uncertainty of their daily food supply. It allowed them to live in one place. With this change, humans could indulge in other pleasures and activities. With more and more discoveries, this led to our present day mode of existence, a result of continued exploration and exploitation of our environment.

Our earth environment is rich with living things. There are about 2 million different, known types of living things. Just as humans have found it necessary to place various screws, nails, bolts, nuts and washers into different groups, it is also necessary to classify organisms into groups. To classify something means to arrange it into groups.

Arrowleaf Balsomroot,
Balsomorhiza sagittata (Pursh) Nutt

A good classification system helps in at least two ways. First, it provides an easier means of dealing with living things by dividing them into groups of similar organisms. Second, it makes information about specific organisms easier to organize and find. It is often convenient to talk about large groups, such as birds, or about smaller groups, such as ducks, songbirds, or owls. Information about specific organisms, such as where screech owls live, what mallard ducks eat or how long it takes robin eggs to hatch, can be found more easily if a good classification system is used.

Just as there are many different ways to group screws, nails, bolts, nuts, and washers, there are many ways to classify living things. One method would be to classify living things according to where they normally live. If this were done, we would have groups of saltwater organisms, pond organisms, wetland organisms, stream organisms, meadow, prairie, high desert, desert, tropical, pine forest, and under-a-rock organisms. Although this method might be useful for some applications, it would present many problems when naming organisms, since many organisms live in several different places. Some move from place to place as they pass through various life stages of their life cycles. We do not use where an organism lives as our means to classify life for naming purposes. The classification system we use today places organisms into groups based on the physical characteristics of the organisms classified. If it were not for a good classification system, most information about the organism would be lost in a hodgepodge of facts.

Who developed the classification system?

Carolus Linnaeus (1707-1778) developed the classification system we still use today, called binomial nomenclature. Binomial means “two-name” and nomenclature means, “naming.” Our system for naming people is binomial. You have a first name and a last name.

Before Linnaeus, many others had attempted to classify plants, primarily based on their medicinal value. These early classification systems, as well as Linnaeus' system, are all examples of "artificial classification" systems. Plants were placed into categories based on features that had been pre-determined. Linnaeus' system was comprised of 24 classes of vascular plants, distinguished from one another, based on the number and nature of stamens in the flower of each plant. This classification system was developed primarily for the aid of identification. It met that objective well.

The disadvantage of all artificial classification systems, including binomial nomenclature, is it often does not reflect "natural relationships" (genetic relationships). Plants within the same class may not be more related to each other than they are to plants from a different class. With the technology of DNA testing that Carl Linnaeus did not have, we could actually re-classify living organisms into new classification systems that reflect genetic relationships. However, this system would not help the average person who does not have a DNA lab in their kitchen identify plants in the field.

Linnaeus picked Latin to use in binomial nomenclature because no one spoke Latin as his/her native tongue. Most worldly scholars of the time knew Latin. They would be able to understand the scientific name of the organism. Latin is also a descriptive language. It suited the purposes of Linnaeus well. If he had picked his native language to name organisms, his life's work would have become out of date as the meanings of the descriptive words he chose to describe an organism changed. For example, we know the word "charity" to mean the giving of money or service, but in the 1600's, charity meant simply "love." If all languages had been acceptable for naming organisms, scientists or taxonomists would have to become linguists to assure they were talking about the same organism others were discussing.

Taxonomy is the study of naming organisms. It is the science of discovering, describing, naming, and classifying organisms. Taxonomists use a classification hierarchy or an arrangement of grade levels. The organisms placed together into lower and lower levels of the classification system have more and more characteristics in common. The system has seven basic levels that include:

Kingdom
- Phylum (or Division for plants)
  - Class
    - Order
      - Family
        - **Genus**
          - **Species**

Examples of the classification hierarchy for two types of organisms follow—one for an animal and one for a plant:

Common name: Mountain Bluebird

Kingdom: Animalia (animals)
  Phylum: Chordata (animals with notochords)
    Class: Aves (birds)
      Order: Passeriformes (perching birds)
        Family: Turdidae (thrushes, sparrows, robins)
          Genus: *Sialia* (bluebirds)
            Species: *Sialia currucoides* (mountain bluebirds)

Sialia currucoides.
Photo courtesy, IDFG.

Common name: Lewis's Mock Orange

Kingdom: Plantae (plants)
  Division: Magnoliophyta (flowering plants)
    Class: Magnoliopsida (dicotyledons)
      Order: Rosales (rose-like plants)
        Family: Hydrangeaceae (hydrangea-like plants)
          Genus: *Philadelpus* (mock oranges)
            Species: *Philadelphus lewisii* (Lewis' mock orange)

Philidelphus lewissi.
Photo courtesy, Gary A. Monroe, USDA Plants Database.

The scientific name of an organism includes its genus and species name (the final two categories of the classification hierarchy highlighted above). The complete scientific name of plants also includes the initials or name of the person or persons who first described the species. The scientific names of plants described by Linnaeus still bear an L. after the binomial. For example, the scientific name of cheat grass is *Bromus tectorum* L.

Using plants as an example, the scientific name of a plant is written in three parts: The plant genus, the specific epithet (species name) and the author's name. The genus is always capitalized. Both the genus and species are *italicized* or <u>underlined,</u> as shown in the example of cheat grass. The genus name is abbreviated to an initial after the first use within a document. *Bromus tectorum* would be written in full the first use and abbreviated as *B. tectorum* in subsequent uses, as long as confusion with other genuses does not occur.

Why learn scientific names?

The scientific name, made up of the genus and the specific epithet, points to a unique species. One, and only one, species will have that scientific name. Common names can often be ambiguous. The common name used to refer to a species in one region may refer to a different species in another region.

Scientists around the world understand scientific names. *Taraxacum officinale* is the common dandelion. *Taraxacum officinale* refers to the same species, no matter where you are in the world. Scientists in Russia, Germany, Korea, and the United States all know to what species reference is being made. You can look at scientific article written in Russian and the only words you will be able to pick out and understand will be the scientific names.

SUBSPECIES

Artemisia tridentate is the scientific name for a common species of sagebrush in Idaho. This species happens to also be divided into sub-species.

In the case of sub-species, an additional name is added after the genus, species and name and author's name.

Big Sagebrush
Artemisia tridentata Nutt. ssp. *vaseyana* (Rydb.) Beetle

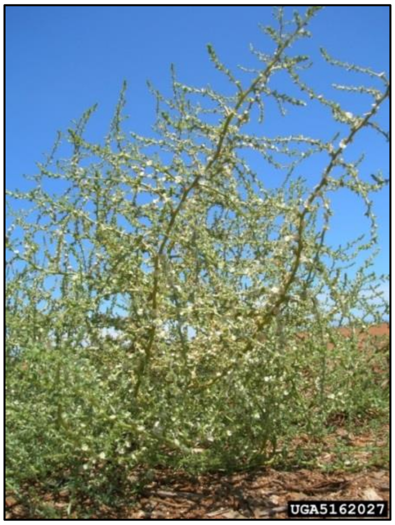
Mountain Big Sagebrush
Artemisia tridentata Nutt. ssp. *wyomingensis* Beetle & Young

Wyoming Big Sagebrush
Artemisia tridentata Nutt. ssp. *xericensis* Winward ex R. Rosentreter & R. Kelsey

The Use of Common Names

The name used to identify plants in everyday conversation is a plant's "common name." You and I use this name most of the time. Common names have originated from various sources. People just like you and I, including early European settlers, Native Americans, traveling naturalists and others, have named all 3,175 species of plants known to occur in Idaho. Plants were named for characteristics: smell, color, beauty, if they hurt, bite, scratch, general appearance reminding the observer of something already known. Early naturalists or travelers named many plants after similar or look-alike plants they were familiar with in Europe. Often, when you see a plant at the same stage of growth as the person who named the plant saw, you can see why the name was given. Likewise, when you hear a plant name, the mind may produce a visual picture from the spoken name. Sometimes this does not work when the plant is a seedling or in winter growth, for example, "snowberry." Some plants have been named after people as a way of formally recognizing them for their work or contribution. Plant naming has usually been based on some physical-visual character of the plant, i.e., the plant is spiny, thorny,

Artemisia frigida, Rocky Mountain Sage. Photo courtesy, Idaho Department of Transportation.



Russian Thistle, Salsola *tragus* L. Photo courtesy, Forrest and Kim Star, U. S. Geological Survey,

hairy, colorful, large flowered, odiferous; or grows in a particular season or a discrete area.

There are two major problems when using common names. First, the common name may actually include more than one particular plant species in a genus. We refer to a pine tree; the name "pine" is the common name for all trees in the genus *Pinus.* Some common pine trees in Idaho include the ponderosa pine (*Pinus ponderosa*), the lodgepole pine (*Pinus contorta*), and the western white pine (*Pinus monticola*). Although these plants are all related, they are independent plant species, which grow in different situations, respond to management differently and are encouraged or suppressed under natural fire regimes differently.

Second, one plant species often has more than one common name. Depending on where you born, raised, or went to college, you many refer to the tree *P. ponderosa* as ponderosa pine, yellow pine, blackjack pine, or bull pine. Common names for plants will change from community to community and region to region. This fact may make identification confusing and illustrates why we use scientific names in training, science, government documents, and industry literature. Several authors, societies and agencies have accepted specific common names, but there is still much confusion out in the field and in publications referring to plants by their common name.

Another example of a problem with common name usage is the plant name, "thistle." Because thistles usually have thorns and are harmful to the touch of skin, many people will call a bristly, thorny, upright plant a thistle. After examining the use of this common name in Idaho, many species of plants have the name thistle as part of their common name. Most of these plants are in the Sunflower Family or Asteraceae. They include plants like bull thistle, yellow starthistle, and spiny sowthistle. These thistles occur in the genera *Cirsium*, *Centaurea*, and *Sonchus*, respectively. Consider "Russian thistle." It is not a member of the Asteraceae or Sunflower Family but is in the Chenopodiaceae or Goosefoot Family. This plant is also named "tumbleweed." Also, consider the confusion that exists with names like "blue-eye grass." Plants with this name are in the genus *Sisyrinchium* in the Iridaceae or Iris Family. These plants are not grasses at all. Their leaves, or early growth, resemble a grass leaf or leaves. Quite often in the animal kingdom, a common name may apply to several different organisms. The name "gopher" has been used to refer to a salamander, a turtle, a frog, one of several snakes or any of about fifty different types of rodents.

Impact of Advances in Genetics on Classification

Linnaeus developed his system of classification long before Charles Darwin advanced the concept of biological evolution. The idea that species were related was not at the forefront of scientific thought. Linnaeus based the classification system on similar characteristics among organisms. If two organisms had many characteristics in common, they were placed together at a low level (such as family or genus) in the classification system. If they had few characteristics in common they were only placed a high level (such as kingdom or phylum/division) in the classification system. Since the classification system was based on arbitrary characteristics rather than actual relationships, it is considered an artificial rather than natural system. Generally, organisms that have many characteristics in common are also closely related. There are many flaws in the system.

Modern genetic techniques allow scientists to better estimate the closeness of the relationships between species. Sometimes this knowledge leads the scientists to propose splitting one classification taxon apart into two and other times lumping two or more taxon into a single taxon. A taxon is any specific element of the classification system (such as a specific family or genus). For example, scientists may look at the genetics of all ten species in a single genus. They may discover that three of the species are only distantly related to the other seven species in the genus. These scientists may propose splitting the genus into two separate genera and providing a new name for one of the genera. This would change the scientific name of the species in the new genus, but the scientific name would still uniquely identify the species. The old (now superseded) scientific name can be traced to the new name and thus the species. In another example, scientist may look at the genetics of various genera in two different families. They may conclude that the genera are all closely related. They may propose lumping the two families into a single family.

Dichotomous Keys are used to identify a living organism. As the name implies, dichotomous keys give a series of two (di) characteristics. The reader of the key must choose a characteristic to move onto the next set of two characteristics. Eventually, if the reader made all the right characteristic choices, the name of the species can be identified. In theory, dichotomous keys are easy! You simply look at the organism you are trying to identify and answer questions about it. However, in reality, some dichotomous keys can be difficult if you are unfamiliar with the terminology of the life form. Vocabulary can limit a person's ability to successfully identify an organism using a dichotomous key. The best way to learn to use these keys is to brush up on your vocabulary and then just practice. Below is an exercise to demonstrate how dichotomous keys work.

Suppose you were an alien from outer space visiting earth. You found the items pictured below and you were interested in learning their names and if you should present one of them to an earthling as a token of peace. You happen to have a copy of Earthly Treasures; A Field Guide and Key with you. Therefore, you begin to "key out" the objects. You first choose the object on the far left on which to work.

A.

1. The earthly object is made of metal or has metal on it……..……………………...Go to B
2. The earthly object is comprised of a material other than metal……………………Go to C

B.

1. The earthly object is made entirely of metal……………………………………...Paperclip
   Pulpilious grasponii
2. The earthly object is made mostly of wood with traces of metal on one end………..Pencil
   Writonae scriptus

C.

1. The earthly object can move freely on its own……………………………………Go to D
2. The earthly object cannot move freely on its own…………………………………Go to E

D.

1. The earthly object moves freely on the ground or in the sky………...………………Eagle
   Unitedae Statesii
2. The earthly object moves freely on the ground only…………………………Earth Worm
   Sidewalkidae squishineus

E.

1. The earthly object has a large hole in the middle………………………………………Tire
   Petroliuminus circularii
2. The earthly object has a core, or solid center……………………………………...Apple

This simple illustration of a dichotomous key also can serve as an example about how vocabulary becomes important. Words like ground, sky, metal, and wood would have to be known in order to use the key. In order to use dichotomous keys to identify plants or animals, learning biological vocabulary may be necessary.

A Final Note

Naming and being able to identify plants and animals is an important component of being a naturalist. Some people enjoy the knowledge of scientific names more than others do. Build your skills so you can use keys and communicate with other naturalists. However, do not let the task of identifying plants and animals intimidate you. Do not worry if the task of keying out organisms or remembering Latin names is not your favorite naturalist activity. There are other naturalists willing to help.

Original author:
Barron S. Rector
Associate Professor and Extension Range Specialist
Texas A& M University, year

Edited and adapted for Idaho:
Derek Antonelli
Biological Technician and Reservist
Idaho Department of Fish and Game, Region 1

Sara Focht
Nongame Projects Coordinator
Idaho Department of Fish and Game

Additional Edits:
Clella Steinke, Upper Snake Master Naturalist

This chapter was modified from the Texas Master Naturalist Program "Nature of Naming" chapter. We appreciate TMNP generous sharing of their curriculum.