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# Species Richness and Variety of Life in Arizona's Ponderosa Pine Forest Type

David R. Patton, Richard W. Hofstetter, John D. Bailey and Mary Ann Benoit

Forest Service **Rocky Mountain Research Station** General Technical Report RMRS-GTR-332 December 2014

Patton, David R.; Hofstetter, Richard W.; Bailey, John D.; Benoit, Mary Ann. 2014. **Species richness and variety of life in Arizona's ponderosa pine forest type**. Gen. Tech. Rep. RMRS-GTR-332. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 44 p.

## Abstract

Species richness (SR) is a tool that managers can use to include diversity in planning and decision-making and is a convenient and useful way to characterize the first level of biological diversity. A richness list derived from existing inventories enhances a manager's understanding of the complexity of the plant and animal communities they manage. Without a list of species, resource management decisions may have negative or unknown effects on all species occupying a forest type. Without abundance data, a common quantitative index for species diversity cannot be determined. However, SR data can include life history information from published literature to enhance the SR value. This report provides an example of how inventory information can characterize the complexity of biological diversity in the ponderosa pine forest type in Arizona. The SR process broadly categorizes the number of plant and animal life forms to arrive at a composite species richness value. Common sense dictates that plants and animals exist in a biotic community because that community has sufficient resources to sustain life. A mixture of forest attributes maintained in time and space fundamentally supports a certain level of diversity as indicated by a richness value. As a management guideline, it is a reasonable assumption that the variety among plant communities and structures increases the potential for maintaining diverse kinds of animal habitats and resultant populations.

**Keywords:** ponderosa pine, animals, plants, biological diversity, species richness

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***About the cover:*** *Ponderosa pine characteristically grows in uneven-aged stands of small even-aged groups.*

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## Acknowledgments

Appreciation is extended to Carl Schmidt, SAF Wildlife & Fish Working Group; Brian Dykstra, Wildlife Program Leader, USDA Forest Service, Southwestern Region; Peter F. Ffolliott, Professor Emeritus, University of Arizona and James N. Long, Professor, Utah State University for their comments and suggestions for improving the report. Dan Miller, Research Entomologist, USDA Forest Service, Forestry Sciences Laboratory, Southern Research Station provided assistance in insect identification. A special acknowledgement is to Dale A. Jones, Retired Director of Wildlife Management, USDA Forest Service for his encouragement and support to develop a storage and retrieval system for plant and animal inventory data and to make this data available to forest managers at the project level.

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# Species Richness and Variety of Life In Arizona's Ponderosa Pine Forest Type

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## Introduction

Ponderosa pine is the most widespread coniferous tree in the western United States. It is an important part of three SAF forest cover types (Interior ponderosa pine, Pacific ponderosa pine/Douglasfir, and Pacific ponderosa pine) and a minor constituent of others: western juniper, pinyon-juniper, Jeffrey pine, Arizona cypress, and Sierra Nevada mixed conifer (Eyre 1980). Forest type, a synonym for forest cover type (Helms 1998), is a term used when referring to vegetation dominated by trees without any indication of its understory vegetation or successional status (Layser and Schubert 1979). A forest type can span large landscapes with varying environmental conditions but is not always in continuous stands. Forest types on a map of broad-scale resolution (USDA 2000), with a list of plants and animals common to the type, are useful for planning and reporting purposes (Garrison et al. 1977, Patton 2011).

The vegetation classification scheme in this report follows the nomenclature used in the Southwestern Terrestrial Ecosystem Survey (USDA 1987a, b, USDA 1997) with categories of forest and woodland types and plant associations. Plant association represents the dominant overstory and understory species e.g., Ponderosa pine/Arizona fescue, and is based on stand and site characteristics (Layser and Schubert 1979, Alexander 1988). The primary objective of this report is to provide an example of how a simple inventory of plant and animal species can be organized and presented in a way that characterizes the complexity of biological diversity in a forest type.

Data for the example comes from information developed to meet periodic reporting requirements of the Resource Planning Act (U. S. Congress 1974) and for future projects in Arizona's forests and woodlands. A secondary objective is to provide access to existing information to characterize diversity in the ponderosa pine forest type. The information is available in table format on a Northern Arizona University website: http://nau.edu/CEFNS/Forestry/Research/Insect-Ecol-and-Mgmt/.

These tables are easy to edit and manipulate for potential use in local project areas. Managers can use similar diversity data in their planning and decision-making process for other vegetation types. Authorities for scientific and common names for plants and animals are listed in Appendix 1.

## Ponderosa Pine in Arizona

Peet (2000) places the ponderosa pine forest in the Madrean Rocky Mountain Floristic Region on the Mogollon Plateau, and Brown (1982) lists it as a community in the Rocky Mountain Petran and Madrean Montane Conifer Forests. Early descriptions of ponderosa pine in Arizona are of a forest that was more park-like than it is today (Cooper 1960); these descriptions are supported through research by Covington and Moore (1994). Covington (2003) provides a detailed account of the evolutionary and recent history of ponderosa pine in the Southwest.

In Arizona, the ponderosa pine type with its biotic and abiotic attributes are important because of its wide distribution and value as a source for wood products, forage for livestock, availability for recreational use, habitat for wildlife, aesthetic and spiritual value, and intangible assets. The forest type can have small seeps, springs, creeks, and wet meadows surrounded by stands of trees that are part of the terrestrial environment. In adjacent areas, there can be a land-water interface of lakes, rivers and riparian vegetation, indicating a dramatic shift from dry to moist conditions. The interface includes species of waterfowl, wading birds, fish, and riparian-dependent plant and animal species that are not included in this report.

### Plant Associations

Considering overstory and understory vegetation, there are 15 plant associations in the ponderosa pine forest type in Arizona (Table 1) (Alexander 1988). Some plant species are not included in the definition but may still be part of the understory vegetation. Two plant associations, *Quercus arizonica* (Quar) and *Quercus emoryi* (Quem) are similar in species composition but key differences are in site conditions and Emory oak abundance. The associations as a whole describe the ponderosa pine forest in a range of low to high elevations, warm to hot climate, dry to moist conditions, and forage production from 250 to 1,500 lb/ac.

While many plant species are classified as a tree life form (Table 2), trees such as Gambel oak can be a shrub stage in the understory. The greatest range in elevation is 2,900 ft for the *Bouteloua gracilis* (Bogr) association. Rockland (Rock) has the most restricted range of 400 feet. Plant associations and number of species in life forms for each family are in Table 3. Appendix 2 lists all the plant species by life form used in developing Tables 1 to 5.

**Table 1**—Plant associations in Arizona's ponderosa pine forest type.

| Type code[a] | Plant association | Elevation[b] | Site[c] | Forage[d] |
|---|---|---|---|---|
| Arar | *Artemisia arbuscula* (black sagebrush) | ~82 | wd | L |
| Arpu | *Arctostaphylos pungens* (pointleaf manzanita) | 50-76 | wvd | L |
| Bogr | *Bouteloua gracilis* (blue gramma) | 57-86 | wvd | H |
| Come | *Cowania mexicana* (cliffrose) | 67-74 | wvd | L |
| Fear | *Festuca arizonica* (Arizona fescue) | 73-84 | wd | H |
| Juma | *Juglans major* (Arizona walnut) | 55-65 | wm | L |
| Mumo | *Muhlenbergia montana* (mountain muhly) | 68-88 | wd | H |
| Muvi | *Muhlenbergia virescens* (screwleaf muhly) | 68-93 | wd | H |
| Quar | *Quercus arizonica* (Arizona white oak) | 55-78 | hd | L |
| Quem | *Quercus emoryi* (emory oak) | 53-69 | wd | M |
| Quga | *Quercus gambelli* (Gambel oak) | 65-92 | wd | M |
| Qugr | *Quercus grisea* (gray oak) | 61-88 | wd | M |
| Quhy | *Quercus hypoleucoides* (silverleaf oak) | 57-80 | wd | M |
| Quru | *Quercus rugosa* (netleaf oak) | 70-88 | wm | L |
| Rock | Rockland (surface rock) | 83-87 | wd | N |

[a] Type codes contain a prefex of Pipo such as Pipo/Bogr, etc.
[b] Hundreds ft.
[c] Conditions: w = warm, d = dry, m = moist, h = hot, vd = very dry.
[d] lbs/ac: N = no value, L = 250-500, M = 500-1,500, H = >1,500.

**Table 2**—Trees in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name<br>group | Species In<br>Pp |
|---|---|---|
| Trees | | |
| Pinales | | |
| Cupressaceae | cypress | 4 |
| Pinaceae | pine | 9 |
| Fagales | | |
| Fagaceae | oak | 8 |
| Juglandales | | |
| Juglandaceae | walnut | 1 |
| Malpighiales | | |
| Salicaceae | aspen | 1 |
| Rosales | | |
| Roseaceae | chokecherry | 1 |
| | Total | 24 |

**Table 3**—Plant life forms in Arizona's ponderosa pine plant associations.

| | | Life forms[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Type code[b]** | **No. of families** | **tr** | **sh** | **fo** | **gr** | **ot[c]** | **No. of species** |
| Arar | 7 | 3 | 4 | 1 | 5 | 0 | 13 |
| Arpu | 14 | 8 | 8 | 2 | 7 | 2 | 27 |
| Bogr | 11 | 10 | 4 | 4 | 9 | 1 | 28 |
| Come | 4 | 3 | 1 | 0 | 3 | 0 | 7 |
| Fear | 11 | 9 | 5 | 4 | 11 | 2 | 31 |
| Juma | 11 | 6 | 2 | 2 | 5 | 1 | 16 |
| Mumo | 14 | 10 | 3 | 10 | 8 | 1 | 32 |
| Muvi | 12 | 9 | 3 | 5 | 12 | 2 | 31 |
| Quar | 15 | 6 | 11 | 4 | 7 | 2 | 30 |
| Quem | 15 | 6 | 11 | 4 | 7 | 2 | 30 |
| Quga | 12 | 8 | 7 | 5 | 8 | 5 | 33 |
| Qugr | 4 | 6 | 0 | 0 | 5 | 0 | 11 |
| Quhy | 15 | 9 | 5 | 5 | 5 | 2 | 26 |
| Quru | 11 | 9 | 2 | 3 | 4 | 2 | 20 |
| Rock | 6 | 13 | 0 | 1 | 7 | 0 | 21 |
| **Other species present[d]** | **11** | **3** | **16** | **0** | **9** | **0** | **28** |

[a] Life Forms: tr = tree, sh = shrub, fo = forb, gr = grass.
[b] Type codes contain a prefex of Pipo such as Pipo/Bogr, etc.
[c] ot = cacti, fern, sedge, agava, vine.
[d] Judd 1962, Clary 1975. Species that might occur in any of the habitat types but were not included in the type definition.

## Stands

Forest stands are the basic units of inventory and management and have slightly different applications across professions. The reference in forestry is to a distinguishable land management unit that shares characteristics typically associated with tree age, size, and composition (pure or mixed). Stands include shrubs, forbs, and grasses as well as trees, which also reflect stages in forest succession. The ecological definition is a contiguous group of similar plants (Helms 1998). In a recent *Journal of Forestry* article, O'Hara and Nagel (2013) emphasize that defining stands should be flexible for different uses. A stand can be any size and composition or structure that makes sense for on-the-ground management.

Ponderosa pine is primarily a climax forest in the Southwest (Pearson 1950) and can exist in pure stands locally, and in mixed stands over diverse landscapes in association with other conifers or deciduous trees (Schubert 1974). Stands of ponderosa can be particularly complicated since they occur in the Transition Life Zone (Merriam 1898). They lose their climax characteristics as they integrate into the lower elevation, drier pinion-juniper woodlands, and to higher and moister mixed-conifer forests (Schubert 1974). Ponderosa pine reaches its best growth, however, between 7,000 and 7,800 ft where annual rainfall is 18 to 24 inches. Tree species composition in the type may be simple, but the spatial distribution of trees is complex given disturbance and regeneration patterns regulated mainly by fire (Bailey and Covington 2002, Covington 2003).

Stands contain structural stages based on tree diameter or age, such as seedling-sapling, young-pole or intermediate, mature, and old growth. Stand density, the number of trees per/ac, relates well to percent crown closure (open, thin, thick and closed). Density can be expressed by several indices constructed from both number of stems and mean tree diameter (Tappeiner et al. 2007). Two broad age classes of ponderosa pine are (1) "blackjacks" that have dark bark and age <150 yr, and (2) "yellow pine" >150 yr with yellow plated bark and a rounded crown. Characteristically, ponderosa pine grows in irregular uneven-aged stands, consisting of small even-aged groups within the stands (Cooper 1960, Schubert 1974). Groups of similarly aged trees vary in size from 0.15 to 0.35 ac (Cooper 1961).

# Diversity in the Pines

Biological diversity (more simply, diversity) is a natural phenomenon of life including factors at all levels of organization (genetic, individual, community, and ecosystems) affecting survival and reproduction of plants and animals. Federal regulations emphasize diversity as a way to ensure species are part of the forest planning process and in efforts to restore or maintain the integrity of terrestrial and aquatic ecosystems. Using the best available science is a requirement in this process.

Diversity has its roots in the works of Darwin and Linnaeus in their early efforts to understand how the natural world of plants and animals is connected and functions. An operational definition of diversity is the meaningful differences in the elements of biological communities (Boyce and Cost 1978). Detailed definitions by Helms (1998), Lindenmayer and Franklin (2002), and Primack (2006) provide a variety of defining factors. Therefore, it is important for project planning, implementation, and monitoring that the definition, standards, and guidelines are available for a given level of management. Pimlot (1969) suggests that the strongest case for diversity is the intangible values relating to life, for example, the presence of wolves, coyotes, and goshawks as predators in ecosystems, and the value of understanding complex environmental interrelationships through bird watching.

## Life Forms

Within the distribution patterns of ponderosa pine trees, there are many biotic and abiotic components contributing to variety of life. One of the major biotic components of any forest type is life form. Life form is a way to categorize living things for planning and monitoring purposes. Life form for plants (sometimes called growth forms) has five categories: trees (tr), shrubs (sh), forbs (fo), grass (gr), or other (ot). Other includes cacti, fern, sedge, agava, vine that can become an individual life form when more detail is required. Plant life forms produce the layering effect of vegetation in forest types. Animal life forms, in general, used by land management agencies are amphibians (am), arthropods (ar), birds (bi), fish (fi), mammals (ma), and reptiles (re).

## Biological Engines

Plant and animal life forms create food chains and webs that sustain and regulate natural systems. Food chains start with a producer life form (such as grass) eaten by an animal life form (e.g., a rabbit) that is eaten by another life form (a bobcat). However, food chains are more than just a plant eaten by an animal eaten by another animal. The **connectance** (Dunne et al. 2002) links between producer and consumer life forms create a biological engine fueled by nutrient cycling and energy flow. Biological engines account for the complexity of the intricate workings in a forest ecosystem.

Complexity is thought to maintain ecosystems stable (Odum 1971, MacArthur 1955); however, May (1975) challenged the stability assumption by using mathematical models. Recent research on stability and diversity has focused on **connectance** as a way to understand ecological networks and it seems that stability increases with connectance (Dunne et al. 2002, Okuyama and Holland 2008). Complexity and stability will remain viable topics for many years; in the meantime, management decisions will continue using the best information available within the framework of adaptive management.

## Species Richness

Species richness (SR) is defined as the number of species (Krebs 1999) in a specific area and goes a long way toward characterizing a community (May 1975). SR relates to alpha diversity (e.g., stand level in a designated area) (Primack 2006). Richness by itself does not account for the relative abundance of individuals but is a snapshot of presence in time. It gives as much weight to species with a few individuals as to those with a high density. Quantifying diversity (e.g., Simpson's Diversity Index), requires the measurement of abundance of all component species (tables 3 to 9), which might not be physically practical or economically feasible, especially for animal species. Furthermore, detailed abundance measurements are often unnecessary to support management goals associated with diversity.

Primack (2006) suggests that indices might not be better than using a richness value. While abundance of each plant or animal species might add quantitative detail to evaluate diversity, animal abundance would only be available for the most common species in the most common forest conditions and is constantly changing because of a variety of factors (e.g., fire disturbance). These practical problems have to be considered before diversity can be used in a meaningful way in operational plans. Without abundance values, none of the common indexes can be used to show differences between areas or alternative management pathways. Lacking such defensible, quantitative data, there is published qualitative information on life history for many species that managers can use for planning and decision-making. Experimental evidence indicates that primary production, resistance to natural disturbances, and resistance to invasion all increase as SR increases (Morin 1999).

Charles Elton (1927) first championed a concept that ecologists must consider: different kinds of habitats have a characteristic set of animals. Using Leopold's (1933) analysis of game range, Pimlot (1969 p 374) states: "***the message is clear that diversity of habitat is the life blood of the majority of species and the ramifications extend from the subsistence of an individual to the viability of a population and to the survival of species."*** Boyce and Cost (1978) suggest that an increase in the diversity of habitats increases the potential livelihood for different kinds of organisms. Creating a broad mixture of stand conditions over time, and their associated disturbance regimes, ensures the broadest diversity of species. An actual field example of the application of species richness is from California where it was used to identify land protection priorities for the state's woodlands (Motroni et al. 1991).

## Data Available and Quality Control

Plant and animal species occurrence in Arizona's ponderosa pine type is from a Forest Service database that was developed to meet the assessment requirements of the Resource Management Planning Act (Patton 1978). The list of species came from museum and herbarium collections; management biologists and researchers in the state, Federal and private agencies; and published literature in professional journals. The original relational database has been maintained and continuously updated by the senior author, and is the source of the data for tables in this report. Animal species in the original lists were assumed common in the forest type based on the information available at that time. The current list for plants includes those identified in the Southwestern Terrestrial Ecosystem Survey that defines plant associations for Arizona and New Mexico (USDA 1987a, b, USDA 1997).

In developing a current SR list for the ponderosa type in Arizona, measures were imposed to keep the list at a reasonable level of inclusion. For example, animal species are included if their presence is authenticated in state and Federal documents and professional publications or databases. Subspecies are included when they are the single representative in Arizona of the genus that occurs in other states. It may be necessary to develop different quality criteria for SR based on the level of use, broad landscapes or specific project areas.

Species richness can have several degrees of similarities of characteristics starting with the taxonomic Order. Including Family and Genus increases the amount of information needed to identify a species. Because of the difficulty in identifying insects at the species level, many are only identified to Family with species shown as "spp" or "unknown." Using suborder, subfamily, tribes, and subspecies may be too complex for practical use unless it relates to a sensitive species that is important for management. A richness list by life form and scientific name with a common name as a vernacular group provides a degree of difference that is easily recognized.

# Variety of Plant Life

## Trees and Shrubs

Trees dominate ecosystems through total biomass and crown closure that controls the amount of light penetrating to the forest floor. A tree is a woody perennial plant, typically large with a well-defined stem or stems carrying a more or less definite crown (Helms 1998). Tree attributes (size, structural characteristics, spatial arrangement and density) and their by-products such as snags, logs, stumps, woody debris, etc., create different living conditions for various animal life forms. Tree by-products are an important part of the habitat relationships that exist in any forest type (Patton 2011).

Ponderosa pine is shade intolerant and needs a large amount of light to grow and produce cones with seeds. Seeds will germinate and become seedlings where there is sufficient light penetrating the canopy or in the small openings between individuals and groups of trees. One difference in trees that exist in the ponderosa pine forest type is the regeneration method. Ponderosa pine regenerates from seeds developed in cones, whereas Gambel oak reproduces by acorns, and aspen, an associated tree species, primarily develops from root sprouts. Gambel oak, aspen, and ponderosa pine are major food and cover plants for a variety of wildlife species. There are 24 species of trees in 6 families in the ponderosa pine type (Table 2) but two trees, ponderosa pine and Gambel oak, are the major overstory species. Plant life forms in plant associations by number of Families and Species indicate the complex relationships that exist in the ponderosa pine type and the potential difficulty of making management decisions (Table 3).

A shrub is a perennial woody plant smaller than a tree. Unlike trees, shrubs usually have many separate stems starting from or near the ground surface. The advantage of multiple stems is more leaves to collect sunlight in low light conditions. Shrubs grow in pure stands, in the absence of an overstory, or in scattered single or small clumps as understory plants. Shrubs create a second layer of vegetation through vertical separation. Because shrubs are closer to the ground level, they are more accessible for food and cover by many vertebrate and invertebrate species. Two shrub families, Rosaceae and Asteraceae, account for 43% of the total number of shrub species in the ponderosa pine forest type (Table 4). Some shrub names indicate the animal that uses a species for food, such as antelope bitterbrush, dwarf rabbitbrush, and bearberry.

## Forbs and Grasses

Forbs are the soft-stemmed, non-woody, wide-leafed, low flowering plants: buttercups, cinquefoils, and clover. Forbs can be annual, biennial, or perennial. Any plant of the Poaceae family (similar to wheat, bluegrasses, and bromes) is a grass. The grass family is one of the largest families of flowering plants. Grasses have long narrow leaves, and usually a small dry one-seeded fruit. Grass-like plants are the sedges and rushes with pithy or hollow stems found in moist to wet soil conditions. Forbs and grasses are commonly grouped together as herbaceous plants.

Sixteen families of herbaceous plants include 94 species (Table 5). Two families (Asteraceae and Poaceae) account for 47% of the total and contain species that are major wildlife food plants (fescue, gramma, wheatgrass, bluegrass, muhly, sage, fleabane, and yarrow). Herbage production of forbs and grasses follows the well-documented inverse relationship of high percent tree canopy/low production; low percent tree canopy/high production. The amount of herbaceous biomass produced in ponderosa pine varies from over 600 lb/ac (dry weight)

in openings to 60 lb/ac where canopy closure is greater than 80% (Jamison 1967). Four of the 15 plant associations (Bogr, Fear, Mumo, Muvi) have forage production >1,500 lb/ac (Table 1).

The value of herbaceous plants to maintain animal populations is from results of a study on producer-consumer biomass on the Coconino National Forest (Clary 1978). In this study, herbaceous plants supported the majority of the wildlife biomass (deer, elk, rodents, etc.) and almost all of the livestock biomass. The number of herbaceous plants in ponderosa pine reflects the variability in the conditions that can occur across landscapes and the importance of herbaceous plants as potential food and cover resources.

**Table 4**—Shrubs in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name group | Species In Pp |
|---|---|---|
| Shrubs | | |
| Sapinales | | |
| Anacardiaceae | sumac | 1 |
| Asterales | | |
| Asteraceae | sunflower | 8 |
| Ranunclales | | |
| Berberidaceae | barberry | 1 |
| Dipsacales | | |
| Caprifoliaceae | honeysuckle | 2 |
| Celastrales | | |
| Celastraceae | boxleaf | 1 |
| Pinales | | |
| Cupressaceae | cypress | 1 |
| Ericales | | |
| Ericaceae | heath | 4 |
| Fabaceae | pea | 2 |
| Garryales | | |
| Garryaceae | silk-tassel | 1 |
| Saxifragales | | |
| Grossulariacea | current | 1 |
| Cornales | | |
| Hydrangeraceae | hydrangia | 3 |
| Liliales | | |
| Liliaceae | lily | 1 |
| Rosales | | |
| Rhamnaceae | buckthorn | 3 |
| Roseaceae | rose | 8 |
| | Total | 37 |

**Table 5**—Forbs and grasses in Arizona's ponderosa pine forest type.

| | Order<br>Family | Common name group | Species In Pp |
|---|---|---|---|
| Forbs | | | |
| | Apiales | | |
| | Apiaceae | carrot | 1 |
| | Asterales | | |
| | Asteraceae | aster | 14 |
| | Incertae sedis | | |
| | Boraginaceae | sunflower | 1 |
| | Fabales | | |
| | Fabaceae | legume | 3 |
| | Geraniales | | |
| | Geranicea | geranium | 1 |
| | Lamiales | | |
| | Lamiaceae | mint | 1 |
| | Liliales | | |
| | Liliaceae | lily | 1 |
| | Ranunculales | | |
| | Ranunculaceae | buttercup | 1 |
| | Rosales | | |
| | Rosaceae | rose | 1 |
| | Gentianales | | |
| | Rubiaceae | coffee | 2 |
| | Lamiales | | |
| | Scrophulariaceae | figwort | 1 |
| | | Total | 27 |
| Grass | | | |
| | Poales | | |
| | Poaceae | fescue | 30 |
| | | Total | 30 |
| Other | | | |
| | Poales | | |
| | Cyperaceae | sedge | 2 |
| | Asparagales | | |
| | Agavaceae | agava | 3 |
| | Polypodiales | | |
| | Dennstaeditaceae | fern | 1 |
| | Vitales | | |
| | Vitaceae | grape | 1 |
| | | Total | 37 |
| | | **Total** | **94** |

# Variety of Animal Life

## Mammals

The mammal life form in the ponderosa pine type varies in size from a tiny shrew to the large elk. There are mammals that fly (bats), swim (beaver), burrow underground (gopher), run fast (pronghorn) or walk slow (porcupine). There is considerable information in the scientific literature on the life history of mammals in ponderosa pine primarily because many are important game animals. All the 48 animal species (Table 6) either consume plants, other animals, or both and every species is part of a biological engine for nutrient cycling and energy flow.

**Table 6**—Mammals in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name<br>group | | Species In<br>Pp |
|---|---|---|---|
| Artiodactyla | | | |
| Antilocapridae | Pronghorn | | 1 |
| Cervidae | Deer, elk | | 3 |
| Tayassuidae | Peccary | | 1 |
| | | Total | 5 |
| Carnivora | | | |
| Canidae | Foxes, wolves | | 1 |
| Felidae | Cats | | 2 |
| Ursidae | Bears | | 1 |
| Mustelidae | Weasels, allies | | 2 |
| Mephitidae | Skunks | | 1 |
| Procyonidae | Raccoon, allies | | 1 |
| | | Total | 8 |
| Chiroptera | | | |
| Molossidae | Free-tailed bats | | 1 |
| Vespertilonidae | Vesper bats | | 10 |
| | | Total | 11 |
| Rodentia | | | |
| Castoridae | Beaver | | 1 |
| Erethizontidae | Porcupine | | 1 |
| Geomyidae | Pocket gophers | | 2 |
| Muridae | Rats-mice | | 7 |
| Sciuridae | Squirrels, allies | | 6 |
| Arvicolinae | Voles, muskrats, lemmings | | 1 |
| | | Total | 18 |
| Lagomorpha | | | |
| Leporidae | Rabbits, hares | | 4 |
| Sorcimorpha | | | |
| Soricidae | Shrews | | 2 |
| | | Total | 6 |
| | | **Total** | **48** |

The amount of food consumed by large herbivores, 4.5 lb/day for mule deer and 11 lb/day for elk (Varner et al. 1954), is from an understory containing woody and herbaceous plants. Eight (17%) of the 48 species in the forest type are carnivores. Mammals have a constant body temperature and need a dependable food source. All of the cats are obligate carnivores (cougar) and consume only animal tissue, while obligate herbivores (elk) consume only plant tissue; however, the black bear is primarily omnivorous. While some animals are taxonomically carnivores, they also consume plant material, e.g., the coyote.

The six families of rodents contain 18 species and are a source of food for carnivores and birds of prey. One small rodent species (vole) is insectivorous. Understory vegetation and plant debris (leaves, logs, stumps etc.) are the primary cover for most of the small mammals (mice, rats, chipmunks). Understory vegetation and plant debris are affected by different management practices such a fire and timber harvesting and need to be considered in the resource management planning process. Two large herbivorous mammals that depend on understory vegetation for their well-being are deer (Wallmo 1981) and elk (Thomas and Toweill 1982) and are often used as featured species in management plans. Appendix 3 contains a listing of all animal species used to create Tables 6 to 9.

## Birds

The number of birds (111) identified as being in ponderosa pine stands reflects a range of niches they use for food and cover (Table 7). Birds are a natural part of biological engines in facilitating energy flow and nutrient cycling in forest ecosystems. They get energy from fruits and berries and their droppings spread the seeds of plants. Some nectar-feeding birds spread pollen to fertilize flowers of overstory and understory plants. Birds eat insects that damage important tree species and in-turn are food for birds of prey. Habits or traits of some bird species have descriptions that suggest their ecological role (e.g., birds of prey, ground dwelling, perching or cavity nesting). Birds like the wild turkey nest on the ground while others have nests in a tree crown, in the cavity of a snag, or an understory shrub. A large number of bird species (73) found in ponderosa pine have the common trait of perching and are known as songbirds or passerines.

**Table 7**—Birds in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name<br>group | | Species In<br>Pp |
|---|---|---|---|
| Apodiformes | | | |
| Apoidae | Swifts | | 1 |
| Trochilidae | Hummingbirds | | 3 |
| Piciformes | | | |
| Picidae | Woodpeckers, allies | | 7 |
| Caprimulgiformes | | | |
| Caprimulgidae | Goatsuckers | | 2 |
| Columbiformes | | | |
| Columbidae | Pigeons, doves | | 2 |
| Ciconiiformes | | | |
| Cathartidae | Vultures | | 1 |
| Galliformes | | | |
| Odontophoridae | Quail | | 2 |
| Phaisianidae | Partridge, grouse, turkey | | 2 |
| Falconiformes | | | |
| Acciptridae | Eagles, hawks, allies | | 9 |
| Falconidae | Falcons, allies | | 3 |
| Strigiformes | | | |
| Strigidae | Owls | | 6 |
| | | Total | 38 |
| Passeriformes | | | |
| Aegithalidae | Bushtits, verdins | | 1 |
| Alaudidae | Larks | | 1 |
| Bombycillidae | Waxwings | | 1 |
| Cardinalidae | Cardinals, allies | | 3 |
| Certhiidae | Creepers | | 1 |
| Cinclidae | Dippers | | 1 |
| Corvidae | Jays, crows, allies | | 5 |
| Emberzidae | Sparrows, allies | | 10 |
| Fringillidae | Finches, allies | | 3 |
| Hirundinidae | Swallows | | 4 |
| Icteridae | Blackbirds | | 7 |
| Laniidae | Shrikes | | 1 |
| Mimidae | Thrashers, allies | | 1 |
| Paridae | Chickadees, titmice | | 2 |
| Parulidae | Wood-warblers | | 4 |
| Peucedramidae | Olive warbler | | 1 |
| Regulidae | Kinglets | | 2 |
| Sittidae | Nuthatches | | 3 |
| Sylviidae | Gnatcatchers | | 1 |
| Trogoldytides | Wrens | | 5 |
| Turdidae | Thrushes | | 7 |
| Tyrannidae | Tyrant flycatchers | | 8 |
| Vireonidae | Vireos | | 1 |
| | | Total | 73 |
| | | **Total** | **111** |

## Amphibians and Reptiles

The low number of amphibians (Table 8) in the ponderosa pine type is attributed to their dependence on water and moist terrestrial areas needed to reproduce and lay eggs. Amphibian eggs have a soft membrane of a jelly-like substance that can lose or gain water rapidly. Most but not all amphibians have a complex mode of life that includes both a water larval stage and a terrestrial adult stage. Because of two developmental stages, amphibians are more vulnerable to human activity that can change the availability and quality of existing water sources and moist terrestrial habitats such as understory vegetation, debris, and decaying logs.

Amphibians have a dual role in ecosystem functioning by eating many species of insects and in-turn serving as prey for larger animals. They have a sensitive and permeable skin that can absorb water and have the potential of being indicators of pollution. The tiger salamander is a protected species under state and Federal law; it occurs in ponderosa pine and is the only native salamander in Arizona.

**Table 8**—Amphibians and reptiles in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name group | Species In Pp |
|---|---|---|
| Amphibians | | |
| Caudata | | |
| Ambystomatidae | Salamanders | 1 |
| Anura | | |
| Bufonidae | True toads | 2 |
| Hylidae | Tree frogs | 3 |
| Ranidae | True frogs | 3 |
| Scaphiopodidae | Spadefoot toads | 1 |
| | Total | 10 |
| Reptiles | | |
| Chelona | | |
| Kinosternidae | Mud turtles | 1 |
| Squamata | | |
| Teiidae | Whiptails, allies | 4 |
| Colubridae | Typical snakes | 6 |
| Crotalidae | Rattlesnakes | 7 |
| Crotaphytidae | Collared lizards | 1 |
| Dipsadidae | Rear-fanged snakes | 2 |
| Anguidae | Alligator lizards, allies | 1 |
| Phrynosomatidae | Spiney lizards | 9 |
| Scincidae | Skinks | 2 |
| Natricidae | Gartersnakes | 4 |
| | Total | 37 |
| | **Total** | **47** |

Reptiles are cold-blooded animals that depend on their surrounding environment for heat. They differ from amphibians in that they have scales and typically lay eggs that are tough and leathery. The arthropod food base for reptiles in ponderosa pine includes insects, lizards, and small mammals. Snakes account for over half (19) of the reptiles (37) in the ponderosa pine forest type (Table 8). The 17 species of lizards are major consumers of insects. All of the rattlesnakes, the Gila monster, and coral snake are venomous (Lowe et al.1986).

## Arthropods

It is a challenge to include arthropods (insects and their allies) when listing species that occur in a forest type (Table 9). The Phylum Arthropoda includes the Class Diplopoda (millipedes), Chilopoda (centipedes), Arachnida (spiders) and Insecta. Insects have a complex taxonomy that can include subclass, suborder, superfamily, subfamily, and tribe. For a genus with a large number of species, authorities sometimes find it more convenient to list only one as a representative for 15 to 20 species. Since the ponderosa pine type includes trees other than ponderosa pine, these other trees are also hosts for insects and are included in the species richness list.

In a study on the Kaibab National Forest, Rasmussen (1941) found 250,000 insects/ac at ground surface. The total number of arthropods (422) probably underestimates the actual number; as a result, the current list is a work in progress. Seven of 80 families (ground beetles, bark beetles, darkling beetles, skippers, gossamer butterflies, brushfooted butterflies, and ants) account for 50% of the species listed. The several families of butterflies are of special interest because of their aesthetic value by nature enthusiasts and potential ecological value as indicators of environmental change.

Insects have a positive contribution in the ponderosa pine forest type as pollinators of understory plants and as a food source for birds and small mammals. However, more information is available about insects that are destructive. Research and management has focused mostly on the pest category (Furniss and Carolin 1977), which is a natural focus because insects affect humans in the loss of plant products and the transmission of disease. One way to group insects is by their effect on different tree species such as defoliators (e.g. budworms), sap sucking (galls and mites), and woodborers (moths and beetles) (Fairweather et al. 2006).

**Table 9**—Arthropods in Arizona's ponderosa pine forest type.

| Order<br>Family | Common name<br>group | Species In<br>Pp |
|---|---|---|
| Coleoptera | | |
| Buprestidae | Flat-headed wood borers | 7 |
| Carabidae | Ground beetles | 29 |
| Cerambycidae | Round-headed borers | 14 |
| Chrysomelidae | Alder leaf beetle | 1 |
| Cleridae | Checkered beetles | 7 |
| Coccinellidae | Lady beetles | 5 |
| Colydiidae | Bark beetle | 1 |
| Curculionidae | Bark beetles | 38 |
| Curculionidae | Weevils | 6 |
| Elateridae | Click beetles | 3 |
| Histeridae | Hister beetles | 2 |
| Melandryidae | Unknown | 1 |
| Meloidae | Blister beetle | 1 |
| Melyridae | Two-spotted melyrid | 1 |
| Nitidulidae | Unknown | 1 |
| Scarabaeidae | Dung beetles | 6 |
| Staphylinidae | Rove beetle | 1 |
| Tenebrionidae | Darkling beetles | 21 |
| Trogositidae | Unknown | 1 |
| | Total | 146 |
| Lepidoptera | | |
| Arctiidae | Tiger moths | 2 |
| Gelechiidae | Unknown | 1 |
| Geometridae | Looper moth | 1 |
| Hesperiidae | Skippers | 35 |
| Lasiocampidae | Tent caterpillar | 1 |
| Lycaenidae | Gossamer-wing butterflies | 23 |
| Lymantriidae | Tussock moth | 1 |
| Nymphalidae | Brushfooted butterflies | 44 |
| Noctuidae | Owlet moths | 4 |
| Olethreutidae | Codling moth | 1 |
| Pieridae | White/sulphur butterflies | 12 |
| Papilionidae | Parnassians/swallowtails | 8 |
| Pyralidae | Pyralid moths | 7 |
| Riodinidae | Metalmarks | 3 |
| Saturniidae | Silk moths | 2 |
| Sessidae | Clear-winged | 2 |
| Tortricidae | Tortricid moths | 7 |
| Yponomeutidae | Moth | 2 |
| | Total | 156 |
| Diptera | | |
| Bombyliidae | Bee fly | 8 |
| Cecidomyidae | Gall midges | 4 |
| Chironomidae | Spindle midge | 1 |
| Dolichophodidae | Long-legged fly | 1 |
| Syrphidae | Syrphid fly | 13 |
| Tachinidae | Tachnid fly | 9 |
| | Total | 36 |

(continued)

**Table 9**—(Continued).

| Order<br>Family | Common name<br>group | | Species In<br>Pp |
|---|---|---|---|
| Hemiptera | | | |
| Adelgidae | Galls | | 2 |
| Anthocoridae | Anthocorid bugs | | 2 |
| Aphididae | Aphids | | 4 |
| Aphrophoridae | Spittlebugs | | 1 |
| Arabidae | Pine flat bug | | 1 |
| Ceropidae | Spittle bug | | 1 |
| Cicadidae | Cicada | | 1 |
| Cicadellidae | Leafhoppers | | 4 |
| Clastopteridae | Spittlebug | | 1 |
| Diaspididae | Pine needle scale | | 1 |
| Lygaeidae | Left-footed bugs | | 2 |
| Margarodidae | Needle scale | | 2 |
| Miridae | Plant bugs | | 2 |
| Pentatomidae | Stink bugs | | 4 |
| Rhopalidae | Plant bug | | 1 |
| Tingidae | Lace bug | | 1 |
| | | Total | 30 |
| Hymenoptera | | | |
| Apidae | Bees | | 2 |
| Braconidae | Wasp | | 1 |
| Diprionidae | Sawflies | | 9 |
| Formicidae | Ants | | 19 |
| Ichneumonidae | Wasp | | 1 |
| Megachilidae | Leaf-cutting bee | | 1 |
| Mutillidae | Velvet ant | | 1 |
| Ptermoalidae | Unknown | | 1 |
| Siricidae | Wood wasp | | 3 |
| Sphecidae | Wasp | | 1 |
| Torymidae | Chaclid | | 1 |
| Vespidae | Wasps | | 3 |
| | | Total | 43 |
| Orthoptera | | | |
| Acrididae | Grasshoppers | | 1 |
| Phasmatidae | Stick insect | | 1 |
| Tettigoniidae | Katydids, crickets | | 1 |
| Rhinotermitidae | Termites | | 1 |
| | | Total | 4 |
| Isoptera | | | |
| Rhinotermitidae | Subterranean termites | | 2 |
| Acari | | | |
| Tetranychus | Spider mites | | 1 |
| Araneae | | | |
| Aranidae | Orbweavers | | 1 |
| Chilopoda | | | |
| Scolopendridae | Centipedes | | 1 |
| Odonata | | | |
| Coenagrionidae | Damselflies | | 1 |
| Thysanoptera | | | |
| Oxythrips | Unknown | | 1 |
| | | Total | 7 |
| | | **Total** | **422** |

## Paying it Forward

An inventory of plant and animal species at the project or planning level from stands to watersheds and landscapes is one of the necessary tools for effective resource management in the 21st Century. Without a list of species, resource management may have negative or unknown effects on all species occupying a forest type. Because of the Forest and Range Renewable Resources Planning Act (U.S. Congress 1974), Federal and state agencies began to accumulate lists of species found on lands under their authority. Where these lists are maintained and continually revised, they provide an inventory of species commonly found in a given forest type and enhance a manager's understanding of the complexity of the plant and animal communities they manage.

## Change is a Certainty

All animal species are directly or indirectly dependent on the availability of plants and plant communities for their life needs. Managers know that species possess different tolerances (ecological amplitude) to environmental factors. There is a certainty that animal species will change location over time as plant composition changes due to development and succession that alters existing habitat. Without creating replacement habitat in a timely manner, areas reserved for a protected species will not have the same resources over time for the species to survive and reproduce. Successional theory further indicates the predictability of maintaining a variety of plant developmental stages within a forested landscape that would maintain diverse kinds of plant and animal life forms and species. Identifying animals associated with plants for food and cover across successional stages provides a base to compare change.

## Characterizing by Species Richness

The ponderosa pine forest type in Arizona has 125 plant species in 36 families and 628 animal species in 147 families for an SR value of 753 species in 183 families (Table 10). With the high number of species that is often present, managers will have a difficult time including diversity as a management component without reducing the number inventoried and monitored. The number of plant and animal species in a forest type is a tangible metric, but there is little corresponding data reflecting the intangible values suggested by Pimlot (1969) (e.g., just knowing that an organism is present). However, one intangible value that seems to exist in a ponderosa pine forest type (Table 10) is related to the number (111) of bird species that might be needed to control the number (422) of insect species.

**Table 10**—Variety of species and life forms in Arizona's ponderosa pine forest type.

| Life forms | Families in Pp | Species in Pp | Percent of total species |
|---|---|---|---|
| **Plants** | | | |
| Forbs | 11 | 27 | 4 |
| Grasses | 1 | 30 | 4 |
| Shrubs | 14 | 37 | 5 |
| Trees | 6 | 24 | 3 |
| Others[a] | 4 | 7 | 1 |
| Total | 36 | 125 | 17 |
| **Animals** | | | |
| Amphibians | 5 | 10 | 1 |
| Arthropods | 80 | 422 | 56 |
| Birds | 33 | 111 | 15 |
| Mammals | 19 | 48 | 6 |
| Reptiles | 10 | 37 | 5 |
| Total | 147 | 628 | 83 |
| **Total** | **183** | **753** | **100** |

[a] Others = cacti, fern, agave, vine, sedge

There are limited ways to use quantified indices as a management tool, given the limits to our current state of knowledge and available management resources. Therefore, an interim way to account for one level of diversity is to use a "self-evident" or a "common sense phenomenon" approach: plants and animals exist in a biotic community because that community has sufficient environmental resources to maintain those species. Sufficient resources relate to the Law of Tolerance, where there are minimum and maximum limits of environmental factors that an animal or plant can tolerate (Odom 1971). A complex mixture of environmental factors maintained in time and space fundamentally supports a certain level of diversity of plants and animals in Arizona's ponderosa pine forest.

## A Second Level of Diversity

The SR list for plants and animals in ponderosa pine approximates the first level of diversity. A second level of diversity with a reasonable degree of inclusion for a planning area is possible by associating animal species with forest successional stages categorized by tree diameter, canopy cover, stand size, and spatial juxtaposition. These successional stages account for predictable differences in understory vegetation (shrubs, forbs and grasses). This second level could take the form of ecological state-and-transition models with potential silvicultural transitions (e.g. prescribed burning).

## Planning for the Future Forest

The future requires meaningful diversity elements that can be assessed and monitored while a forest is actively and adaptively being restored or under a management plan. Managers will never have complete or perfect information about diversity for decision-making purposes; however, tools exist that provide approximations of conditions. Using existing relational databases at the local level to collate past and present research data and allow extraction of selective stand structural data, provides a significant tool for science-based management decisions.

Along with GPS and GIS technology, aerial photography, and growth and yield models, stand boundaries can be an overlay on a base map for the planning area. With additional diversity layers, the map becomes a visual model to establish current conditions and future use to monitor change. With this kind of information, foresters, wildlife biologists and conservation organizations can work together to use existing stand conditions along with land capability to design a future forest containing a variety of life that meets both forest and wildlife management objectives.

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## Appendix 2—List of plant species in Arizona's ponderosa pine forest type (this information is open access on Northern Arizona University website: http://nau.edu/CEFNS/Forestry/Research/Insect-Ecol-and-Mgmt/).

| Scientific name | Common name | Plant Code[a] | Life Form | Order | Family |
|---|---|---|---|---|---|
| *Hymenoxys richardsonii* | Pingue | hymric | fo | Asterales | Asteraceae |
| *Erigeron flagellaris* | Trailing fleabane | erifla | fo | Asterales | Asteraceae |
| *Pedicularis centranthera* | dwarf lousewort | pedcen | fo | Lamiales | Scrophulariaceae |
| *Galium asperrimum* | bedstraw | galasp | fo | Gentianales | Rubiaceae |
| *Galium fendleri* | Fendler's bedstraw | galfen | fo | Gentianales | Rubiaceae |
| *Geranium caespitosum* | purple geranium | gercae | fo | Geraniales | Geraniaceae |
| *Haplopappus parryi* | Parry's goldenweed | happar | fo | Asterales | Asteraceae |
| *Lotus wrightii* | red and yellow pea | lotwri | fo | Fabales | Fabaceae |
| *Hieracium fendleri* | hieracium fendleri | hiefen | fo | Asterales | Asteraceae |
| *Erigeron divergens* | Spreading fleabane | eridiv | fo | Asterales | Asteraceae |
| *Pseudocymopterus montanus* | false springparsley | psemon | fo | Apiales | Apiaceae |
| *Lathyrus graminfolius* | peavine | latlan | fo | Fabales | Fabaceae |
| *Leucelene ericoides* | rose heath | leueri | fo | Asterales | Asteraceae |
| *Potentilla hippiana* | horse cinquefoil | pothip | fo | Rosales | Rosaceae |
| *Lithospermum multiflorum* | manyflower gromwell | litmul | fo | Incertae sedis | Boraginaceae |
| *Achillea millefolium* | common yarrow | achmil | fo | Asterales | Asteraceae |
| *Hedeoma hyssopifolium* | false pennyroyal | hedhys | fo | Lamiales | Lamiaceae |
| *Senecio wootonii* | Wooton's ragwort | senwoo | fo | Asterales | Asteraceae |
| *Erigeron platyphyllus* | fleabane | eripla | fo | Asterales | Asteraceae |
| *Thalictrum fendleri* | meadowrue | thafen | fo | Ranunculales | Ranunculaceae |
| *Vicia americana* | American vetch | vicame | fo | Fabales | Fabaceae |
| *Solidago sparsiflora* | threenerve goldenrod | solspa | fo | Asterales | Asteraceae |
| *Solidago canadensis* | Canada goldenrod | solcan | fo | Asterales | Asteraceae |
| *Senecio neomexicanus* | groundsel | senneo | fo | Asterales | Asteraceae |
| *Artemisia ludoviciana* | Louisiana sagebrush | artlud | fo | Asterales | Asteraceae |
| *Smilacina stellata* | Solomon's seal | smiste | fo | Liliales | Liliaceae |
| *Antennaria parvifolia* | common pussytoes | antpar | fo | Asterales | Asteraceae |
| *Agropyron smithii* | western wheatgrass | agrsmi | gr | Poales | Poaceae |
| *Muhlenbergia longiligula* | longtongue muhly | muhlon | gr | Poales | Poaceae |
| *Muhlenbergia montana* | mountain muhly | muhmon | gr | Poales | Poaceae |
| *Muhlenbergia rigens* | deergrass | muhrig | gr | Poales | Poaceae |
| *Muhlenbergia virescens* | screwleaf muhly | mulvir | gr | Poales | Poaceae |
| *Panicum bulbosum* | bulb panicgrass | panbul | gr | Poales | Poaceae |
| *Angdropgon hallii* | sand bluestem | andhal | gr | Poales | Poaceae |
| *Aristida fendleriana* | Arizona threeawn | arifen | gr | Poales | Poaceae |
| *Koeleria macrantha* | junegrass | koemac | gr | Poales | Poaceae |
| *Blepharoneuron tricholepis* | pine dropseed | bletri | gr | Poales | Poaceae |
| *Bromus inermis* | smooth brome | broine | gr | Poales | Poaceae |
| *Bouteloua gracilis* | blue gramma | bougra | gr | Poales | Poaceae |
| *Festuca arizonica* | Arizona fescue | fesari | gr | Poales | Poaceae |
| *Bromus carinatus* | mountain brome | brocar | gr | Poales | Poaceae |

| Scientific name | Common name | Plant Code[a] | Life Form | Order | Family |
|---|---|---|---|---|---|
| *Elymus longifolium* | squirreltail | elylon | gr | Poales | Poaceae |
| *Elymus canadensis* | Canada wildrye | elycan | gr | Poales | Poaceae |
| *Danthonia parryi* | oatgrass | danpar | gr | Poales | Poaceae |
| *Bromus porteri* | Porter brome | bropor | gr | Poales | Poaceae |
| *Aristida orcuttiana* | single threeawn | ariorc | gr | Poales | Poaceae |
| *Poa longiligula* | longtongue mutton bluegrass | poalon | gr | Poales | Poaceae |
| *Sitanion hystrix* | bottle-brush squirreltail | sithys | gr | Poales | Poaceae |
| *Sporobolus interruptus* | black dropseed | spoint | gr | Poales | Poaceae |
| *Schizachyrium cirratum* | texas bluestem | schcir | gr | Poales | Poaceae |
| *Stipa comata* | needle-and-thread | sticom | gr | Poales | Poaceae |
| *Stipa pringlei* | Pringel's speargrass | stipri | gr | Poales | Poaceae |
| *Schizachyrium scoparium* | little bluestem | schsco | gr | Poales | Poaceae |
| *Poa pratensis* | Kentucky bluegrass | poapra | gr | Poales | Poaceae |
| *Poa fendleriana* | mutton bluegrass | poafen | gr | Poales | Poaceae |
| *Poa ampla* | big bluegrass | poaamp | gr | Poales | Poaceae |
| *Piptochaetium fimbriatum* | pinyon ricegrass | pipfim | gr | Poales | Poaceae |
| *Agave parryi* | century plant | agapar | ot | Asparagales | Agavaceae |
| *Yucca glauca* | soapweed yucca | yucgla | ot | Asparagales | Agavaceae |
| *Yucca schottii* | Schott's yucca | yucsch | ot | Asparagales | Agavaceae |
| *Vitis arizonica* | canyon grape | vitari | ot | Vitales | Vitaceae |
| *Carex rossii* | Ross' sedge | carros | ot | Poales | Cyperaceae |
| *Pteridium aquilinum* | bracken fern | pteaqu | ot | Polypodiales | Dennstaediaceae |
| *Carex geophila* | dryland sedge | cargeo | ot | Poales | Cyperaceae |
| *Rhamnus crocaea* | redberry buckthorn | rhacro | sh | Rosales | Rhamnaceae |
| *Garrya wrightii* | Wright silktassel | garwri | sh | Garryales | Garryaceae |
| *Sambucus coerulea* | blue elderberry | samcoe | sh | Dipsacales | Caprifoliaceae |
| *Calliandra humilis* | dwarf calliandra | calhum | sh | Ericales | Fabaceae |
| *Mimosa biuncifera* | catclaw mimos | mimbiu | sh | Ericales | Fabaceae |
| *Fallugia paradoxa* | Apache-plume | falpar | sh | Rosales | Rosaceae |
| *Ribes cercum* | wax crrent | ribcer | sh | Saxifragales | Grossulariaceae |
| *Rhamnus betulaefolia* | birchleaf buckthorn | rhabet | sh | Rosales | Rhamnaceae |
| *Cercocarpus montanus* | true mountainmahogany | cermon | sh | Rosales | Rosaceae |
| *Rhus trilobata* | skunkbush sumac | rhutri | sh | Sapinales | Anacardiaceae |
| *Chamaebatiaria millefolium* | fernbush | chamil | sh | Rosales | Rosaceae |
| *Chrosothamns parryi* | rabbitbrush | chrpar | sh | Asterales | Asteraceae |
| *Juniperus communis* | common juniper | juncom | sh | Pinales | Cupressaceae |
| *Chrysopsis villosa* | hairy goldenaster | chrvil | sh | Asterales | Asteraceae |
| *Cowania mexicana* | cliffrose | cowmex | sh | Rosales | Rosaceae |
| *Rubus strigosus* | wild raspberry | rubstr | sh | Rosales | Rosaceae |
| *Ceanothus fendleri* | buckbrush | ceafen | sh | Rosales | Rhamnaceae |
| *Symphoricarpob s oreophilus* | snowberry | symore | sh | Dipsacales | Caprifoliaceae |
| *Tetradymia canescens* | gray horsebrush | tetcan | sh | Asterales | Asteraceae |
| *Arbutus arizonica* | Arizonia madrone | arbari | sh | Ericales | Ericaceae |
| *Physocarpus monogynus* | mountain ninebark | phymon | sh | Rosales | Rosaceae |
| *Philadelphus microphyllus* | littleleaf mockorange | phimic | sh | Cornales | Hydrangeaceae |

| Scientific name | Common name | Plant Code[a] | Life Form | Order | Family |
|---|---|---|---|---|---|
| *Arctostaphylos patula* | greenleaf manzanita | arcpat | sh | Ericales | Ericaceae |
| *Arctostaphylos pringlei* | pringle manzanita | arcpri | sh | Ericales | Ericaceae |
| *Pachystima mysinites* | Oregon boxleaf | pacmys | sh | Celastrales | Celastraceae |
| *Jamesia americana* | cliff jamesia | jamame | sh | Cornales | Hydrangeaceae |
| *Arctostaphylos pungens* | pointleaf manzanita | arcpun | sh | Ericales | Ericaceae |
| *Gutierrezia sarothrae* | broom snakeweed | gutsar | sh | Asterales | Asteraceae |
| *Artemisia arbuscula* | low sagebrush | artarb | sh | Asterales | Asteraceae |
| *Artemisia carruthii* | flat sagebrush | artcar | sh | Asterales | Asteraceae |
| *Artemisia nova* | black sagebrush | artnov | sh | Asterales | Asteraceae |
| *Fendlerella utahensis* | Utah fendlerella | fenuta | sh | Cornales | Hydrangeaceae |
| *Artemisia tridentata* | big sagebrush | arttri | sh | Asterales | Asteraceae |
| *Purshia tridentata* | antelope bitterbrush | purtri | sh | Rosales | Rosaceae |
| *Holodiscus dumosus* | bush rockspirea | holdum | sh | Rosales | Rosaceae |
| *Berberis repens* | Oregon grape | berrep | sh | Ranunculales | Berberidaceae |
| *Nolina microcarpa* | sacahuista | nolmic | sh | Liliales | Liliaceae |
| *Juniperus osteosperma* | Utah juniper | junost | tr | Pinales | Cupressaceae |
| *Pinus fallax* | Arizona pinyon | pinfal | tr | Pinales | Pinaceae |
| *Pinus engelmannii* | Apache pine | pineng | tr | Pinales | Pinaceae |
| *Pinus edulis* | pinyon pine | pinedu | tr | Pinales | Pinaceae |
| *Pinus discolor* | border pinyon | pindis | tr | Pinales | Pinaceae |
| *Pinus aristata* | bristlecone pine | pinari | tr | Pinales | Pinaceae |
| *Pinus ponderosa* | ponderosa pine | pinpon | tr | Pinales | Pinaceae |
| *Pinus strobiformis* | southwestern white pine | pinstr | tr | Pinales | Pinaceae |
| *Populus tremuloides* | quaking aspen | poptre | tr | Malpighiales | Salicaceae |
| *Prunus virginiana* | common chokecherry | pruvir | tr | Rosales | Rosaceae |
| *Quercus turbinella* | shrub live oak | quetur | tr | Fagales | Fagaceae |
| *Juniperus scopulorum* | Rocky Mountain juniper | junsco | tr | Pinales | Cupressaceae |
| *Robinia neomexicana* | New Mexican locust | robneo | tr | Fagales | Fagaceae |
| *Juniperus monosperma* | one-seed juniper | junmon | tr | Pinales | Cupressaceae |
| *Juniperus deppeana* | alligator juniper | jundep | tr | Pinales | Cupressaceae |
| *Juglans major* | Arizona walnut | jugmaj | tr | Juglandales | Juglandaceae |
| *Quercus arizonica* | Arizona white oak | queari | tr | Fagales | Fagaceae |
| *Quercus emeryi* | Emory oak | queeme | tr | Fagales | Fagaceae |
| *Quercus gambelii* | Gambel oak | quegam | tr | Fagales | Fagaceae |
| *Quercus grisea* | gray oak | quegri | tr | Fagales | Fagaceae |
| *Quercus hypoleucoides* | silverleaf oak | quehyp | tr | Fagales | Fagaceae |
| *Pinus leiophylla* | Chihuahua pine | pinlei | tr | Pinales | Pinaceae |
| *Quercus rugosa* | netleaf oak | querug | tr | Fagales | Fagaceae |
| *Pseudotsuga menziesii* | Douglas-fir | psemen | tr | Pinales | Pinaceae |

[a]Plant Code: The first 3 letters from genus plus the first 3 letters of species. When duplicates occur, the last letter is replaced by a number. The spp after the first 3 letters of a genus indicates that the species may be present but needs verification. This code is the unique, primary key for using plant data in a relational database.

# Appendix 3—List of animal species in Arizona's ponderosa pine forest type (this information is open access on Northern Arizona University website: http://nau.edu/CEFNS/Forestry/Research/Insect-Ecol-and-Mgmt/).

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Ambystoma mavoritum* | barred tiger salamander | ambmav | am | Caudata | Ambystomatidae |
| *Anaxyrus microscaphus* | arizona toad | anamic | am | Anura | Bufonidae |
| *Anaxyrus punctatus* | red-spotted toad | anapun | am | Anura | Bufonidae |
| *Hyla arenicolor* | canyon treefrog | hylare | am | Anura | Hylidae |
| *Hyla wrightorum* | arizona treefrog | hylwri | am | Anura | Hylidae |
| *Lithobates chiricahuensis* | chiricahua leopard frog | litchi | am | Anura | Ranidae |
| *Lithobates pipiens* | northern leopard frog | litpip | am | Anura | Ranidae |
| *Lithobates tarahumarae* | tarahumara frog | littar | am | Anura | Ranidae |
| *Pseudacris triseriata* | western chorus frog | psetri | am | Anura | Hylidae |
| *Spea multiplicata* | mexican spadefoot | spemul | am | Anura | Scaphiopodidae |
| *Acanthocinus obliquus* | roundheaded borer | acaobl | ar | Coleoptera | Cerambycidae |
| *Acanthocinus princeps* | roundheaded borer | acapri | ar | Coleoptera | Cerambycidae |
| *Acanthocinus spectabilis* | roundheaded borer | acaspe | ar | Coleoptera | Cerambycidae |
| *Acanthomyops latipes* | unknown | acalat | ar | Hymenoptera | Formicidae |
| *Acanthoscelides monagas* | bean weevil | acamon | ar | Coleoptera | Curculionidae |
| *Acanthoscelides napensis* | bean weevil | acanap | ar | Coleoptera | Curculionidae |
| *Achalarus casica* | desert cloudwing | achcas | ar | Lepidoptera | Hesperiidae |
| *Acmaeodera variegate* | flat-headed wood borer | acmvar | ar | Coleoptera | Buprestidae |
| *Acmaeops proteus* | round-headed borer | acmpro | ar | Coleoptera | Cerambycidae |
| *Adelges cooleyi* | cooley spruce gall | adecoo | ar | Hemiptera | Adelgidae |
| *Adelpha bredowii* | california sister | adebre | ar | Lepidoptera | Nymphalidae |
| *Agonum placidum* | ground beetle | agopla | ar | Coleoptera | Carabidae |
| *Agraulis vanillae* | gulf fritillary | agrvan | ar | Lepidoptera | Nymphalidae |
| *Allograpta obligua* | flower bee | allobl | ar | Diptera | Syrphidae |
| *Altica ambiens* | alder flea beetle | altamb | ar | Coleoptera | Chrysomelidae |
| *Amara farcta* | unknown | amafar | ar | Coleoptera | Carabidae |
| *Amara interstitialis* | unknown | amaint | ar | Coleoptera | Carabidae |
| *Amara latior* | unknown | amalat | ar | Coleoptera | Carabidae |
| *Amara obesa* | unknown | amaobe | ar | Coleoptera | Carabidae |
| *Amara quensii* | unknown | amaque | ar | Coleoptera | Carabidae |
| *Amblyscirtes exoteria* | large roadside-skipper | ambexo | ar | Lepidoptera | Hesperiidae |
| *Amblyscirtes fimbriata* | orange-edged roadside-skipper | ambfim | ar | Lepidoptera | Hesperiidae |
| *Anabrus simplex* | mormon cricket | anasim | ar | Orthroptera | Tettigoniidae |
| *Anatis lecontei* | ladybird beetle | analec | ar | Coleoptera | Coccineliidae |
| *Anchytonix* spp | owlet moths | ancspp | ar | Lepidoptera | Noctuidae |
| *Anisodactylus anthracinus* | unknown | aniant | ar | Coleoptera | Carabidae |
| *Anisodactylus consobrinus* | unknown | anicon | ar | Coleoptera | Carabidae |
| *Anthaxia retifera* | flat-headed wood Borer | antret | ar | Coleoptera | Buprestidae |
| *Anthocharis thoosa* | southwestern orangetip | anttho | ar | Lepidoptera | Pieridae |
| *Anthrax fulviana* | bee fly | antful | ar | Diptera | Bombyliidae |
| *Anthrax lateralis* | bee fly | antlat | ar | Diptera | Bombyliidae |
| *Anthrax sinuosa* | bee fly | antsin | ar | Diptera | Bombyliidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Apenteles electrae* | wasps | apeele | ar | Hymenoptera | Braconidae |
| *Aphodius anthracinus* | dung beetle | aphant | ar | Coleoptera | Scarabaeidae |
| *Aphodius subruncatus* | dung beetle | aphsub | ar | Coleoptera | Scarabaeidae |
| *Aphodius vittatus* | dung beetle | aphvit | ar | Coleoptera | Scarabaeidae |
| *Aphrohora* spp | spittle bugs | aphspp | ar | Hemiptera | Aphrophoridae |
| *Apis mellifera* | honey bee | apimel | ar | Hymenoptera | Apidae |
| *Apodemia mormo* | mormon metalmark | apomor | ar | Lepidoptera | Rioridinidae |
| *Apodemia nais* | nais metalmark | aponai | ar | Lepidoptera | Rioridinidae |
| *Apodemia phyciodoides* | cresent metalmark | apophy | ar | Lepidoptera | Rioridinidae |
| *Aradus cinnamomeus* | pine flat bug | aracin | ar | Hemiptera | Arabidae |
| *Araneus* spp | orbweavers | orbspp | ar | Araneae | Aranidae |
| *Artnopalus* spp | round-headed borer | artspp | ar | Coleoptera | Cerambycidae |
| *Asemum* spp | round-headed borer | asespp | ar | Coleoptera | Cerambycidae |
| *Asida macra* | unknown | asimac | ar | Coleoptera | Tenebrionidae |
| *Asterocampa celtis* | hackberry emperor | astcel | ar | Lepidoptera | Nymphalidae |
| *Athous arizonicus* | click beetle | athari | ar | Coleoptera | Elateridae |
| *Atlides halesus* | great purple hairstreak | atlhal | ar | Lepidoptera | Lycaenidae |
| *Aulonium* spp | cylindrical bark beetles | aulspp | ar | Coleoptera | Colydiidae |
| *Battus philenor* | pipevine swallowtail | batphi | ar | Lepidoptera | Papilionidae |
| *Bembidion rupicola* | unknown | bemrup | ar | Coleoptera | Carabidae |
| *Bembidium lucidum* | unknown | bemuci | ar | Coleoptera | Carabidae |
| *Boisea rubrolineata* | western boxelder bug | labrub | ar | Hemiptera | Miridae |
| *Brephidium exile* | unknown | breexi | ar | Lepidoptera | Lycaenidae |
| *Brochymena* spp | stink bug | brospp | ar | Hemiptera | Pentatomidae |
| *Buprestis aurulenta* | flat-headed borer | bupaur | ar | Coleoptera | Buprestidae |
| *Calathus dubius* | ground beetle | caldub | ar | Coleoptera | Carabidae |
| *Callophrys augustinus* | brown elfin | calaug | ar | Lepidoptera | Lycaenidae |
| *Callophrys eryphon* | western pine elfin | calery | ar | Lepidoptera | Lycaenidae |
| *Callophrys gryneus* | juniper hairstreak | calgry | ar | Lepidoptera | Lycaenidae |
| *Callophrys spinetorum* | thicket hairstreak | calspi | ar | Lepidoptera | Lycaenidae |
| *Callophrys xami* | xami hairstreak | calxam | ar | Lepidoptera | Lycaenidae |
| *Camponotus modac* | unknown | cammod | ar | Hymenoptera | Formicidae |
| *Camponotus* spp | carpenter ants | camspp | ar | Hymenoptera | Formicidae |
| *Camponotus vicinus* | unknown | camvic | ar | Hymenoptera | Formicidae |
| *Carabus taedatus agassii* | ground beetle | cartae | ar | Coleoptera | Carabidae |
| *Carphoborus* spp | unknown | carspp1 | ar | Coleoptera | Curculionidae |
| *Carpophilus* spp | unknown | carspp2 | ar | Coleoptera | Nitidulidae |
| *Cataboma pyrastiri* | unknown | catpyr | ar | Diptera | Syrphidae |
| *Cecidomyia piniinopis* | gall midge | cecpin | ar | Diptera | Cecidomyiidae |
| *Celastrina argiolus L.* | unknown | celarg | ar | Lepidoptera | Lycaenidae |
| *Celastrina neglecta* | summer azure | celneg | ar | Lepidoptera | Lycaenidae |
| *Cercopidae* spp | spittlebug | cerspp | ar | Hemiptera | Cercopidae |
| *Cercyonis meadii* | mead's wood-nymph | cermea | ar | Lepidoptera | Nymphalidae |
| *Cercyonis oetus* | dark wood nymph | ceroet | ar | Lepidoptera | Nymphalidae |
| *Cercyonis pegala* | common wood-nymph | cerpeg | ar | Lepidoptera | Nymphalidae |
| *Chaenius leucoscelis* | unknown | chaleu | ar | Coleoptera | Carabidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Chalcophora* spp | flat-headed wood borer | chaspp | ar | Coleoptera | Buprestidae |
| *Chionaspis pinifoliae* | unknown | chipin | ar | Hemiptera | Diaspididae |
| *Chlorochroa* spp | stink bug | chlspp | ar | Hemiptera | Pentatomidae |
| *Chlosyne acastus* | sagebrush checkerspot | chlaca | ar | Lepidoptera | Nymphalidae |
| *Choristoneura lambertiana* | unknown | cholam | ar | Lepidoptera | Tortricidae |
| *Choristoneura occidentalis* | western spruce budworm | choocc | ar | Lepidoptera | Tortricidae |
| *Choristoneura retiniana* | unknown | choret | ar | Lepidoptera | Tortricidae |
| *Chrysotoxum derviatum* | unknown | chrder | ar | Diptera | Syrphidae |
| *Cicindela puctulata* | unknown | cicpuc | ar | Coleoptera | Carabidae |
| *Cinara* spp | aphid | cinspp | ar | Hemiptera | Aphididae |
| *Clastoptera* spp | spittlebug | claspp | ar | Hemiptera | Clastopteridae |
| *Coelocnemis magna* | darkling beetle | coemag | ar | Coleoptera | Tenebrionidae |
| *Coleotecnites ponderosana* | moth, needle miner | colpon1 | ar | Lepidoptera | Gelechiidae |
| *Colias eurytheme* | orange sulphur | coleur | ar | Lepidoptera | Pieridae |
| *Colladonus beameri* | leafhopper | colbea | ar | Hemiptera | Cicadellidae |
| *Colladonus ponderosus* | leafhopper | colpon2 | ar | Hemiptera | Cicadellidae |
| *Colladonus tahotus* | leafhopper | coltah | ar | Hemiptera | Cicadellidae |
| *Collops bipunctatus* | two-spotted melyrid | colbip | ar | Coleoptera | Melyridae |
| *Coloradia doris* | caterpillar | coldor | ar | Lepidoptera | Saturniidae |
| *Coloradia pandora* | moth | colpan | ar | Lepidoptera | Saturniidae |
| *Conophthorus ponderosae* | unknown | conpon | ar | Coleoptera | Curculionidae |
| *Conotrachelus neomexicanus* | ponderosa pine cone weevil | conneo | ar | Coleoptera | Curculionidae |
| *Contarinia coloradensis* | gall midge | concol | ar | Diptera | Cecidomyiidae |
| *Corticeus* spp | darkling beetle | corspp | ar | Coleoptera | Tenebrionidae |
| *Corythucha arcuate* | lace bug | corarc | ar | Hemiptera | Tingidae |
| *Crematogaster punctulata* | unknown | crepun | ar | Hymenoptera | Formicidae |
| *Ctenicera* spp | click beetle | ctespp | ar | Coleoptera | Elateridae |
| *Cychrus dubius* | ground beetle | cycdub | ar | Coleoptera | Carabidae |
| *Cycloneda sanguinea* | ladybird beetle | cycsan | ar | Coleoptera | Coccineliidae |
| *Cyclotrachelus constrictus* | unknown | cyccon | ar | Coleoptera | Carabidae |
| *Cydia piperana* | ponderosa pine seedworm | cydpip | ar | Lepidoptera | Tortricidae |
| *Cyllopsis pertepida* | canyonland satry | cylper | ar | Lepidoptera | Nymphalidae |
| *Cymbiodyta arizonica* | chiricahua water scavenger beetle | cymari | ar | Coleoptera | Carabidae |
| *Cymindis planipennis* | unknown | cympla | ar | Coleoptera | Carabidae |
| *Danaus glippus* | unknown | dangli | ar | Lepidoptera | Nymphalidae |
| *Danaus Plexippus* | monarch | danple | ar | Lepidoptera | Nymphalidae |
| *Dasineura* spp | midge | dasspp | ar | Diptera | Cecidomyiidae |
| *Dendroctonus adjunctus* | roundheaded pine beetle | denadj | ar | Coleoptera | Curculionidae |
| *Dendroctonus approximatus* | snout beetle/ mexican pine beetle | denapp | ar | Coleoptera | Curculionidae |
| *Dendroctonus brevicomis* | western pine beetle | denbre | ar | Coleoptera | Curculionidae |
| *Dendroctonus frontalis* | bark beetle | denfro | ar | Coleoptera | Curculionidae |
| *Dendroctonus mexicanus* | mexican pine beetle | denmex | ar | Coleoptera | Curculionidae |
| *Dendroctonus ponderosae* | mountain pine beetle | denpon | ar | Coleoptera | Curculionidae |
| *Dendroctonus rufipennis* | snout beetle/spruce beetle | denfuf | ar | Coleoptera | Curculionidae |
| *Dendroctonus valens* | red turpentine beetle | denval | ar | Coleoptera | Curculionidae |
| *Diapheromera femorata* | walkingstick | diafem | ar | Orthroptera | Phasmatidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Dicerca* spp | flat-headed wood borer | dicspp2 | ar | Coleoptera | Buprestidae |
| *Dichelonyx* spp | unknown | dicspp1 | ar | Coleoptera | Scarabaeidae |
| *Dioryctria abietivorella* | pyralid moth | dioabi | ar | Lepidoptera | Pyralidae |
| *Dioryctria auranticella* | pyralid moth | dioaur | ar | Lepidoptera | Pyralidae |
| *Dioryctria cambiicola* | cone moth | diocam1 | ar | Lepidoptera | Pyralidae |
| *Dioryctria cambiicola* | pyralid moth | diocam2 | ar | Lepidoptera | Pyralidae |
| *Dioryctria rossi* | moth | dioros | ar | Lepidoptera | Pyralidae |
| *Dipalta serpentine* | bee fly | dipser | ar | Diptera | Bombyliidae |
| *Dolichovespula* spp | hornet | dolspp | ar | Hymenoptera | Vespidae |
| *Dryocoetes confusus* | western balsam bark beetle | drycon | ar | Coleoptera | Curculionidae |
| *Echinomia algens* | unknown | echalg | ar | Diptera | Tachinidae |
| *Elatobium abietinum* | spruce aphid | elaabi | ar | Hemiptera | Aphididae |
| *Eleodes carbonaria* | darkling beetle | elecar | ar | Coleoptera | Tenebrionidae |
| *Eleodes consobrina* | darkling beetle | elecon | ar | Coleoptera | Tenebrionidae |
| *Eleodes dissmilis* | darkling beetle | eledis | ar | Coleoptera | Tenebrionidae |
| *Eleodes extricatus* | darkling beetle | eleext | ar | Coleoptera | Tenebrionidae |
| *Eleodes hispilabris* | darkling beetle | elehis | ar | Coleoptera | Tenebrionidae |
| *Eleodes humeralis* | darkling beetle | elehum | ar | Coleoptera | Tenebrionidae |
| *Eleodes nigrina* | darkling beetle | elenig | ar | Coleoptera | Tenebrionidae |
| *Eleodes obscura* | darkling beetle | eleobs2 | ar | Coleoptera | Tenebrionidae |
| *Eleodes obsoletus* | darkling beetle | eleobs1 | ar | Coleoptera | Tenebrionidae |
| *Eleodes planipennis* | darkling beetle | elepla | ar | Coleoptera | Tenebrionidae |
| *Eleodes quadricollis* | auger beetle | elequa | ar | Coleoptera | Tenebrionidae |
| *Embaphion contuscum* | darkling beetle | embcon | ar | Coleoptera | Tenebrionidae |
| *Emmenastus ater* | unknown | emmate | ar | Coleoptera | Tenebrionidae |
| *Emmenastus convexus* | handsome fungus beetle | emmcon | ar | Coleoptera | Tenebrionidae |
| *Enoclerus lecontei* | black bellied clerid | enolec | ar | Coleoptera | Cleridae |
| *Enoclerus moestus* | checkered beetle | enomoe | ar | Coleoptera | Cleridae |
| *Enoclerus sphegeus* | red-bellied clerid | enosph | ar | Coleoptera | Cleridae |
| *Epalpus bicolor* Will. | unknown | epabic | ar | Diptera | Tachinidae |
| *Epargyreus clarus* | silver-spotted skipper | epacla | ar | Lepidoptera | Hesperiidae |
| *Epicauta* spp | blister beetle | epispp | ar | Coleoptera | Meloidae |
| *Ergates spiculatus* | roundheaded borer | ergspi | ar | Coleoptera | Cerambycidae |
| *Ergatis* spp | ponderosa borer | ergspp | ar | Coleoptera | Cerambycidae |
| *Erora quaderna* | arizona hairstreak | eroqua | ar | Lepidoptera | Lycaenidae |
| *Erynnis afranius* | afranius duskywing | eryafr | ar | Lepidoptera | Hesperiidae |
| *Erynnis funeralis* | funereal dusky wing | eryfun | ar | Lepidoptera | Hesperiidae |
| *Erynnis icelus* | dreamy duskywing | eryice | ar | Lepidoptera | Hesperiidae |
| *Erynnis juvenalis* | juvenal's duskywing | eryjuv | ar | Lepidoptera | Hesperiidae |
| *Erynnis meridianus* | meridian duskywing | erymer | ar | Lepidoptera | Hesperiidae |
| *Erynnis pacuvius* | pacuvius duskywing | erypac | ar | Lepidoptera | Hesperiidae |
| *Erynnis persius* | persius duskywing | eryper | ar | Lepidoptera | Hesperiidae |
| *Erynnis telemachus* | rocky mountain duskywing | erytel | ar | Lepidoptera | Hesperiidae |
| *Erynnis tristis* | mournful duskywing | erytri | ar | Lepidoptera | Hesperiidae |
| *Essigella* spp | aphid | essspp | ar | Hemiptera | Aphididae |
| *Eucosma sonomana* | twig moth | eucson | ar | Lepidoptera | Tortricidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Eulachnus* spp | aphid | eulspp | ar | Hemiptera | Aphididae |
| *Eupeodes volucris* | unknown | eupvol | ar | Diptera | Syrphidae |
| *Euphilotes spaldingi* | spalding's dotted-blue | ephspa | ar | Lepidoptera | Lycaenidae |
| *Euphydryas chalcedona* | unknown | eupcha | ar | Lepidoptera | Nymphalidae |
| *Euphyes vestris* | dun skipper | eupves | ar | Lepidoptera | Hesperiidae |
| *Euptoieta claudia* | variegated fritillary | eupcla | ar | Lepidoptera | Nymphalidae |
| *Eurema mexicana* | mexican yellow | eurmex | ar | Lepidoptera | Pieridae |
| *Eurema nicippe* | unknown | eurnic | ar | Lepidoptera | Pieridae |
| *Eustrophinus arizonensis* | unknown | eusari | ar | Coleoptera | Melandryidae |
| *Euxoa* spp | owlet moths | euxspp | ar | Lepidoptera | Noctuidae |
| *Exoprosopa dodrans* | bee fly | exodod | ar | Diptera | Bombyliidae |
| *Exoprosopa fasciata* | bee fly | exofas | ar | Diptera | Bombyliidae |
| *Fixenia ilavia* | unknown | fixila | ar | Lepidoptera | Lycaenidae |
| *Formica laeviceps* (McKay) | unknown | forlae | ar | Hymenoptera | Formicidae |
| *Formica neogagatus* | unknown | forneo | ar | Hymenoptera | Formicidae |
| *Formica occulta* | unknown | forocc | ar | Hymenoptera | Formicidae |
| *Formica oreas* | unknown | forore | ar | Hymenoptera | Formicidae |
| *Galenara consimilus* | unknown | galcon | ar | Lepidoptera | Geometridae |
| *Glaucopsyche lygdamus* | silvery blue | glalyg | ar | Lepidoptera | Lycaenidae |
| *Gnathotrichus retusus* | ambrosia beetle | gnaret | ar | Coleoptera | Curculionidae |
| *Gnathotrichus sulcatus* | unknown | gnasul | ar | Coleoptera | Curculionidae |
| *Grapta zephyrus* | unknown | grazep | ar | Lepidoptera | Nymphalidae |
| *Halisidota ingens* | unknown | haling | ar | Lepidoptera | Arctiidae |
| *Harpalus amputates* | ground beetle | haramp | ar | Coleoptera | Carabidae |
| *Harpalus fraternus* | ground beetle | harfra | ar | Coleoptera | Carabidae |
| *Harpalus funcetus* | ground beetle | harfun | ar | Coleoptera | Carabidae |
| *Harpalus herbivagus* | ground beetle | harher | ar | Coleoptera | Carabidae |
| *Harpalus oblitus* | ground beetle | harobl | ar | Coleoptera | Carabidae |
| *Harpalus pensylvanicus* | ground beetle | harpen | ar | Coleoptera | Carabidae |
| *Harpalus retractus* | ground beetle | harret | ar | Coleoptera | Carabidae |
| *Heliopetes alpheus* | unknown | helalp | ar | Lepidoptera | Hesperiidae |
| *Heliopetes ericetorum* | northern white-skipper | heleri | ar | Lepidoptera | Hesperiidae |
| *Heliothis armiger* | owlet moths | helarm | ar | Lepidoptera | Noctuidae |
| *Hemiargus isola* | unknown | hemiso | ar | Lepidoptera | Lycaenidae |
| *Hemicrepidus spp* | click beetle | hemspp | ar | Coleoptera | Elateridae |
| *Hesperagrion heterodoxum* | damselflies | heshet | ar | Odonata | Coenagrionid |
| *Hesperia colorado* | western branded skipper | hescol | ar | Lepidoptera | Hesperiidae |
| *Hesperia nevada* | nevada skipper | hesnev | ar | Lepidoptera | Hesperiidae |
| *Hesperia pahaska* | pahaska skipper | hespah | ar | Lepidoptera | Hesperiidae |
| *Hesperia uncas* | uncas skipper | hesunc | ar | Lepidoptera | Hesperiidae |
| *Hesperia woodgatei* | apache skipper | heswoo | ar | Lepidoptera | Hesperiidae |
| *Hippodamia lecontei* | unknown | hiplec | ar | Coleoptera | Coccineliidae |
| *Hippodamia convergens* | ladybird beetle | hipcon | ar | Coleoptera | Coccineliidae |
| *Hippodamia signata* | convergent lady beetle | hipsig | ar | Coleoptera | Coccineliidae |
| *Homoncocnemis fortis* | owlet moths | homfor | ar | Lepidoptera | Noctuidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Hylastes nigrinus* | bark beetle | hylnig | ar | Coleoptera | Curculionidae |
| *Hylurgops porosus* | bark beetle | hylpor | ar | Coleoptera | Curculionidae |
| *Hylurgops subcostulatus* | bark beetle | hylsub | ar | Coleoptera | Curculionidae |
| *Hypaurotis crysalus* | colorado hairstreak | hypcry | ar | Lepidoptera | Lycaenidae |
| *Hyphantria cunea* | unknown | hypcun | ar | Lepidoptera | Lycaenidae |
| *Icaricia icarioides* | blue butterfly | icaica | ar | Lepidoptera | Lycaenidae |
| *Icaricia lupini* | lupine blue | icalup | ar | Lepidoptera | Lycaenidae |
| *Iphthimus laevissimus* | darkling beetle | iphlae | ar | Coleoptera | Tenebrionidae |
| *Iphthimus lewisii* | darkling beetle | iphlew | ar | Coleoptera | Tenebrionidae |
| *Ips bonanseai* | bark beetle | ispbon | ar | Coleoptera | Curculionidae |
| *Ips calligraphus* | bark beetle | ipscal | ar | Coleoptera | Curculionidae |
| *Ips confusus* | pine engraver beetle | ipscon | ar | Coleoptera | Curculionidae |
| *Ips integer* | bark beetle | ipsint2 | ar | Coleoptera | Curculionidae |
| *Ips knausi* | bark beetle | ipskna | ar | Coleoptera | Curculionidae |
| *Ips latidens* | bark beetle | ipslat | ar | Coleoptera | Curculionidae |
| *Ips lecontei* | bark beetle | ipslec | ar | Coleoptera | Curculionidae |
| *Ips pilifrons* | ips beetle | ipspil | ar | Coleoptera | Curculionidae |
| *Ips pini* | bark beetle | ipsbee | ar | Coleoptera | Curculionidae |
| *Judolia instabillis* | round-headed borer | judins | ar | Coleoptera | Cerambycidae |
| *Junonia coenia* | common buckeye | juncoe | ar | Lepidoptera | Nymphalidae |
| *Jurinella ambigua* | unknown | juramb | ar | Diptera | Tachinidae |
| *Labops hesperius* | black grass bug | labhes | ar | Hemiptera | Miridae |
| *Lasius crypticus* | unknown | lascry | ar | Hymenoptera | Formicidae |
| *Lasius pallitarsis* | unknown | laspal | ar | Hymenoptera | Formicidae |
| *Lasius sitiens* | unknown | lassit | ar | Hymenoptera | Formicidae |
| *Lasius umbratus* | unknown | lasumb | ar | Hymenoptera | Formicidae |
| *Laspeyresia piperana* | cone moth | laspip | ar | Lepidoptera | Olethreutidae |
| *Lebia viridis* | unknown | lebvir | ar | Coleoptera | Carabidae |
| *Leptocoris trivittatus* | plant bug | leptri | ar | Hemiptera | Rhopalidae |
| *Leptoglossus occidentalis* | leaf-footed bug | lepocc | ar | Hemiptera | Lygaeidae |
| *Leptotes marina* | marine blue | lepmar | ar | Lepidoptera | Lycaenidae |
| *Leptothorax rugulatus* | unknown | leprug | ar | Hymenoptera | Formicidae |
| *Libytheana carinenta* | tropical snout | libcar | ar | Lepidoptera | Nymphalidae |
| *Limenitis archippus* | viceroy | limarc | ar | Lepidoptera | Nymphalidae |
| *Limenitis arthemis* | white admiral | limart | ar | Lepidoptera | Nymphalidae |
| *Limenitis weidemeyerii* | weidmeyer's admiral | limwei | ar | Lepidoptera | Nymphalidae |
| *Lophocampa ingens* | tiger moth | loping | ar | Lepidoptera | Arctiidae |
| *Lycaeides melissa* | Karner blue | lycmel | ar | Lepidoptera | Lycaenidae |
| *Magdalis cuneiformis* | weevil | magcun | ar | Coleoptera | Curculionidae |
| *Malacosoma californicum* | unknown | malcal | ar | Lepidoptera | Lasiocampidae |
| *Mastrus* spp | wasp | masspp | ar | Hymenoptera | Ichneumonidae |
| *Matsucoccus acalyptus* | unknown | mataca | ar | Hemiptera | Margarodidae |
| *Matsucoccus vexillorum* | prescott scale | matvex | ar | Hemiptera | Margarodidae |
| *Medetera* spp | long-legged flies | medspp | ar | Diptera | Dolichopodidae |
| *Megastigmus albifrons* | unknown | megalb | ar | Hymenoptera | Torymidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Megdalis* spp | unknown | megspp | ar | Coleoptera | Curculionidae |
| *Melanophila* spp | flat-headed wood borer | melspp1 | ar | Coleoptera | Buprestidae |
| *Melanoplus* spp | unknown | melspp2 | ar | Orthroptera | Acrididae |
| *Melanostoma stegnum* Say. | unknown | melste | ar | Diptera | Syrphidae |
| *Melitaea nympha* | checkerspot | melnym | ar | Lepidoptera | Nymphalidae |
| *Mesogramma marginata* | unknown | mesmar | ar | Diptera | Syrphidae |
| *Microphthalma disjuncta* | unknown | micdis | ar | Diptera | Tachinidae |
| *Monochamus maculososus* | round-headed borer | monmac | ar | Coleoptera | Cerambycidae |
| *Monomorium minimum* | little black ant | monmin | ar | Hymenoptera | Formicidae |
| *Mycelia ethusa* | unknown | myceth | ar | Lepidoptera | Nymphalidae |
| *Mycterus concolor* | unknown | myccon | ar | Coleoptera | Curculionidae |
| *Myeloborus amplus* | bark beetle | myeamp | ar | Coleoptera | Curculionidae |
| *Myiolepta varipes* | unknown | myivar | ar | Diptera | Syrphidae |
| *Nathalis iole* | dainty sulphur | natiol | ar | Lepidoptera | Pieridae |
| *Necrobia violaceus* | blackelegged ham beetle | necvio | ar | Coleoptera | Cleridae |
| *Neobaphion planipennis* | darkling beetle | neopla | ar | Coleoptera | Tenebrionidae |
| *Neodiprion autumnalis* | conifer sawfly | neoaut | ar | Hymenoptera | Diprionidae |
| *Neodiprion demoides* | conifer sawfly | neodem | ar | Hymenoptera | Diprionidae |
| *Neodiprion edulicolis* | conifer sawfly | neoedu | ar | Hymenoptera | Diprionidae |
| *Neodiprion fulviceps* | sawfly | neoful | ar | Hymenoptera | Diprionidae |
| *Neodiprion gillettei* | conifer sawfly | neogil | ar | Hymenoptera | Diprionidae |
| *Neodiprion gilletti* | sawfly | nepgil | ar | Hymenoptera | Diprionidae |
| *Neodiprion ventralis* | sawfly | neoven | ar | Hymenoptera | Diprionidae |
| *Neominois ridingsii* | riding's satry | neorid | ar | Lepidoptera | Nymphalidae |
| *Neophasia menapia* | pine white | neomen | ar | Lepidoptera | Pieridae |
| *Nokomis fritillary* | orange butterfly | nokfri | ar | Lepidoptera | Nymphalidae |
| *Nudobius cephalicus* | rove beetle | nudcep | ar | Coleoptera | Staphylinidae |
| *Nymphalis antiopa* | mourning cloak | nymant | ar | Lepidoptera | Nymphalidae |
| *Nysius californicus* | unknown | nyscal | ar | Hemiptera | Lygaeidae |
| *Okanagana cruenifera* | cicada | ohacru | ar | Hemiptera | Cicadidae |
| *Oligonychus* spp | spider mites | olispp | ar | Acari | Tetranychus |
| *Orgyia pseudotsugata* | Douglas-fir tussock moth | orgpse | ar | Lepidoptera | Lymantriidae |
| *Oxythrips* spp | unknown | oxyspp | ar | Thysanoptera | Thripidae |
| *P. tessllata* | unknown | peltes | ar | Diptera | Tachinidae |
| *Pachyrhinus californicus* | unknown | paccal | ar | Lepidoptera | Nymphalidae |
| *Panzeria radicum* | unknown | panrad | ar | Diptera | Tachinidae |
| *Papilio bairdii* | swallowtail | papbai | ar | Lepidoptera | Papilionidae |
| *Papilio machaon* | old world swallowtail | papmac | ar | Lepidoptera | Papilionidae |
| *Papilio multicaudata* | two-tailed swallowtail | papmul | ar | Lepidoptera | Papilionidae |
| *Papilio polyxenes* | black swallowtail | pappol | ar | Lepidoptera | Papilionidae |
| *Papilio rutulus* | western tiger swallowtail | paprut | ar | Lepidoptera | Papilionidae |
| *Paramacera allyni* | pine satry | parall | ar | Lepidoptera | Nymphalidae |
| *Paratrytone snowi* | unknown | parsno | ar | Lepidoptera | Hesperiidae |
| *Parides alopius* | white-dotted cattleheart | paralo | ar | Lepidoptera | Papilionidae |
| *Peleteria robustta* | unknown | pelrob | ar | Diptera | Tachinidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Petrova arizonensis* | pinyon pitch nodule moth | petari | ar | Lepidoptera | Tortricidae |
| *Petrova metallica* | pitch nodule moth | petmet | ar | Lepidoptera | Tortricidae |
| *Pheidole ceres* | unknown | phecer | ar | Hymenoptera | Formicidae |
| *Pheidole coloradensis* | leaf-cutting bee | phecol | ar | Hymenoptera | Formicidae |
| *Phloeosinus* spp | cedar bark beetles | phospp | ar | Coleoptera | Curculionidae |
| *Phoebis sennae* | cloudless sulphur | phosen | ar | Lepidoptera | Pieridae |
| *Pholisora catullus* | common sootywing | phocat | ar | Lepidoptera | Hesperiidae |
| *Phthiria consors* | unknown | phtcon | ar | Diptera | Bombyliidae |
| *Phthiria sulphurea Loew.* | unknown | phtsul | ar | Diptera | Bombyliidae |
| *Phyciodes camillus* | unknown | phycam | ar | Lepidoptera | Nymphalidae |
| *Phyciodes cocyta* | northern crescent | phycoc | ar | Lepidoptera | Nymphalidae |
| *Phyciodes mylitta* | mylitta crescent | phymyl | ar | Lepidoptera | Nymphalidae |
| *Phyciodes picta* | painted crescent | phypic | ar | Lepidoptera | Nymphalidae |
| *Phycoides pratensis* | unknown | phypra | ar | Lepidoptera | Nymphalidae |
| *Phycoides pulchella* | unknown | phypul | ar | Lepidoptera | Nymphalidae |
| *Phyllophaga fimbripes* | may-June beetle | phyfim | ar | Coleoptera | Scarabaeidae |
| *Pieris occidentalis* | unknown | pieocc | ar | Lepidoptera | Papilionidae |
| *Pieris protodice* | unknown | piepro | ar | Lepidoptera | Pieridae |
| *Pieris rapae* | cabbage white | pierap | ar | Lepidoptera | Pieridae |
| *Pineus pinifoliae* | pine leaf adelgid | pinpin | ar | Hemiptera | Adelgidae |
| *Pinyina edulicola* | pinyon spindle gall midge | pinedu | ar | Diptera | Chironomidae |
| *Piruna polingii* | spotted skipperling | pirpol | ar | Lepidoptera | Hesperiidae |
| *Pissodes dubius* | balsam-fir bark weevil | pisdub | ar | Coleoptera | Curculionidae |
| *Pissodes schwarzi* | snout beetle | pissch | ar | Coleoptera | Curculionidae |
| *Pissodes strobi* | snout beetle | pisstr | ar | Coleoptera | Curculionidae |
| *Pityoborus secundus* | twig beetle | pitsec | ar | Coleoptera | Curculionidae |
| *Pityogenes carinulatus* | bark beetle | pitcar | ar | Coleoptera | Curculionidae |
| *Pityokteines minutus* | bark beetle | pitmin | ar | Coleoptera | Curculionidae |
| *Pityophthorus* spp | twig beetle | pitspp | ar | Coleoptera | Curculionidae |
| *Platynus dissectus* | unknown | pladis | ar | Coleoptera | Carabidae |
| *Platypedia berbardinoensis* | leafhopper | plaber | ar | Hemiptera | Cicadellidae |
| *Playsoma punctigerum* | hister beetle | plapun | ar | Coleoptera | Histeridae |
| *Plegaderus nitidus* | hister beetle | plenit | ar | Coleoptera | Histeridae |
| *Poanes melane* | umber skipper | poamel | ar | Lepidoptera | Hesperiidae |
| *Poanes taxiles* | taxiles skipper | poatax | ar | Lepidoptera | Hesperiidae |
| *Podisus crocatus* | soldier bug | podcro | ar | Hemiptera | Pentatomidae |
| *Podisus* spp | soldier bug | podspp | ar | Hemiptera | Pentatomidae |
| *Pogonocheras propinauus* | round-headed borer | pogpro | ar | Coleoptera | Cerambycidae |
| *Poladryas minuta* | dotted checkerspot | polmin | ar | Lepidoptera | Nymphalidae |
| *Polites draco* | draco skipper | poldra | ar | Lepidoptera | Hesperiidae |
| *Polyergus breviceps* | unknown | polbre | ar | Hymenoptera | Formicidae |
| *Polygonia gracilis* | hoary comma | polgra | ar | Lepidoptera | Nymphalidae |
| *Polygonia satyrus* | saytr comma | polsat | ar | Lepidoptera | Nymphalidae |
| *Pontia protodice* | checkered white | ponpro | ar | Lepidoptera | Pieridae |
| *Pontia sisymbrii* | spring white | ponsis | ar | Lepidoptera | Pieridae |
| *Pseudohylesinus nebulosa* | whie clouded longhorn beetle | pseneb | ar | Coleoptera | Curculionidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Pyrameis caryae* | unknown | pyrcar | ar | Lepidoptera | Nymphalidae |
| *Pyrgus albescens* | white checkered-skipper | pyralb | ar | Lepidoptera | Hesperiidae |
| *Pyrgus scriptura* | small checkered-skipper | pyrscr | ar | Lepidoptera | Hesperiidae |
| *Pyrgus zanthus* | unknown | pyrzan | ar | Lepidoptera | Hesperiidae |
| *Reticulitermes flavipes* | unknown | retfla | ar | Isoptera | Rhinotermitidae |
| *Reticulitermes hesperus* | western suberranean termite | rethes | ar | Isoptera | Rhinotermitidae |
| *Reticulitermes tibialis* | subterranean termite | rettib | ar | Orthroptera | Rhinotermitidae |
| *Rhadine* spp | unknown | rhaspp | ar | Coleoptera | Carabidae |
| *Rhyacionia bushnelli* | tip moth | rhybus | ar | Lepidoptera | Pyralidae |
| *Rhyacionia neomexicana* | moth | rhyneo | ar | Lepidoptera | Pyralidae |
| *Rubsaamenia* spp | unknown | rubspp | ar | Diptera | Cecidomyiidae |
| *Satyrium saepium* | hedge-row hairstreak | satsae | ar | Lepidoptera | Lycaenidae |
| *Satyrium sylvinus* | silvin hairstreak | satsyl | ar | Lepidoptera | Lycaenidae |
| *Schizolachnus* spp | aphid | schspp | ar | Hemiptera | Aphididae |
| *Scolopendra* spp | centipedes | scospp | ar | Chipoda (class) | Scolopendridae |
| *Scoloposcelis flavicornis* | anthocorid bug | scofla | ar | Hemiptera | Anthocoridae |
| *Scolytus fiskei* | unknown | scofis | ar | Coleoptera | Curculionidae |
| *Scolytus monticolae* | bark beetle | scomon | ar | Coleoptera | Curculionidae |
| *Scolytus ventralis* | snout beetle | scoven | ar | Coleoptera | Curculionidae |
| *Scythropus* spp | unknown | scyspp | ar | Coleoptera | Curculionidae |
| *Senotainia rubriventris* | unknown | senrub | ar | Diptera | Tachinidae |
| *Siphona geniculate* | tachinid fly | sipgen | ar | Diptera | Tachinidae |
| *Sirex* spp | woodwasp | sirspp | ar | Hymenoptera | Siricidae |
| *Speyeria aphrodite* | aphrodite fritillary | speaph | ar | Lepidoptera | Nymphalidae |
| *Speyeria hesperis* | northwestern fritillary | spehes | ar | Lepidoptera | Nymphalidae |
| *Speyeria mormonia* | mormon fritillary | spemor | ar | Lepidoptera | Nymphalidae |
| *Sternocorus* spp | round-headed borer | stespp | ar | Coleoptera | Cerambycidae |
| *Stinga morrisoni* | morrison's skipper | stimor | ar | Lepidoptera | Hesperiidae |
| *Strymon melinus* | gray hairstreak | strmel | ar | Lepidoptera | Lycaenidae |
| *Styloxus bicolor* | roundheaded borer | stybic | ar | Coleoptera | Cerambycidae |
| *Synanthedon* spp | clear-winged moth | synspp | ar | Lepidoptera | Sessidae |
| *Syraphus creper* | syrphid fly | syrcre | ar | Diptera | Syrphidae |
| *Syraphus lotus* | syrphid fly | syrlot | ar | Diptera | Syrphidae |
| *Syraphus ribesii* | syrphid fly | syrrib | ar | Diptera | Syrphidae |
| *Syraphus ruficauda* | unknown | syrruf | ar | Diptera | Syrphidae |
| *Syrphus americanus* | syrphid fly | syrame | ar | Diptera | Syrphidae |
| *Syrphus arcuatus* | syrphid fly | syrarc | ar | Diptera | Syrphidae |
| *Tachys nanus* | ground beetle | tacnan | ar | Coleoptera | Carabidae |
| *Tampinoma sessile* | unknown | tamses | ar | Hymenoptera | Formicidae |
| *Temnochila chlorodia* | unknown | temchl | ar | Coleoptera | Trogositidae |
| *Thanasimus dubius* | unknown | thadub | ar | Coleoptera | Cleridae |
| *Thanasimus undatulus* | unknown | thaund | ar | Coleoptera | Cleridae |
| *Thessalia fulvia* | brushfoot | theful | ar | Lepidoptera | Nymphalidae |
| *Thorybes diversus* | unknown | thodiv | ar | Lepidoptera | Hesperiidae |
| *Thorybes mexicana* | mexican cloudywing | thomex | ar | Lepidoptera | Hesperiidae |
| *Thorybes pylades* | northern cloudywing | thopyl | ar | Lepidoptera | Hesperiidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Trachykele blondeli* | juniper borer | trablo | ar | Coleoptera | Buprestidae |
| *Tragosoma* spp | unknown | traspp | ar | Coleoptera | Cerambycidae |
| *Trichodes ornatus* | ornate checkered beetle | triorn | ar | Coleoptera | Cleridae |
| *Tricoryhyphes condylus* | mayfly | tricon | ar | Coleoptera | Tenebrionidae |
| *Tritneptis doris* | unknown | tridor | ar | Hymenoptera | Ptermoalidae |
| *Trox sonorae* | skin beetle | troson | ar | Coleoptera | Scarabaeidae |
| *Unknown* | velvet ant | mutspp | ar | Hymenoptera | Mutillidae |
| *Unknown* | wasp | sphspp | ar | Hymenoptera | Sphecidae |
| *Urocerus* spp | unknown | urospp | ar | Hymenoptera | Siricidae |
| *Vanessa antiopa* | unknown | vanant | ar | Lepidoptera | Nymphalidae |
| *Vanessa atalanta* | red admiral | vanata | ar | Lepidoptera | Nymphalidae |
| *Vanessa californica* | unknown | vancal | ar | Lepidoptera | Nymphalidae |
| *Vanessa cardui* | painted lady | vancar | ar | Lepidoptera | Nymphalidae |
| *Vanessa virginiensis* | american lady | vanvir | ar | Lepidoptera | Nymphalidae |
| *Vespamima* spp | clear-winged moth | vesspp | ar | Lepidoptera | Sessidae |
| *Vespula acadica* | forest yellowjacket | vesaca | ar | Hymenoptera | Vespidae |
| *Vespula pennsylvanica* | western yellowjacket | vespen | ar | Hymenoptera | Vespidae |
| *Xeris* spp | unknown | xerspp | ar | Hymenoptera | Siricidae |
| *Xylocopa* spp | unknown | xylspp | ar | Hymenoptera | Apidae |
| *Zadiprion rohweri* | sawfly | zadroh | ar | Hymenoptera | Diprionidae |
| *Zadiprion townsendi* | sawfly | zadtow | ar | Hymenoptera | Diprionidae |
| *Zelleria haimbachi* | unknown | zelhai | ar | Lepidoptera | Yponomeutidae |
| *Zelleria* spp | ermine moth | zelspp | ar | Lepidoptera | Yponomeutidae |
| *Zerene cesonia* | southern dogface | zerces | ar | Lepidoptera | Pieridae |
| *Zestusa dorus* | short-tailed arizona skipper | zesdor | ar | Lepidoptera | Hesperiidae |
| *Accipiter cooperii* | cooper's hawk | acccoo | bi | Falconiformes | Accipitridae |
| *Accipiter gentilis* | northern goshawk | accgen | bi | Falconiformes | Accipitridae |
| *Aegolius acadicus* | northern saw-whet owl | aegaca | bi | Strigiformes | Strigidae |
| *Aeronautes saxatalis* | white-throated swift | aersax | bi | Apodiformes | Apoidae |
| *Agelaius phoeniceus* | red-winged blackbird | agepho | bi | Passeriformes | Icteridae |
| *Amphispiza bilineata* | black-throated sparrow | ampbil | bi | Passeriformes | Emberizidae |
| *Aquila chrysaetos* | golden eagle | aquchr | bi | Falconiformes | Accipitridae |
| *Archilochus alexandri* | black-chinned hummingbird | arcale | bi | Apodiformes | Trochilidae |
| *Asio otus* | long-eared owl | asiotu | bi | Strigiformes | Strigidae |
| *Bombycilla cedrorum* | cedar waxwing | bomced | bi | Passeriformes | Bombycillidae |
| *Bubo virginianus* | great horned owl | butvirg | bi | Strigiformes | Strigidae |
| *Buteo jamaicensis* | red-tailed hawk | butjam | bi | Falconiformes | Accipitridae |
| *Buteo regalis* | ferruginous hawk | butreg | bi | Falconiformes | Accipitridae |
| *Buteo swainsoni* | swainson's hawk | butswa | bi | Falconiformes | Accipitridae |
| *Calcarius ornatus* | chestnut-collared longspur | calorn | bi | Passeriformes | Parulidae |
| *Callipepla gambelii* | gambel's quail | calgam | bi | Galliformes | Odontophoridae |
| *Cardellina rubrifrons* | red-faced warbler | carrub | bi | Passeriformes | Parulidae |
| *Cathartes aura* | turkey vulture | cataur | bi | Ciconiiformes | Cathartidae |
| *Catharus guttatus* | hermit thrush | catgut | bi | Passeriformes | Turdidae |
| *Catharus ustulatus* | swainson's thrush | catust | bi | Passeriformes | Turdidae |
| *Catherpes mexicanus* | canyon wren | catmex | bi | Passeriformes | Troglodytidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Certhia americana* | brown creeper | cerame | bi | Passeriformes | Certhiidae |
| *Chondestes grammacus* | lark sparrow | chogra | bi | Passeriformes | Emberizidae |
| *Chordeiles minor* | common nighthawk | chomin | bi | Caprimulgiformes | Caprimulgidae |
| *Cinclus mexicanus* | american dipper | cinmex | bi | Passeriformes | Cinclidae |
| *Circus cyaneus* | northern harrier | circya | bi | Falconiformes | Accipitridae |
| *Cistothorus palustris* | marsh wren | cispal | bi | Passeriformes | Troglodytidae |
| *Coccothraustes vespertinus* | evening grosbeak | cocves | bi | Passeriformes | Fringillidae |
| *Colaptes auratus* | northern flicker | colaur | bi | Piciformes | Picidae |
| *Contopus pertinax* | greater pewee | conper | bi | Passeriformes | Tyrannidae |
| *Contopus sordidulus* | western wood-pewee | consor | bi | Passeriformes | Tyrannidae |
| *Corvus brachyrhynchos* | american crow | corbra | bi | Passeriformes | Corvidae |
| *Corvus corax* | common raven | corcor | bi | Passeriformes | Corvidae |
| *Cyanocitta stelleri* | steller's jay | cyaste | bi | Passeriformes | Corvidae |
| *Cyrtonyx montezumae* | montezuma quail | crymon | bi | Galliformes | Odontophoridae |
| *Dendragapus obscurus* | dusky grouse | denobs | bi | Galliformes | Phaisianidae |
| *Dumetella carolinensis* | gray catbird | dumcar | bi | Passeriformes | Mimide |
| *Empidonax difficilis* | pacific slope flycatcher | empdif | bi | Passeriformes | Tyrannidae |
| *Empidonax hammondii* | hammond's flycatcher | empham | bi | Passeriformes | Tyrannidae |
| *Empidonax oberholseri* | dusky flycatcher | empobe | bi | Passeriformes | Tyrannidae |
| *Eremophila alpestris* | horned lark | erealp | bi | Passeriformes | Alaudidae |
| *Euphagus cyanocephalus* | brewer's blackbird | eupcya | bi | Passeriformes | Icteridae |
| *Falco mexicanus* | prairie falcon | falmex | bi | Falconiformes | Falconidae |
| *Falco peregrinus* | peregrine falcon | falper | bi | Falconiformes | Falconidae |
| *Falco sparverius* | american kestrel | falspa | bi | Falconiformes | Falconidae |
| *Geothlypis trichas* | common yellowthroat | geotri | bi | Passeriformes | Parulidae |
| *Glaucidium gnoma* | northern pygmy-owl | glagno | bi | Strigiformes | Strigidae |
| *Gymnorhinus cyanocephalus* | pinyon jay | gymcya | bi | Passeriformes | Corvidae |
| *Haliaeetus leucocephalus* | bald eagle | halleu | bi | Falconiformes | Accipitridae |
| *Hirundo rustica* | barn swallow | hirrus | bi | Passeriformes | Hirundinidae |
| *Icterus parisorum* | scott's oriole | ictpar | bi | Passeriformes | Icteridae |
| *Junco hyemalis* | dark-eyed junco | junhye | bi | Passeriformes | Emberizidae |
| *Lanius ludovicianus* | loggerhead shrike | lanlud | bi | Passeriformes | Laniidae |
| *Loxia curvirostra* | red crossbill | loxcur | bi | Passeriformes | Fringillidae |
| *Melanerpes formicivorus* | acorn woodpecker | melfor | bi | Piciformes | Picidae |
| *Melanerpes lewis* | lewis' woodpecker | mellew | bi | Piciformes | Picidae |
| *Meleagris gallopavo* | wild turkey | melgal | bi | Galliformes | Phaisianidae |
| *Melospiza lincolnii* | lincoln's sparrow | mellin | bi | Passeriformes | Emberizidae |
| *Melospiza melodia* | song sparrow | melmel | bi | Passeriformes | Emberizidae |
| *Molothrus ater* | brown-headed cowbird | molate | bi | Passeriformes | Icteridae |
| *Myadestes townsendi* | townsend's solitaire | myatow | bi | Passeriformes | Turdidae |
| *Myioborus pictus* | painted redstart | myipic | bi | Passeriformes | Parulidae |
| *Nucifraga columbiana* | clark's nutcracker | nuccol | bi | Passeriformes | Corvidae |
| *Otus flammeolus* | flammulated owl | otufla | bi | Strigiformes | Strigidae |
| *Pandion haliaetus* | osprey | panhal | bi | Falconiformes | Accipitridae |
| *Passerculus sandwichensis* | savannah sparrow | passan | bi | Passeriformes | Emberizidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Patagioenas fasciata* | band-tailed pigeon | patfas | bi | Columbiformes | Columbidae |
| *Peucedramus taeniatus* | olive warbler | peutae | bi | Passeriformes | Peucedramidae |
| *Phalaenoptilus nuttallii* | common poorwill | phanut | bi | Caprimulgiformes | Caprimulgidae |
| *Pheucticus melanocephalus* | black-headed grosbeak | phemel | bi | Passeriformes | Cardinalidae |
| *Picoides pubescens* | downy woodpecker | picpub | bi | Piciformes | Picidae |
| *Picoides villosus* | hairy woodpecker | picvil | bi | Piciformes | Picidae |
| *Pipilo chlorurus* | green-tailed towhee | pipchl | bi | Passeriformes | Emberizidae |
| *Piranga flava* | hepatic tanager | pirfla | bi | Passeriformes | Cardinalidae |
| *Piranga ludoviciana* | western tanager | pirlud | bi | Passeriformes | Cardinalidae |
| *Poecile gambeli* | mountain chickadee | poegam | bi | Passeriformes | Paridae |
| *Poecile sclateri* | mexican chickadee | poescl | bi | Passeriformes | Paridae |
| *Polioptila caerulea* | blue-gray gnatcatcher | polcae | bi | Passeriformes | Sylviidae |
| *Pooecetes gramineus* | vesper sparrow | poogra | bi | Passeriformes | Emberizidae |
| *Progne subis* | purple martin | prosub | bi | Passeriformes | Hirundinidae |
| *Psaltriparus minimus* | bushtit | psamin | bi | Passeriformes | Aegithalidae |
| *Regulus calendula* | ruby-crowned kinglet | regcal | bi | Passeriformes | Regulidae |
| *Regulus satrapa* | golden-crowned kinglet | regsat | bi | Passeriformes | Regulidae |
| *Salpinctes obsoletus* | rock wren | salobs | bi | Passeriformes | Troglodytidae |
| *Sayornis nigricans* | black phoebe | saynig | bi | Passeriformes | Tyrannidae |
| *Sayornis saya* | say's phoebe | saysay | bi | Passeriformes | Tyrannidae |
| *Selasphorus platycercus* | broad-tailed hummingbird | selpla | bi | Apodiformes | Trochilidae |
| *Selasphorus rufus* | rufous hummingbird | selruf | bi | Apodiformes | Trochilidae |
| *Sialia currucoides* | mountain bluebird | siacur | bi | Passeriformes | Turdidae |
| *Sialia mexicana* | western bluebird | siamex | bi | Passeriformes | Turdidae |
| *Sialia sialis* | eastern bluebird | siasia | bi | Passeriformes | Turdidae |
| *Sitta canadensis* | red-breasted nuthatch | sitcan | bi | Passeriformes | Sittidae |
| *Sitta carolinensis* | white-breasted nuthatch | sitcar | bi | Passeriformes | Sittidae |
| *Sitta pygmaea* | pygmy nuthatch | sitpyg | bi | Passeriformes | Sittidae |
| *Sphyrapicus nuchalis* | red-naped sapsucker | sphnuc | bi | Piciformes | Picidae |
| *Sphyrapicus thyroideus* | williamson's sapsucker | sphthy | bi | Piciformes | Picidae |
| *Spinus pinus* | pine siskin | spipin | bi | Passeriformes | Fringillidae |
| *Spizella passerina* | chipping sparrow | spipas | bi | Passeriformes | Emberizidae |
| *Strix occidentalis* | spotted owl | strocc | bi | Strigiformes | Strigidae |
| *Sturnella magna* | eastern meadowlark | stumag | bi | Passeriformes | Icteridae |
| *Sturnella neglecta* | western meadowlark | stuneg | bi | Passeriformes | Icteridae |
| *Tachycineta bicolor* | tree swallow | tacbic | bi | Passeriformes | Hirundinidae |
| *Tachycineta thalassina* | violet-green swallow | tactha | bi | Passeriformes | Hirundinidae |
| *Thryomanes bewickii* | bewick's wren | thrbew | bi | Passeriformes | Troglodytidae |
| *Troglodytes aedon* | house wren | troaed | bi | Passeriformes | Troglodytidae |
| *Turdus migratorius* | american robin | turmig | bi | Passeriformes | Turdidae |
| *Tyrannus vociferans* | cassin's kingbird | tyrvoc | bi | Passeriformes | Tyrannidae |
| *Vireo gilvus* | warbling vireo | virgil | bi | Passeriformes | Vireonidae |
| *Xanthocephalus xanthocephalus* | yellow-headed blackbird | xanxan | bi | Passeriformes | Icteridae |
| *Zenaida macroura* | mourning dove | zenmac | bi | Columbiformes | Columbidae |
| *Zonotrichia leucophrys* | white crowned sparrow | zonleu | bi | Passeriformes | Emberizidae |
| *Antilocapra americana* | pronghorn | antame | ma | Artiodactyla | Antilocapridae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Bassariscus astutus* | ringtail | basast | ma | Carnivora | Procyonidae |
| *Canis latrans* | coyote | canlat | ma | Carnivora | Canidae |
| *Castor canadensis* | american beaver | cascan | ma | Rodentia | Castoridae |
| *Corynorhinus townsendii* | pale townsend's big-eared bat | cortow | ma | Chiroptera | Vespertilionidae |
| *Eptesicus fuscus* | big brown bat | eptfus | ma | Chiroptera | Vespertilionidae |
| *Erethizon dorsatum* | north american porcupine | eredor | ma | Rodentia | Erethizontidae |
| *Idionycteris phyllotis* | allen's big-eared bat | idiphy | ma | Chiroptera | Vespertilionidae |
| *Lasionycteris noctivagans* | silver-haired bat | lasnoc | ma | Chiroptera | Vespertilionidae |
| *Lasiurus cinereus* | hoary bat | lascin | ma | Chiroptera | Vespertilionidae |
| *Lepus californicus* | black-tailed jackrabbit | lepcal | ma | Lagomorpha | Leporidae |
| *Lynx rufus* | bobcat | lynruf | ma | Carnivora | Felidae |
| *Mephitis mephitis* | striped skunk | mepmep | ma | Carnivora | Mephitidae |
| *Mustela frenata* | long-tailed weasel | musfre | ma | Carnivora | Mustelidae |
| *Myodes gapperi* | southern red-backed vole | myogap | ma | Rodentia | Arvicolinae |
| *Myotis auriculus* | southwestern myotis | myoaur | ma | Chiroptera | Vespertilionidae |
| *Myotis evotis* | long-eared myotis | myoevo | ma | Chiroptera | Vespertilionidae |
| *Myotis occultus* | arizona myotis | myoocc | ma | Chiroptera | Vespertilionidae |
| *Myotis thysanodes* | fringed myotis | myothy | ma | Chiroptera | Vespertilionidae |
| *Myotis volans* | long-legged myotis | myovol | ma | Chiroptera | Vespertilionidae |
| *Neotamias cinereicollis* | gray-collared chipmunk | neocin1 | ma | Rodentia | Sciuridae |
| *Neotamias dorsalis* | cliff chipmunk | neodor | ma | Rodentia | Sciuridae |
| *Neotoma albigula* | western white-throated woodrat | neoalb | ma | Rodentia | Muridae |
| *Neotoma cinerea* | bushy-tailed woodrat | neocin2 | ma | Rodentia | Muridae |
| *Neotoma mexicana* | mexican woodrat | neomex | ma | Rodentia | Muridae |
| *Neotoma stephensi* | stephen's wood rat | neoste | ma | Rodentia | Muridae |
| *Nyctinomops macrotis* | big free-tailed bat | nycmac | ma | Chiroptera | Molossidae |
| *Odocoileus hemionus* | mule deer | odohem | ma | Artiodactyla | Cervidae |
| *Odocoileus virginianus* | white-tailed deer | odovir | ma | Artiodactyla | Cervidae |
| *Onychomys torridus* | southern grasshopper mouse | onytor | ma | Rodentia | Muridae |
| *Pecari tajacu* | collared peccary | pectaj | ma | Artiodactyla | Tayassuidae |
| *Peromyscus boylii* | brush mouse | perboy | ma | Rodentia | Muridae |
| *Peromyscus maniculatus* | american deer mouse | perman | ma | Rodentia | Muridae |
| *Puma concolor* | mountain lion | pumcon | ma | Carnivora | Felidae |
| *Sciurus aberti* | abert's squirrel | sciabe | ma | Rodentia | Sciuridae |
| *Sorex merriami* | merriam's shrew | sormer | ma | Soricimorpha | Soricidae |
| *Sorex monticolus* | montane shrew | sormon | ma | Soricimorpha | Soricidae |
| *Spermophilus tridecemlineatus* | thirteen-lined ground squirrel | spetri | ma | Rodentia | Sciuridae |
| *Spermophilus variegatus* | rock squirrel | spevar | ma | Rodentia | Sciuridae |
| *Sylvilagus audubonii* | desert cottontail | sylaud | ma | Lagomorpha | Leporidae |
| *Sylvilagus floridanus* | eastern cottontail | sylflo | ma | Lagomorpha | Leporidae |
| *Sylvilagus nuttallii* | mountain cottontail | sylnut | ma | Lagomorpha | Leporidae |
| *Tamiasciurus hudsonicus* | red squirrel | tamhud | ma | Rodentia | Sciuridae |
| *Taxidea taxus* | american badger | taxtax | ma | Carnivora | Mustelidae |
| *Thomomys bottae* | botta's pocket gopher | thobot | ma | Rodentia | Geomyidae |
| *Thomomys talpoides* | northern pocket gopher | thotal | ma | Rodentia | Geomyidae |

| Scientific name | Common name | Ainimal code[a] | Life form | Order | Family |
|---|---|---|---|---|---|
| *Ursus americanus* | black bear | ursame | ma | Carnivora | Ursidae |
| *Zapus hudsonius* | meadow jumping mouse | zaphud | ma | Rodentia | Dipodidae |
| *Aspidoscelis exsanguis* | chihuahuan spotted whiptail | aspexs | re | Squmata | Teiidae |
| *Aspidoscelis pai* | pai striped whiptail | asppai | re | Squmata | Teiidae |
| *Aspidoscelis sonorae* | sonoran spotted whiptail | aspson | re | Squmata | Teiidae |
| *Aspidoscelis velox* | plateau striped whiptail | aspvel | re | Squmata | Teiidae |
| *Coluber constrictor* | racer | colcon | re | Squmata | Colubridae |
| *Crotalus atrox* | western diamond-backed rattlesnake | croatr | re | Squmata | Crotalidae |
| *Crotalus cerberus* | arizona black rattlesnake | crocebe | re | Squmata | Crotalidae |
| *Crotalus lepidus* | rock rattlesnake | crolep | re | Squmata | Crotalidae |
| *Crotalus molossus* | black-tailed rattlesnake | cromol | re | Squmata | Crotalidae |
| *Crotalus pricei* | twin-spotted rattlesnake | cropri | re | Squmata | Crotalidae |
| *Crotalus viridis* | prairie rattlesnake | crovir | re | Squmata | Crotalidae |
| *Crotalus willardi* | ridge-noseed rattlesnake | crowil | re | Squmata | Crotalidae |
| *Crotaphytus collaris* | eastern collared lizard | crocol | re | Squmata | Crotaphytidae |
| *Diadophis punctatus* | ring-necked snake | didpun | re | Squmata | Dipsadidae |
| *Elgaria kingii* | madrean alligator lizard | elgkin | re | Squmata | Anguidae |
| *Hypsiglena torquata* | night snake | hyptor | re | Squmata | Dipsadidae |
| *Kinosternon sonoriense* | sonoran mud turtle | kinson | re | Chelonia | Kinosternidae |
| *Lampropeltis pyromelana* | sonoran mountain kingsnake | lampyr | re | Squmata | Colubridae |
| *Lampropeltis triangulum* | milk snake | lamtri | re | Squmata | Colubridae |
| *Phrynosoma hernandesi* | mountain short-horned lizard | phyher | re | Squmata | Phrynosomatidae |
| *Phrynosoma modestum* | round-tailed horned lizard | phrmod | re | Squmata | Phrynosomatidae |
| *Pituophis catenifer* | gopher snake | pitcat | re | Squmata | Colubridae |
| *Plestiodon obsoletus* | great plains skink | pleobs | re | Squmata | Scincidae |
| *Plestiodon skiltonianus* | western skink | pleski | re | Squmata | Scinicidae |
| *Sceloporus jarrovii* | yarrow's spiny lizard | scejar | re | Squmata | Phrynosomatidae |
| *Sceloporus slevini* | slevin's bunchgrass lizard | sceslv | re | Squmata | Phrynosomatidae |
| *Sceloporus undulatus* | fence lizard | sceund | re | Squmata | Phrynosomatidae |
| *Sceloporus virgatus* | striped plateau lizard | scevir | re | Squmata | Phrynosomatidae |
| *Tantilla hobartsmithi* | smith's blackhead snake | tanhob | re | Squmata | Colubridae |
| *Tantilla wilcoxi* | chihuahuan black-headed snake | tanwil | re | Squmata | Colubridae |
| *Thamnophis cyrtopsis* | western blackneck gartersnake | thacyr | re | Squmata | Natricidae |
| *Thamnophis elegans* | terrestrial gartersnake | thaele | re | Squmata | Natricidae |
| *Thamnophis eques* | mexican gartersnake | thaequ | re | Squmata | Natricidae |
| *Thamnophis rufipunctatus* | narrow-headed gartersnake | tharuf | re | Squmata | Natricidae |
| *Urosaurus graciosus* | long-tailed brush lizard | urogra | re | Squmata | Phrynosomatidae |
| *Urosaurus ornatus* | ornate tree lizard | uroorn | re | Squmata | Phrynosomatidae |
| *Uta stansburiana* | side-blotched lizard | utasta | re | Squmata | Phrynosomatidae |

[a]Animal code: The first 3 letters from genus plus the first 3 letters of species. When duplicates occur, the last letter is replaced by a number. The spp after the first 3 letters of a genus indicates that the species may be present but needs verification. This code is the unique, primary key for using animal data in a relational database.


**United States Department of Agriculture**
**Forest Service**

**Rocky Mountain Research Station**