

Plant Life Form Key

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Plant life forms, or growth forms, can tell you a lot about the forces shaping an ecological community. The life form spectrum, the types and relative proportions of life forms in the vegetation, provides a basis for vegetation comparisons among different places, even when the species names are unknown. Quantified descriptions of the vegetation structure can also indicate how suitable the site may be as habitat for a particular animal. To perceive the landscape in this way, you need to learn the life form categories and their distinctions.

This key enables you to determine a plant's life form using characteristics you can observe. It is a dichotomous key: each couplet requires that you choose one of two options, and thus follow the numbered path that leads to the most appropriate life form category.

The life forms presented in this key are roughly comparable with the Raunkiaer system (1934) as modified by Mueller-Dombois and Ellenberg (1974), but we have added some extras and lumped others to tailor this key for your field work. The life form names are Americanized, but if a Raunkiaer equivalent exists it is also given in brackets with an equals symbol. For example our "trees and shrubs" category is identical with Raunkiaer's "phanerophytes," as indicated in couplet 30.

At each ultimate life form type an exemplar species is given in parentheses; thus saguaro (*Carnegiea gigantea*) is an example of a columnar cactus. Some species may change from one life form category to another during their life cycle. Bursage ragweed (*Ambrosia confertiflora*) takes the form of a rosette hemicryptophyte in the winter and early spring, but when it grows erect, leafy flowering stems during the summer it becomes a typical hemicryptophyte, according to this key.

Leaf categories are presented at the end of the key (p. 6). These can be added to the growth form designation to provide a more detailed description of each plant. The leaf sizes offer more insight into ecological forces, especially those influencing the availability of soil moisture. For example, if a site is dominated by phanerophytes that are nanophyllous or microphyllous, episodes of drought and heat can be inferred.

Dichotomous Key

- 1a. Plant either growing out of other plants, or totally lacking green pigment.....
.....**heterotrophic or semi-heterotrophic plants (parasitic)**... 2
- 1b. Plant rooted in the soil, and with green pigment (unless it is dormant).....
.....**autotrophic plants**... 4
- 2a. (1a) Plant with green stems or leaves, growing from the stem of another woody plant
.....**mistletoe [= vascular semi-parasites]** (*Phoradendron californicum*, desert mistletoe)
- 2b. Plant not green..... 3
- 3a. (2b) Usually only the flowering organs appearing above ground.....
.....**saprophytes or root parasites** (*Orobancha cooperi*)
- 3b. Plant forming a stringy mass twining and rooting into stems of other plants, not rooted in soil.....
.....**dodder** (*Cuscuta* sp.)
- 4a. (1b) Small plants (< 3 cm tall) that lack vessels, the stem-like part <2 mm in diameter, or plants without stems
.....**non-vascular plants**... 5
- 4b. Plants with stems containing vessels, usually with leaves.....
.....**vascular plants**... 6
- 5a. (4a) No differentiated organs, simply a living crust on the soil surface, rocks, or bark.....
.....**cryptobiotic crusts**
- 5b. Plant form differentiated into distinct organs, with stalks or plate-like appendages.....
.....**mosses or lichens**

6a. (4b) Vascular plants that use other plants or structures to support their stems	7
6b. Self-supporting vascular plants.....	10
7a. (6a) Plant attached to branches or trunk of tree, but not parasitic.....	
..... epiphyte (<i>Tillandsia exserta</i> , ball moss)	
7b. Plant rooted in soil, with long, relatively weak stems climbing up into canopy	vines8
8a.(6a) Stems woody, able to enlarge through radial growth.....	
..... liana [= phanerophytic liana] (<i>Vitis arizonica</i> , grapevine)	
8b. Stems only herbaceous, usually surviving <1 year.....	9
9a. (8b) Plant perennial, able to send up new stems from a tuberous root or woody caudex.....	
..... perennial climber [= herbaceous liana] (<i>Cucurbita digitata</i> , finger-leaved gourd)	
9b. Plant annual, lacking any remains of previous growth, hence life span <1 year; the population depending entirely upon reproduction by seeds.....	
..... annual climber (<i>Lathyrus odoratus</i> , sweet pea)	
10a. (6b) Lacking any remains of previous growth, hence life span <1 year; the population depending entirely upon reproduction by seeds.....	annuals [= therophytes] ... 11
NOTE: Be aware of PA's = perennial plants that can bloom during their first year, and AP's = plants that are usually annual, but may live more than a year under favorable conditions. If there is any doubt, record what you observe, not what you infer.	
10b. Some organs able to survive periods of stress, either as woody stems, remnant shoot systems near the soil surface, or underground storage structures such as tubers, bulbs or rhizomes....	12
11a. (10a) Leaf blades narrow (>15 times longer than wide); either with a basal sheath around the stem or appearing to be attached directly to the stem.....	
..... annual grasses [= graminoid therophytes] (<i>Bromus rubens</i> , red brome grass)	
11b. Leaf blades relatively broad, or else terminating a stem-like petiole attached to the true stem....	
..... annual herbs or forbs (<i>Erodium cicutarium</i> , filaree)	
12a. (10b) Plants less than 25 cm tall; stems perennial, but remaining close to the soil surface; leaves either uncurling fronds or scale-like; leaves dormant and shriveled during drought, but able to rehydrate and become green after rains.....	resurrection ferns (<i>Notholaena standleyi</i> , cloakfern) OR resurrection club mosses (<i>Selaginella arizonica</i>)
12b. Either plants larger, or else leaves unable to desiccate and rehydrate.....	13
13a. (12b) Stems entirely herbaceous, dying back to the soil surface or beneath each year (except in subshrub bunchgrasses).....	14
13b. Stems partly or entirely woody, not dying back to the soil surface (except after a fire or unusually extreme freeze).....	21
14a. (13a) Stems dying back to storage organs (deep rhizomes, tubers or bulbs) well beneath the soil surface.....	geophyte (<i>Allium cepa</i> , onion)
14b. Stems dying back to a remnant shoot system (shallow rhizomes) or crown (caudex) at or close to the soil surface.....	herbaceous perennials [= hemicryptophytes] ... 15
15a.(14b) Leaf blades relatively narrow (more than 15 times longer than wide); either with a basal sheath around the stem or appearing to be attached directly to the stem.....	
..... perennial grasses [= graminoid hemicryptophytes] ... 16	
15b. Leaf blades relatively broad, or else terminating a stem-like petiole attached to the true stem....	
..... perennial forbs ... 19	

- 16a. (15a) Grasses with stems dispersed or in elongate clusters connected by aboveground or belowground organs.....**sodgrasses**...17
- 16b. Grasses with stems in dense clusters, usually stems arising from short, contracted rhizomes; each cluster apparently independent from nearby plants.....**bunchgrasses**...18
- 17a. (16a) Sodgrasses with elongate stems that root in the ground (stolons) and produce new clumps of stems.....**stoloniferous grass** (*Hilaria belangeri*, curly mesquite grass)
- 17b. Grasses with aboveground stems connected by means of horizontal underground stems (rhizomes)**rhizomatous grass** (*Sorghum halepense*, Johnson grass)
NOTE: Bermuda grass (*Cynodon dactylon*) has both rhizomes and stolons [= **stoloniferous and rhizomatous sodgrass**]
- 18a. (16b) Stems often branched well above the soil surface; not always dying completely to base, thus the grass appearing somewhat bushy.....**subshrub bunchgrass**
[= **graminoid chamaephytic hemicryptophyte**] (*Muhlenbergia porteri*, bush muhly grass)
- 18b. Stems with few or no branches; almost always dying back to the ground surface after bearing fruit.....**herbaceous bunchgrass** [= **graminoid caespitose hemicryptophyte**](*Aristida purpurea*, purple three-awn)
- 19a. (15b) Stems densely clustered and much branched near the soil surface, creating a cushion-like form.....**cushion herb** [= **caespitose hemicryptophyte**] (*Dianthus caryophyllus*, carnation)
- 19b. Stems not clustered, or else stems branched well above the soil surface.....20
- 20a. (19b) Most leaves arising close together from the stem and forming a rosette near the soil surface.....**rosette herb** [= **rosette hemicryptophyte**] (*Taraxacum officinale*, dandelion)
- 20b. Most leaves dispersed along the stem, not forming rosettes.....
.....**typical herb** [= **typical hemicryptophyte**] (*Boerhaavia coccinea*, red spiderling)
- 21a. (13b) Stems succulent, with a large proportion of non-woody, moist, living storage tissue.....**Cactus and cactoids**...22
- 21b. Stems entirely or partly woody, supported by lignified, dead tissue in the center28
- 22a. (21a) Plant >0.5 m tall.....**stem succulent shrubs** [= **stem-succulent phanerophytes**]...23
- 22b. Plant <0.5 m tall.....**stem succulent subshrubs** [= **stem-succulent chamaephytes**]...26
- 23a. (22a) Stems composed of distinct joints separated by constrictions, at least near the ends of branches.....24
- 23b. Stems not jointed near the ends, usually with no constrictions.....25
- 24a. (23a) Stem joints cylindrical, rounded in x-section....**cholla** (*Opuntia fulgida*, chain-fruit cholla)
- 24b. Stem joints flattened, narrowly oblong in x-section.....
.....**shrubby prickly pear**(*Opuntia wilcoxii*, nopal)
- 25a. (23b) Stem length/width ratio <4.....**barrel cactus** (*Ferocactus wislizeni*)
- 25b. Stem length/width ratio >4.....**columnar cactus** (*Carnegiea gigantea*, saguaro)
- 26a. (22b) Stems not jointed near the ends, usually with no constrictions.....
.....**caespitose cactus** (*Mammillaria grahamii*, pincushion cactus)
- 26b. Stems composed of distinct joints, at least near the ends.....27
- 27a. (26b) Stem joints flattened, narrowly oblong in x-section.....
.....**subshrub prickly pear** (*Opuntia phaeacantha*, brown-spined prickly pear)
- 27b. Stem joints cylindrical, rounded in x-section.....**subshrub cholla** (*Opuntia parishii*, dog cholla)

- 28a. (21b) Leaves forming dense clusters or rosettes at the end of the stem; leaves usually either tough or succulent, relatively long-lived..... **tuft plants**...29
- 28b. Leaves usually well dispersed along the stem; needle-like, scale-like or with herbaceous or toughened blades30
- 29a. (28a) Plant <1 m tall.....**rosette subshrub [=tuft chamaephyte]** (*Agave schottii*, shin dagger)
- 29b. Plant >1 m tall.....**rosette shrub or tree [= tuft phanerophyte]** (*Yucca elata*, soap tree yucca)
- 30a.(28b) Plant <0.5 m tall, or if taller, usually dying back to within 0.5 m of the soil surface.....**subshrubs and dwarf-shrubs [= chamaephytes]**...31
- 30b. Plant >0.5 m tall.....**trees and shrubs [= phanerophytes]**...32
- 31a. (30a) Stems entirely woody and living to the tips**dwarf-shrub [= frutescent chamaephyte]** (*Calliandra eriophylla*, fairy duster)
- 31b. Stems partly herbaceous, often dying back somewhat**subshrub [= suffrutescent chamaephyte]** (*Gutierrezia sarothrae*, broom snakeweed)
- 32a. (30b) Plants consisting of long, clustered, spiny branches 2-4+ m long arising from a short trunk.....**ocotillo** (*Fouquieria splendens*)
- 32b. Plants with shorter, denser branch systems OR with a single trunk >1 m long.....33
- 33a. (32b) Plants <3 m tall; stems branched from the base..**shrub** (*Ziziphus obtusifolia*, graythorn)
- 33b. Plants >3 m tall.....34
- 34a. (33b) Trunks single or few, mostly branched well above the base.....**tree** (*Populus fremontii*, cottonwood)
- 34b. Trunks branched from near the base.....**shrubby tree** (*Prosopis velutina*, mesquite)

LEAF CATEGORIES

Simple -- margin entire, serrate, dentate, etc.

Lobed -- incisions at least halfway to center of blade

Compound -- with separate leaflets.

Leaf size categories in Raunkiaer system (Lincoln & Boxshall, p. 324, Radford et al. p. 318)

Leptophyllous ... blade area $<0.25 \text{ cm}^2$

Nanophyllous ... blade area $0.25\text{-}2.25 \text{ cm}^2$

Microphyllous ... blade area $2.25\text{-}20 \text{ cm}^2$

Notophyllous ... blade area $20\text{-}45 \text{ cm}^2$

Mesophyllous ... blade area $45\text{-}200 \text{ cm}^2$

Macrophyllous ... blade area $200\text{-}1600 \text{ cm}^2$

Megaphyllous ... blade area $>1600 \text{ cm}^2$

Leaves may be tough (**sclerophyllous**) or flexible and herbaceous (**malacophyllous**).

Leaves may be **succulent** or tough **fibrous**.

Seasonal phenology -- leaves are **evergreen**, **cold-deciduous**, or **drought-deciduous**.

Leaf area calculations

For long grass leaves, estimate area as an elongate triangle ... area = $1/2$ (base X height).

For rounded leaves, estimate area as an ellipse ... area = π X semi-major axis X semi-minor axis.

Hint = calculate the area of your little fingernail, and use it as a scale.

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Glossary

herbaceous stem -- a stem that does not grow in diameter, and forms neither hard interior tissue nor bark.

woody stem -- a stem that grows in diameter from a cambial meristem (secondary growth). Tissues toward the inside of the stem often become hard, or lignified, to form wood. The outside of the stem usually has bark.

Annual plant -- a plant that cannot survive longer than one growing season. There is no woody stem tissue and no remains of any growth from a previous year.

Perennial plant -- a plant that can survive for several growing seasons. Perennials will have woody stems, underground storage organs, or remains of stems from previous years at the base of living stems.

Cushion herb (= caespitose or cespitose herb) - a plant with short, highly branched stems densely interlaced to form a mat or cushion.

Rosette -- a cluster of leaves arranged in a circular pattern, like the petals of a double rose.

Stolon (= runner) -- an above-ground stem that arches to the soil surface and grows new roots and shoots.

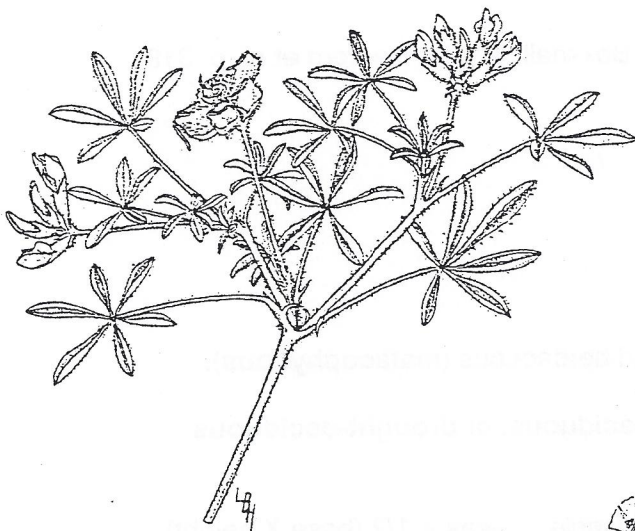
Rhizome -- a horizontal underground stem, which can grow shoots up through the soil surface.

Simple leaf -- a leaf with one continuous blade, either attached directly to the stem or held away for the stem on a stalk-like petiole.

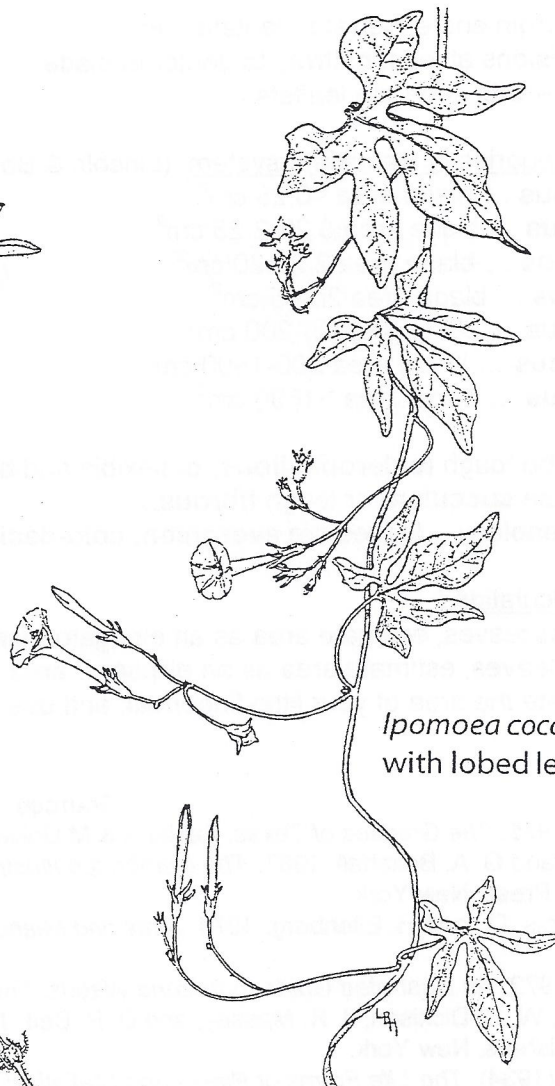
Compound leaf -- a leaf with more than one blade.

Lobed leaf -- a leaf with a single blade that is deeply divided into distinct projections.

Lupinus kingii with
palmately compound leaves



Ipomoea coccinea
with lobed leaves

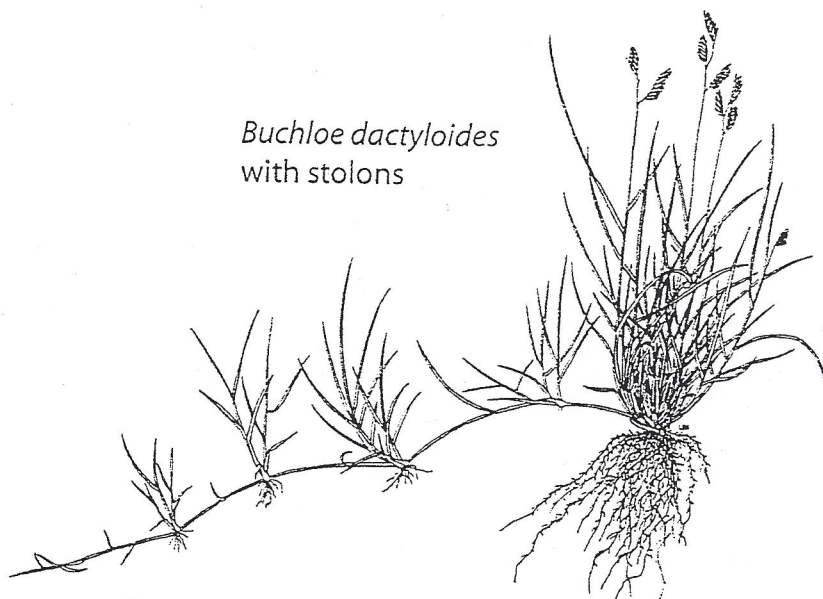


Kallstroemia grandiflora with
pinnately compound leaves



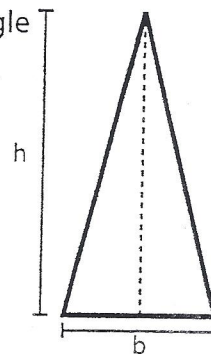
Terms and Hints for Plant Life Form Key

Buchloe dactyloides
with stolons



isosceles triangle

$$\text{area} = \frac{b \times h}{2}$$



Rumex acetosella with rhizome



Plantago lanceolata
rosette herb with
flowering stalks

ellipse
area = $3.14 \times a \times b$

