

# BASIC FORMS

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Beyond defining trees as a whole, there are many terms used by professionals and the public for primary tree parts above ground. For example, trunk, bole and stem tend to be used interchangeably by people discussing trees. There are some subtle professional differences among these concepts.

A tree trunk is considered the upright, massive main stem or main vertical axis of tree. A tree bole is a portion of the stem or trunk of a tree of such size from which lumber can be cut. A tree stem is the supporting axis bearing a living crown composed of tapering, overlapping columns of wood increments. Definition and word use varies by background of an observer and location across the continent.

## Sub-Division

The term ramify means to subdivide (branch) an axis. The primary subdivisions of a stem which generate secondary growth (growth in girth or circumference) have been called by various names. A bough is any large division of the stem axis. A limb is a primary division of a stem or bough which bears foliage.

A branch is a large, medium, or small division of the main axis of the stem or another branch, equal to or greater than four (4) years (or full growing seasons) of age. As tree parts above ground are further divided, branchlets and twigs are defined. A branchlet is a small division of a branch equal to 2-3 years (or full growing seasons) of age. A twig is the current or most recent growing season's apical extension growth. A sprig is a portion of a twig.

## Elongation Organization

Twigs, branchlets, and branches can be divided into two fundamental structural components – nodes and internodes. As with the children's building toy called **TinkerToys**<sup>(TM)</sup>, there are elongated sticks (internodes) which separate round multi-connections (nodes). Without nodes, internode elongation would stop, and without internodes, nodes would pile-up and smother each other. Figure 1.

In trees, a node (nodal torus) is a zone perpendicular to the long axis of a stem, branch, branchlet, or twig where vascular connections are diverted to support axillary buds, leaves, and elongating shoots / twigs (a vascular confluence zone). An internode is an elongated shoot segment between nodes. Trees are modular and segmented with an internode and node making one structural unit – sometime termed a shoot. Defensive capabilities in above ground tree tissues are concentrated in nodes.

## Tree Crowns

In defining trees and tree forms, total above ground size, stem and crown shape, and crown composition (number of branches, branchlets, and twigs, and their relative positions) are key. A few terms help better define crown components. A leader is the upper-most portion of the main axis of a tree. Polycormic describes a tree with several strong vertical axes.

The crown of a tree is the upper portion of main axis (stem) bearing live branches and foliage. The shape of a crown is fashioned by branch growth rates. The terms for branch elongation setting crown shape are: acrotony where upper branches elongate most; mesotony where the middle branches elongate most; and, basitony where lower branches elongate most.

The elongation of twigs is usually generically divided into long shoots where internode growth is allowed to elongate; short shoots where internode growth is constrained (but not completely stopped) in elongation; and, spur shoots where internodes elongate only slightly. Orientation of twig, branchlet, and branch growth is divided between orthotropic shoots which have a vertical growth habit and plagiotrophic shoots which approach a horizontal growth habit.

## Tree Forms & Shapes

Tree form plants can be divided into five general shapes based upon where the crown is located above the ground. Figure 2.

- Abcurrent tree forms have an aerial terminal bud and leaves (palm-like).
- Adcurrent tree forms have basal buds and leaves (ground hugging yucca-like).
- Bicurrent tree forms have irregular forked branching usually with thick green stems (catus-like).
- Decurrent (deliquescent) tree forms have many dominant branches with a spreading crown form caused by lateral branches growing at similar rates as the main axis terminal (leader), or the terminal continues to die with lateral branches rebranching continuously (so no one central axis develops but many spreading branches).
- Excurent tree form has a single dominant axis (leader) and forms a conical shaped crown as the terminal elongates more annually than lateral branches (a distinct main axis and many short secondary branches).

Tree crown shape have been described in many ways and representing many shapes. One set of crown shapes represent both outward crown appearance and internal branching forms. These generic shapes are given in Figure 3. Another way to describe tree crown shape, lateral area, wind drag, and volume is by using solid geometric shape descriptors. Figure 4 provides the 10 general crown shape forms with relative side area, crown volume, and drag for each. Figure 5 shows the solid shape forms..

## Crown Ratios

The size of a tree crown can be estimated using linear, area, or volume measures. One simple measure commonly used to describe tree crown, and tree health and structural attributes, is live crown ratio. Live crown ratio is the proportion of total tree height along the main axis which carries living branches with foliage. Stem and basal sprouts are not included in this measure. The total vertical linear height of the live branch area along the main stem is divided by total tree height. The result is a decimal percentage which is live crown ratio. Figure 6.

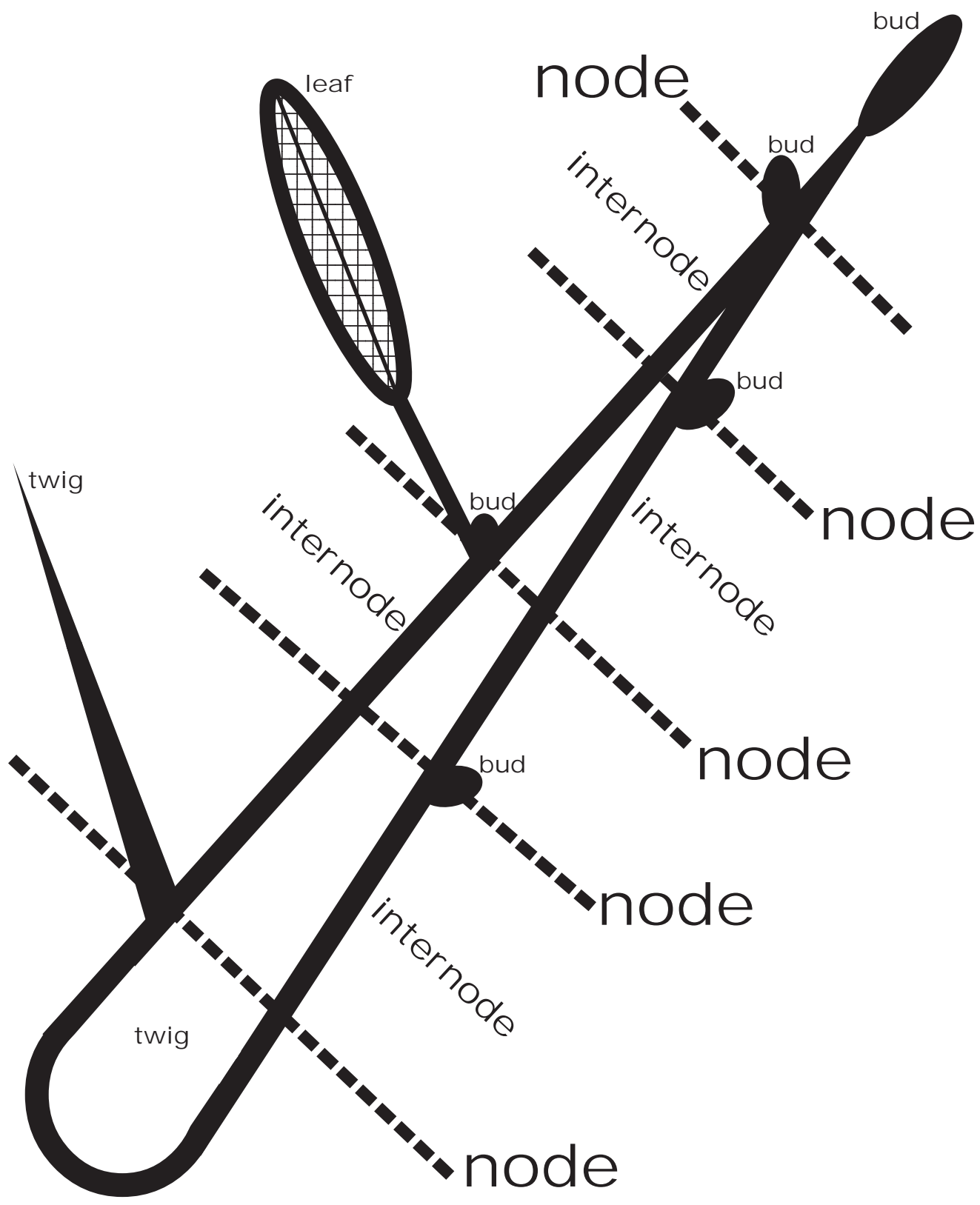


Figure 1: Diagram of a twig with five nodes (dotted lines across twig) and four internode areas identified along a short length.

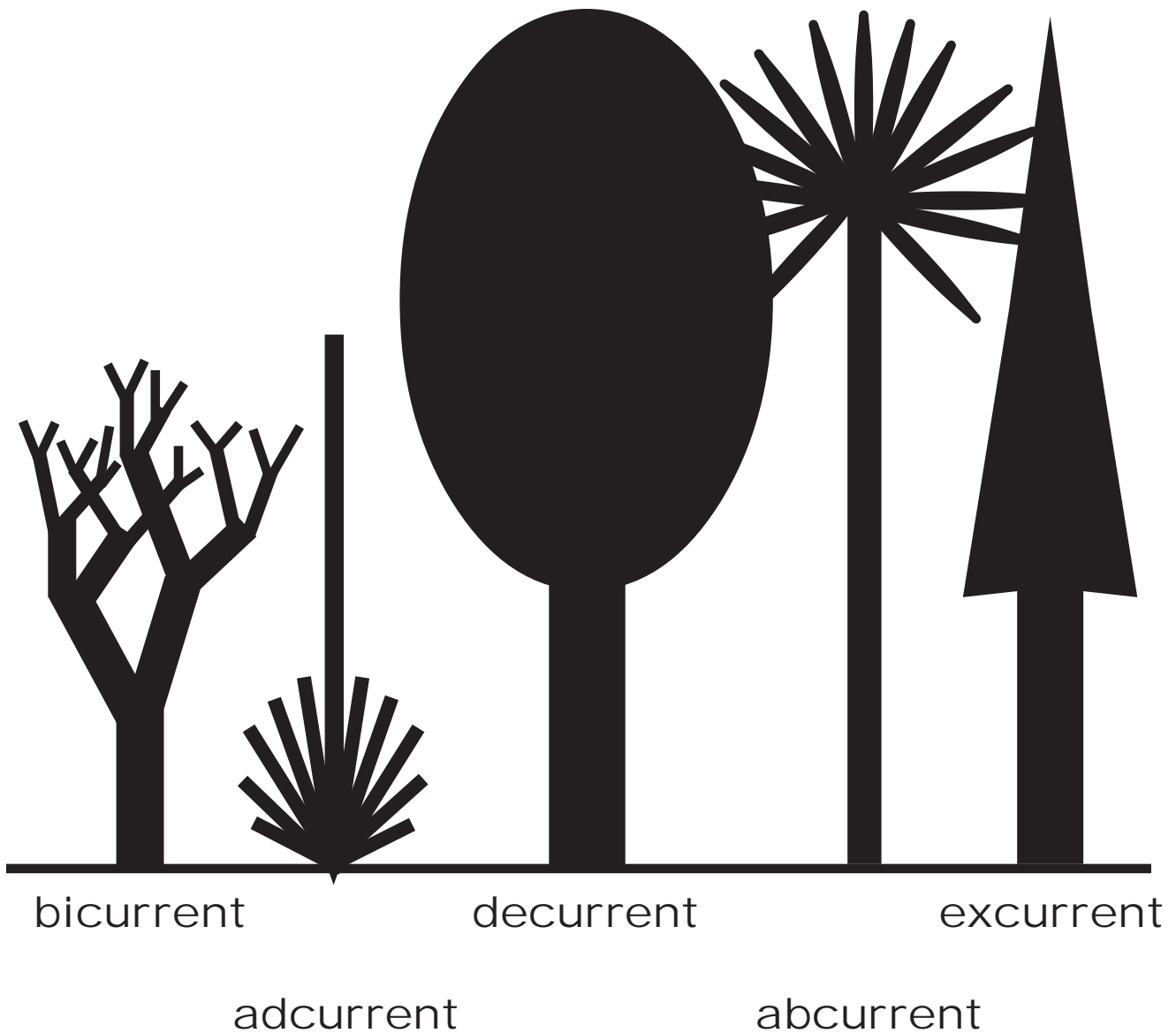


Figure 2: The five primary crown architectures found in tree-form plants.

Bicurrent = irregular, forked, thick green stems (cactus-like);

Adcurrent = basal buds & leaves (ground yucca types);

Decurrent or deliquescent = many dominant branches, spreading form;

Abcurrent = aerial terminal bud & leaves (palm-like);

Excurrent = single dominant leader, conical form.

## Common Description of Crown Shape & Branching Form

pyramidal  
conical  
spindle / columnar  
fastigiata  
ellipsoidal  
ovoid  
globose / circular  
broad  
vase  
umbrella  
irregular  
weeping

Figure 3: Terms describing common tree crown shapes and branching habits.

geometric shape	relative / proportional		
	lateral area	crown volume	drag
square / cylinder	1.0	0.8	1.0
round edge cylinder	0.9	0.7	0.84
elongated spheroid	0.8	0.6	0.68
spheroid	0.7	0.5	0.53
expanded paraboloid	0.6	0.5	0.54
paraboloid	0.5	0.4	0.42
fat cone	0.4	0.3	0.29
cone	0.3	0.25	0.17
neiloid	0.2	0.2	0.08
thin neiloid	0.1	0.1	0.01

Figure 4: Tree crown geometric shape descriptors and relative or proportional lateral (frontal) view area, crown volume, and solid shape drag. (drag based upon drag of a solid cube = 1.27).

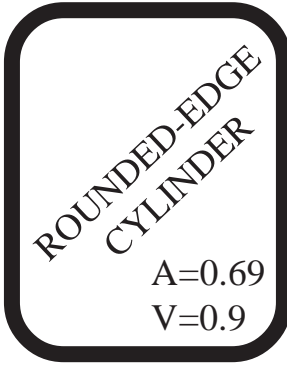
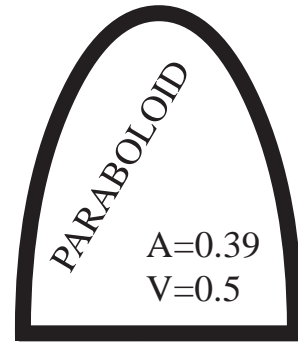
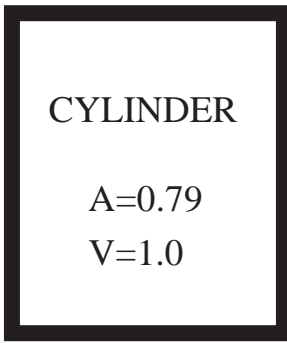
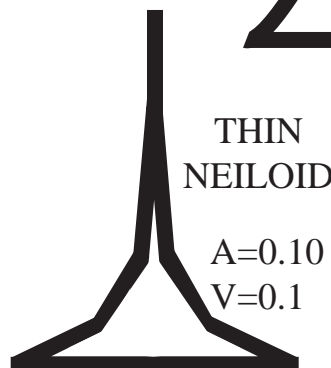
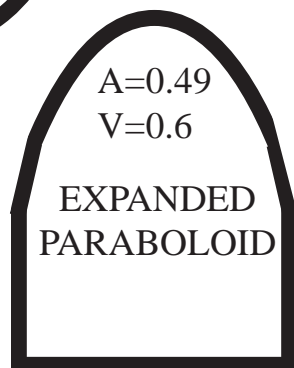
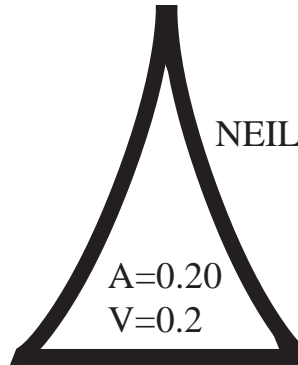
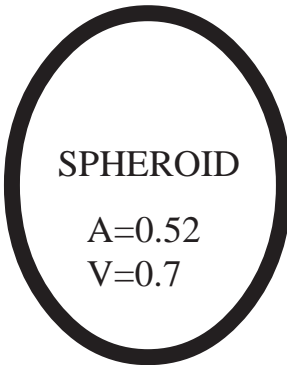
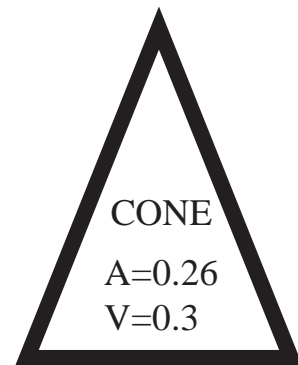
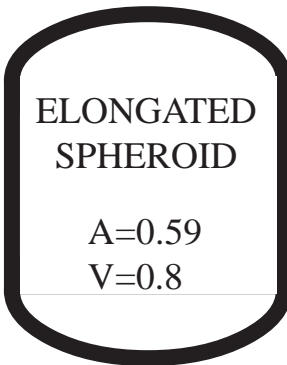
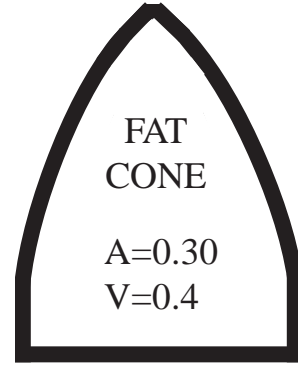


Figure 5:  
Idealized side view of  
different tree crown  
shapes. All shapes  
have circular cross-  
sections, or are round  
when viewed from  
above. Shape names  
and relative crown  
area (A) and crown  
volume (V) values  
are provided.



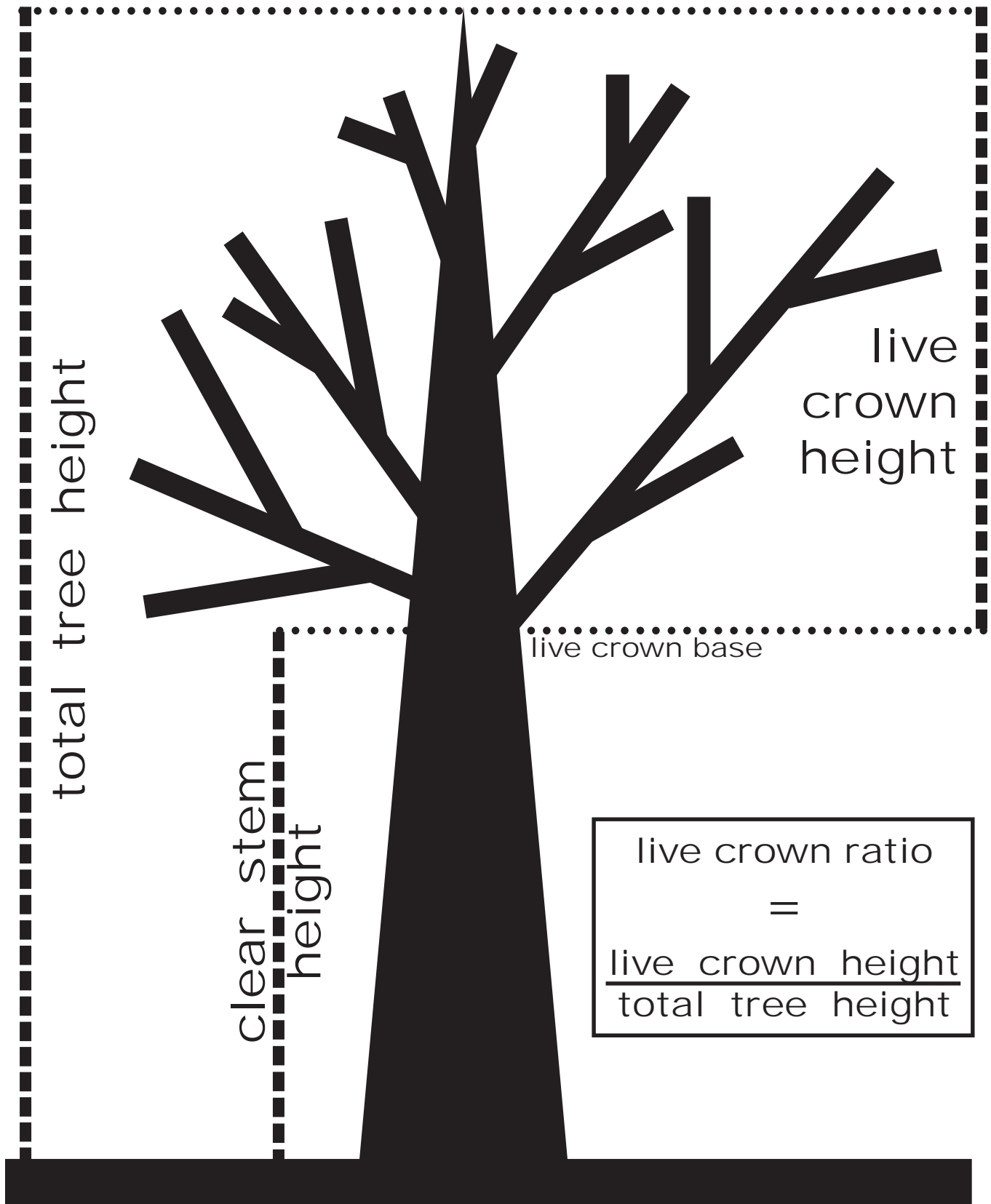


Figure 6: Diagram of various height measures in a tree and the formula for determining live crown ratio.