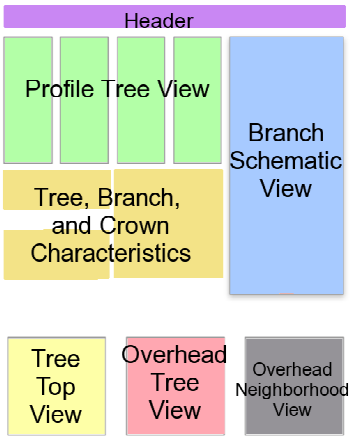
Tree Structure Catalog Cover Sheet

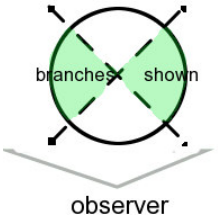


This catalog illustrates tree structure of Pacific Northwest trees and was designed to better understand patterns of crown structure. The catalog consists of one tree per page, displaying images and metrics that reflect trees in the *Thousand Year Chronosequence Study* — field research on forest structure and function for eight locations, in the western Cascades of Washington State, ranging in age from 50 to 950 years (Van Pelt and Nadkarni[1]). Although more than 1,000 trees were sampled in this study, only those on which detailed branch structure was collected are depicted in this catalog (about 100 trees). This cover sheet describes each element (Header, Profile Tree View, etc.) depicted in the layout at left.

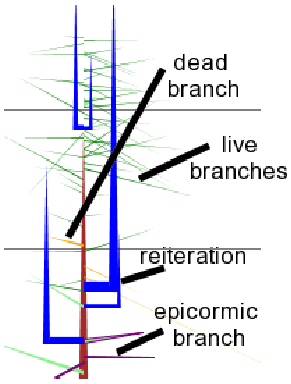
Catalog Header. The Catalog Header gives the location code and a unique identifier for each tree. The table at right lists the codes and names of sample locations.

Location Code	Location Name	Location Code	Location Name
CF	Cedar Flats	OH	Ohanapecosh
CH	Chinook Creek	PC	Panther Creek
CR	Carbon River	PL	Plantation
MC	Martha Creek	TC	Trout Creek

Profile Tree View. This view depicts the tree's live-branch profile from each of four directions at 45º intervals: North, Northeast, East, and Southeast, and highlight gaps and asymmetries in the crown. Each image shows two 90º slices of live branches in profile. Branches closer together than one vertical meter are connected. For perspective, branches are projected on the plane perpendicular to the orientation; thus, a branch not on the perpendicular will appear shorter than it is. Images oriented at the other four directions (South, Southwest, West, and Northwest) mirror the first four, and are not included.



Branch Schematic View. This diagram illustrates overall tree structure, and focuses on reiterations (shown in blue) and epicormic branches (shown in purple). Primary live branches are green and dead branches brown. Branches are drawn to scale, and small branches might be too small to see. All branches were drawn ignoring perspective, i.e., branches are full size regardless of where they are located around the stem. Most branch depictions show a vertical angle (extent); e.g., pointing 20º down from horizontal.[2]



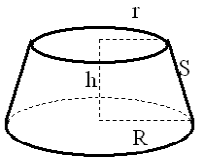
Tree Characteristics. Tree Characteristics include species code, diameter at breast height (DBH), and tree height. The following species codes with scientific and common names are used in the catalog.

Species Code	Scientific Name	Common Name
ABAM	*Abies amabilis*	Pacific silver fir
PSME	*Pseudotsuga menziesii*	Douglas-fir
THPL	*Thuja plicata*	Western red cedar
TSHE	*Tsuga heterophylla*	Western hemlock

[1] Van Pelt, R., and N. M. Nadkarni. 2004. Development of canopy structure in *Pseudotsuga menziesii* forests in the southern Washington Cascades. Forest Science 50:326-341.

[2] Extent was not measured for some types of branches (reiterations), nor for some trees; reiterations and branches on trees for which extent was not measured show at 90º to the stem.

Crown Characteristics. General crown metrics are given for each tree. Crown volume and surface area were calculated by dividing the crown into a series of 2-meter conic sections, where (h) is the height of the section and radii (r and R) are equal to average branch length at the highest and lowest points in the section. Crown volume is the sum of the conic section volumes, and crown surface area is the sum of the outside surface area of all conic sections (S). The number and accumulated length of gaps were computed, where a gap is defined as a vertical space with no live branches, within the crown of the tree, that is greater than 1m.



Characteristic	Description
Crown volume	The sum of the volume of all conic sections, in cubic meters.
Crown surface area	The sum of the surface areas of all conic sections, in square meters.
Gap count	The total number of gaps within the crown.
Gap sum	The total gap length or the sum of all gaps within the crown in linear meters.

Branch Characteristics. Branch metrics were calculated for each tree. Data for some trees were insufficient to calculate all metrics on those trees. The following branch metrics were calculated:

Characteristic	Description
Mean length	The average length of all branches, live and dead.
Mean height	The average branch height above the ground. Calculated with both live and dead branches.
Mean diameter	The average diameter of all branches on the tree, live and dead.
Largest diameter	The diameter of the largest branch.
Largest 10 mean diameter	The average diameter of the 10 largest diameter branches, live and dead.
Total branch count	Count of all branches on the tree.
Epicormic count	Count of live and dead epicormic branches.
Dead count	Count of all dead branches.
Lowest branch height	The height above the ground of the first live branch.

Tree Top View. This image shows the top of the tree. It is included to help show whether the top is alive or dead, and to highlight small branches that might not be obvious on the Branch Schematic View. Branches smaller in diameter than 4cm were not measured; thus, some trees might appear as if they have no branches at the top when in fact the top branches were smaller than the measurement protocol.

Overhead Tree View. This image shows the top-down crown projection of the tree, and gives an idea of foliage density and symmetry. The foliage on each branch is drawn as a diamond shape sized proportionally to the measured foliage.[3]

Overhead Neighborhood View. This stem map shows the neighborhood of the tree, i.e., all neighboring trees with diameters greater than 5cm at breast height. Live tree boles are brown, with a green diamond depicting crown radii measured to the North, East, South, and West. Dead tree boles are shown in red. The tree of interest's crown diamond is highlighted in blue and its bole is rectangular rather than circular. Grey lines between trees define areas closest to the midpoint of the stem of each live tree.[4]

[3] Foliage was measured as percent cover or foliar units, here scaled to percent cover, differently for each location: percent cover = foliar units / (branch length * *location constant*) * 100. *location constant* is determined by mapping mean percent cover to mean foliar units per meter by location, and ranges from 3.5 to 4. Older locations have lower percent cover.

[4] These *Thiessen Polygons* [0](*aka* Voronoi Diagrams) define regions of influence around each of a set of points (tree centers) s.t. any location within a particular polygon is nearer to that polygon's point than to any other point (Heywood, I. Cornelius S., Carver, S. 1998, *An Introduction to Geographical Information Systems*, Prentice Hall).