

# Tree Growth Rate Table: Annual Percentage Growth

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Trees grow in diameter every year. From the farthest reach of the woody roots to the tips of the twigs, trees expand in girth. This annual growth increment allows trees to respond to changing environmental conditions and react to injuries. The ability of the tree to resist strong winds, ice storms, and major losses of woody materials, while remaining alive and erect, is a direct consequence of annual diameter growth.

The amount of woody increment produced each year is dependent upon the proper functioning and productivity of the leaves. All the leaves together make up the living crown of a tree. The food and growth substances ultimately generated by photosynthesis and metabolic processes in the leaves will directly determine the amount of materials available for generating annual increments. The annual increment produced throughout the tree is a result of crown production -- crown production is a direct result of annual increment transport efficiency and volume. The growth increment also mechanically supports the crown against dynamic forces of gravity, wind, precipitation and the tree's own size, shape and mass.

Because the crown is provided with raw materials and growth substances collected and generated by the roots, and the roots are provided with food and growth substances generated by the crown, the physical distance and biological health between living crown and absorbing root are critical. Those cells between leaf and rootlet must store, defend, support, transport, prevent waste, and conserve precious resources needed for tree survival. Trees invest heavily in woody materials applied as an annual layer of cells over the outside of last year's structure.

The annual addition of growth represents an approximation of specific crown vigor, general tree health, relative whole tree growth rates, and crown volume. The more net food and growth substances generated by the crown, the larger the tree grows at a faster annual pace. Each year the total annual growth increment is a ecological integration of all genetic, environmental, and chance occurrence factors that influences whole tree survival and growth.

The measure of annual growth increments in trees can be estimated by circular cross-sections and annual radial growth. Relative annual increment values (as a percent of the last annual increment) using this table can be determined by first estimating tree diameter at four-and-one-half feet above the ground (DBH) as measured along the main stem on the uphill side. For this table, an estimate of generalized annual growth rate is determined based upon the number of annual increments present in the last (outside) inch of wood (xylem) generated. This measure estimates a growth rate by diameter (DBH) class. Table PX provides a percent (in decimal form) increase per year in xylem increment area based upon growth rate per diameter class.



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Table PX: Percent increase in cross-sectional area per single growth increment by diameter (DBH = diameter in inches at 4.5 feet above the ground). The growth rate estimator ranges from 1 .0 growth increment per inch (R1) to 20 growth increments per inch (R20). Diameter ranges from 6 inches DBH to 100 inches DBH.

D	R1.0	R1.5	R2.0	R2.5	R3.0	R4.0	R5.0	R7.5	R10.0	R12.5	R15.0	R17.5	R20.0
6	—	0.65	0.44	0.33	0.27	0.19	0.15	0.10	0.07	0.06	0.05	0.04	0.03
7	0.96	0.53	0.36	0.28	0.22	0.16	0.13	0.08	0.06	0.05	0.04	0.03	0.03
8	0.78	0.44	0.31	0.24	0.19	0.14	0.11	0.07	0.05	0.04	0.03	0.03	0.03
9	0.66	0.38	0.27	0.21	0.17	0.12	0.10	0.06	0.05	0.04	0.03	0.03	0.02
10	0.57	0.33	0.25	0.18	0.15	0.11	0.09	0.06	0.04	0.03	0.03	0.02	0.02
11	0.49	0.30	0.21	0.16	0.13	0.10	0.08	0.05	0.04	0.03	0.02	0.02	0.02
12	0.44	0.27	0.19	0.15	0.12	0.09	0.07	0.05	0.03	0.03	0.02	0.02	0.02
13	0.40	0.24	0.17	0.14	0.11	0.08	0.07	0.04	0.03	0.03	0.02	0.02	0.02
14	0.36	0.22	0.16	0.13	0.10	0.08	0.06	0.04	0.03	0.02	0.02	0.02	0.01
15	0.33	0.20	0.15	0.12	0.10	0.07	0.06	0.04	0.03	0.02	0.02	0.02	0.01
16	0.31	0.19	0.14	0.11	0.09	0.07	0.05	0.03	0.03	0.02	0.02	0.01	0.01
17	0.28	0.18	0.13	0.10	0.08	0.06	0.05	0.03	0.02	0.02	0.02	0.01	0.01
18	0.27	0.17	0.12	0.11	0.08	0.06	0.05	0.03	0.02	0.02	0.02	0.01	0.01
19	0.25	0.16	0.11	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.02	0.01	0.01
20	0.25	0.15	0.11	0.09	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01
21	0.22	0.14	0.10	0.08	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01
22	0.21	0.13	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.009
23	0.20	0.13	0.09	0.07	0.06	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.009
24	0.19	0.12	0.08	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.008
25	0.18	0.12	0.09	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.008
26	0.17	0.11	0.08	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.009	0.008
27	0.17	0.11	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.009	0.008
28	0.16	0.10	0.08	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.008	0.007
29	0.15	0.10	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.01	0.009	0.008	0.007
30	0.15	0.10	0.07	0.06	0.05	0.03	0.03	0.02	0.01	0.01	0.009	0.008	0.007
31	0.14	0.09	0.07	0.06	0.04	0.03	0.03	0.02	0.01	0.01	0.009	0.008	0.007
32	0.14	0.09	0.07	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.008	0.008	0.006
33	0.13	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.008	0.007	0.006
34	0.13	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.008	0.007	0.006
35	0.13	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.009	0.008	0.007	0.006
36	0.12	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.009	0.007	0.006	0.006
37	0.12	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.009	0.007	0.006	0.005
38	0.11	0.07	0.06	0.04	0.04	0.03	0.02	0.01	0.01	0.009	0.007	0.006	0.005
39	0.11	0.07	0.05	0.04	0.04	0.03	0.02	0.01	0.01	0.008	0.007	0.006	0.005
40	0.11	0.07	0.05	0.04	0.03	0.03	0.02	0.01	0.01	0.008	0.007	0.006	0.005
45	0.10	0.06	0.05	0.04	0.03	0.02	0.02	0.01	0.009	0.007	0.006	0.005	0.005
50	0.09	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.008	0.006	0.005	0.005	0.004
55	0.08	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.007	0.006	0.005	0.004	0.004
60	0.07	0.05	0.03	0.03	0.02	0.02	0.01	0.009	0.007	0.005	0.004	0.004	0.003
65	0.06	0.04	0.03	0.03	0.02	0.02	0.01	0.008	0.006	0.005	0.004	0.004	0.003
70	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.008	0.006	0.005	0.004	0.003	0.003
75	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.007	0.005	0.004	0.004	0.003	0.003
80	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.007	0.005	0.004	0.003	0.003	0.003
85	0.05	0.03	0.02	0.02	0.02	0.01	0.01	0.006	0.005	0.004	0.003	0.003	0.002
90	0.05	0.03	0.02	0.02	0.02	0.01	0.01	0.006	0.005	0.004	0.003	0.003	0.002
95	0.04	0.03	0.02	0.02	0.01	0.01	0.009	0.006	0.004	0.003	0.003	0.002	0.002
100	0.04	0.03	0.02	0.02	0.01	0.01	0.008	0.005	0.004	0.003	0.003	0.002	0.002