

TABLE 2-8. Total apical growth of a single-branched saguaro at Saguaro National Monument (east) 1975-1977. Stem height (trunk; cm), vertical measurement from base of branch to tip of branch, and subsequent 1-year apical growth increment (cm). Graphed in Fig. 2-2.

| Plant no. | | 1975 | | 1976 | |
|-----------|---------|---------|--------|---------|--------|
| Stem | Branch | Height | Growth | Height | Growth |
| 7521 | (trunk) | 1,051.6 | 7.5 | 1,059.1 | 10.1 |
| | A | 398.1 | 6.3 | 494.4 | 7.1 |
| | B | 347.4 | 5.5 | 352.9 | 7.4 |
| | C | 388.6 | 5.2 | 393.8 | 9.6 |
| | D | 353.1 | 6.9 | 360.0 | 8.7 |
| | E | 379.5 | 7.0 | 395.9 | 9.4 |
| | F | 50.6 | 3.3 | 60.5 | 6.6 |
| | G | 270.1 | 4.5 | 278.4 | 3.8 |
| | H | 305.8 | 5.8 | 311.6 | 6.7 |
| | I | 358.8 | 4.9 | 363.7 | 7.2 |
| | J | 496.6 | 6.0 | 412.6 | 7.4 |
| Total | | 4,310.2 | 62.9 | 4,457.1 | 84.0 |

TABLE 2-9. Total apical growth of branched saguaros ($N = 4$) at Saguaro National Monument (west) 1975-1977. Stem height (cm), vertical measurement from base of branch to tip of branch, and 1-year subsequent apical growth increment (cm). Graphed in Fig. 2-3.

| Plant no. | | 1975 | | 1976 | |
|-----------|---------|---------|--------|---------|--------|
| Stem | Branch | Height | Growth | Height | Growth |
| 7162 | (trunk) | 676.1 | 6.7 | 682.8 | 7.5 |
| | A | 265.4 | 4.7 | 270.1 | 8.9 |
| | B | 182.6 | 5.9 | 188.5 | 7.4 |
| | C | 156.7 | 4.7 | 161.4 | 5.8 |
| Total | | 1,280.8 | 22.0 | 1,302.8 | 29.6 |
| 7523 | (trunk) | 994.8 | 4.1 | 998.9 | 5.4 |
| | A | 513.7 | 4.3 | 518.0 | 6.5 |
| | B | 440.8 | 4.7 | 445.5 | 6.1 |
| | C | 418.4 | 4.7 | 423.1 | 6.0 |
| | D | 438.1 | 5.0 | 443.1 | 4.2 |
| | E | 148.7 | 3.8 | 152.5 | 4.0 |
| Total | | 2,954.5 | 26.6 | 2,981.1 | 32.2 |

TABLE 2-9—continued

| Plant no. | | 1975 | | 1976 | |
|-----------|---------|---------|--------|---------|--------|
| Stem | Branch | Height | Growth | Height | Growth |
| 71116 | (trunk) | 1,001.3 | 4.1 | 1,005.4 | 7.1 |
| | A | 435.5 | 4.0 | 439.5 | 8.5 |
| | B | 97.2 | 4.0 | 101.2 | 5.3 |
| | C | 195.3 | 3.9 | 199.2 | 9.1 |
| Total | | 1,729.3 | 16.0 | 1,745.3 | 30.0 |
| 7525 | (trunk) | 1,356.4 | 2.4 | 1,358.8 | 4.6 |
| | A | 37.1 | 1.8 | 38.9 | 3.8 |
| | B | 627.5 | 3.6 | 631.1 | 3.9 |
| | C | 679.3 | 3.2 | 682.5 | 5.9 |
| | D | 289.5 | 2.4 | 291.9 | 4.6 |
| | E | 669.0 | 3.2 | 672.2 | 6.5 |
| Total | | 3,658.8 | 16.6 | 3,675.4 | 29.3 |

TABLE 2-10. Age, aboveground stem height (cm), and subsequent 1-year apical growth (cm) of saguaros in nonrocky habitats at Saguaro National Monument (east). Graphed in Fig. 2-4.

| Age (yrs) | Height (cm) | Apical growth (cm/yr) |
|-----------|-------------|-----------------------|
| 1 | 0.35 | 0.15 |
| 2 | 0.51 | 0.22 |
| 3 | 0.73 | 0.32 |
| 4 | 1.04 | 0.44 |
| 5 | 1.49 | 0.61 |
| 6 | 2.10 | 0.82 |
| 7 | 2.92 | 1.06 |
| 8 | 3.98 | 1.35 |
| 9 | 5.33 | 1.67 |
| 10 | 7.00 | 2.02 |
| 11 | 9.03 | 2.39 |
| 12 | 11.42 | 2.79 |
| 13 | 14.21 | 3.20 |
| 14 | 17.40 | 3.62 |
| 15 | 21.02 | 4.04 |
| 16 | 25.06 | 4.48 |
| 17 | 29.55 | 4.92 |
| 18 | 34.47 | 5.37 |
| 19 | 39.83 | 5.81 |
| 20 | 45.65 | 6.26 |

TABLE 2-10—continued

| Age (yrs) | Height (cm) | Apical growth (cm/yr) |
|-----------|-------------|-----------------------|
| 21 | 51.90 | 6.70 |
| 22 | 58.61 | 7.14 |
| 23 | 65.75 | 7.58 |
| 24 | 73.33 | 8.01 |
| 25 | 81.35 | 8.44 |
| 26 | 89.78 | 8.85 |
| 27 | 98.63 | 9.25 |
| 28 | 107.88 | 9.64 |
| 29 | 117.52 | 10.01 |
| 30 | 127.53 | 10.37 |
| 31 | 137.90 | 10.71 |
| 32 | 148.62 | 11.04 |
| 33 | 159.66 | 11.34 |
| 34 | 171.00 | 11.63 |
| 35 | 182.63 | 11.89 |
| 36 | 194.52 | 12.14 |
| 37 | 206.66 | 12.36 |
| 38 | 219.03 | 12.57 |
| 39 | 231.59 | 12.75 |
| 40 | 244.34 | 12.91 |
| 41 | 257.25 | 13.05 |
| 42 | 270.30 | 13.17 |
| 43 | 283.47 | 13.27 |
| 44 | 296.74 | 13.36 |
| 45 | 310.10 | 13.43 |
| 46 | 323.53 | 13.48 |
| 47 | 337.00 | 13.51 |
| 48 | 350.51 | 13.53 |
| 49 | 364.04 | 13.53 |
| 50 | 377.57 | 13.53 |
| 51 | 391.10 | 13.51 |
| 52 | 404.61 | 13.48 |
| 53 | 418.08 | 13.43 |
| 54 | 431.52 | 13.38 |
| 55 | 444.90 | 13.32 |
| 56 | 458.22 | 13.26 |
| 57 | 471.48 | 13.18 |
| 58 | 484.66 | 13.10 |
| 59 | 497.76 | 13.01 |
| 60 | 510.77 | 12.92 |
| 61 | 523.69 | 12.82 |
| 62 | 536.51 | 12.72 |
| 63 | 549.23 | 12.62 |
| 64 | 561.85 | 12.51 |
| 65 | 574.36 | 12.40 |
| 66 | 586.76 | 12.29 |

TABLE 2-10—continued

| Age (yrs) | Height (cm) | Apical growth (cm/yr) |
|-----------|-------------|-----------------------|
| 67 | 599.05 | 12.17 |
| 68 | 611.23 | 12.06 |
| 69 | 623.28 | 11.94 |
| 70 | 635.23 | 11.83 |
| 71 | 647.05 | 11.71 |
| 72 | 658.76 | 11.59 |
| 73 | 670.35 | 11.47 |
| 74 | 681.82 | 11.35 |
| 75 | 693.17 | 11.23 |
| 76 | 704.41 | 11.12 |
| 77 | 715.52 | 11.00 |
| 78 | 726.52 | 10.88 |
| 79 | 737.40 | 10.77 |
| 80 | 748.17 | 10.65 |
| 81 | 758.82 | 10.54 |
| 82 | 769.36 | 10.42 |
| 83 | 779.78 | 10.31 |
| 84 | 790.09 | 10.20 |
| 85 | 800.30 | 10.09 |
| 86 | 810.39 | 9.98 |
| 87 | 820.37 | 9.88 |
| 88 | 830.25 | 9.77 |
| 89 | 840.02 | 9.67 |
| 90 | 849.68 | 9.56 |
| 91 | 859.25 | 9.46 |
| 92 | 868.71 | 9.36 |
| 93 | 878.07 | 9.26 |
| 94 | 887.33 | 9.16 |
| 95 | 896.50 | 9.07 |
| 96 | 905.56 | 8.97 |
| 97 | 914.54 | 8.88 |
| 98 | 923.42 | 8.79 |
| 99 | 932.20 | 8.70 |
| 100 | 940.90 | 8.61 |
| 101 | 949.51 | 8.52 |
| 102 | 958.03 | 8.43 |
| 103 | 966.46 | 8.35 |
| 104 | 974.81 | 8.26 |
| 105 | 983.07 | 8.18 |
| 106 | 991.25 | 8.10 |
| 107 | 999.35 | 8.02 |
| 108 | 1,007.37 | 7.94 |
| 109 | 1,015.31 | 7.86 |
| 110 | 1,023.17 | 7.79 |
| 111 | 1,030.96 | 7.71 |
| 112 | 1,038.67 | 7.64 |

TABLE 2-10—continued

| Age (yrs) | Height (cm) | Apical growth (cm/yr) |
|-----------|-----------------------|-----------------------|
| 113 | 1,046.31 | 7.56 |
| 114 | 1,053.87 | 7.49 |
| 115 | 1,061.36 | 7.42 |
| 116 | 1,068.78 | 7.35 |
| 117 | 1,076.13 | 7.28 |
| 118 | 1,083.42 | 7.21 |
| 119 | 1,090.63 | 7.15 |
| 120 | 1,097.78 | 7.08 |
| 121 | 1,104.86 | 7.02 |
| 122 | 1,111.88 | 6.96 |
| 123 | 1,118.84 | 6.89 |
| 124 | 1,125.73 | 6.83 |
| 125 | 1,132.56 | 6.77 |
| 126 | 1,139.33 | 6.71 |
| 127 | 1,146.04 | 6.65 |
| 128 | 1,152.69 | 6.59 |
| 129 | 1,159.29 | 6.54 |
| 130 | 1,165.82 | 6.48 |
| 131 | 1,172.31 | 6.43 |
| 132 | 1,178.73 | 6.37 |
| 133 | 1,185.10 | 6.32 |
| 134 | 1,191.42 | 6.26 |
| 135 | 1,197.69 | 6.21 |
| 136 | 1,203.90 | 6.16 |
| 137 | 1,210.06 | 6.11 |
| 138 | 1,216.17 | 6.06 |
| 139 | 1,222.23 | 6.01 |
| 140 | 1,228.24 | 5.96 |
| 141 | 1,234.21 | 5.92 |
| 142 | 1,240.12 | 5.87 |
| 143 | 1,245.99 | 5.82 |
| 144 | 1,251.81 | 5.78 |
| 145 | 1,257.59 | 5.73 |
| 146 | 1,263.32 | 5.69 |
| 147 | 1,269.00 | 5.64 |
| 148 | 1,274.65 | 5.60 |
| 149 | 1,280.25 | 5.56 |
| 150 | 1,285.80 | 5.51 |
| 151 | 1,291.32 ^a | 5.47 |
| 152 | 1,296.79 | 5.43 |
| 153 | 1,302.22 | 5.39 |
| 154 | 1,307.62 | 5.35 |
| 155 | 1,312.97 | 5.31 |
| 156 | 1,318.28 | 5.27 |
| 157 | 1,323.56 | 5.24 |
| 158 | 1,328.79 | 5.20 |

TABLE 2-10—continued

| Age (yrs) | Height (cm) | Apical growth (cm/yr) |
|-----------|-------------|-----------------------|
| 159 | 1,333.99 | 5.16 |
| 160 | 1,339.15 | 5.12 |
| 161 | 1,344.28 | 5.09 |
| 162 | 1,349.36 | 5.05 |
| 163 | 1,354.42 | 5.02 |
| 164 | 1,359.43 | 4.98 |
| 165 | 1,364.41 | 4.95 |
| 166 | 1,369.36 | 4.91 |
| 167 | 1,374.27 | 4.88 |
| 168 | 1,379.15 | 4.85 |
| 169 | 1,384.00 | 4.81 |
| 170 | 1,388.81 | 4.78 |
| 171 | 1,393.60 | 4.75 |
| 172 | 1,398.35 | 4.72 |
| 173 | 1,403.06 | 4.69 |

^a Growth data limit (ht 1,292.7 cm). Subsequent values by regression.

Branching and total height growth

Tables 2-8 and 2-9 provide data on the growth of individual branches ("arms") and total apical growth of branched adult saguaros. From permanent benchmarks set directly beneath the tip of each branch and at the base of the stem, yearly height measurements were made with pole calipers to obtain annual height-growth increments. The initial height of each branch was determined by measuring the vertical distance from the base of the branch (juncture with the stem) to the branch tip.

The sum of stem and branch heights and total apical growth (stem + branches) for each individual are graphed in Figs. 2-2 and 2-3 (solid circles, upper right). As shown in those two graphs, *the total height growth of adult saguaros continues to increase exponentially by the growth of branches until mechanical injury or senescence finally becomes limiting on growth of large individuals.*