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Appendix G
Growth Rate Percentage formula

15-7 GROWTH PERCENTAGE

Growth percentage is a means of expressing the increment of any tree parameter in relation to the total size of the parameter at the initiation of growth. Although growth percentage is most frequently used for volume and basal area growth, it is applicable to any parameter.

In terms of simple interest, growth percent p_i is

$$p = \frac{s_n - s_0}{ns_0}(100) \tag{15-2}$$

where

s_0 = size of parameter at beginning of growth period
s_n = size of parameter at end of growth period
n = number of units of time in growth period

In this equation, average growth per unit of time is expressed as a percentage of the initial size s_0. To illustrate, if the present volume of a tree is 400 board feet and the volume 10 years ago was 300 board feet,

$$p = \frac{400 - 300}{10(300)}(100) = 3.3\%$$

In terms of compound interest, growth percent p is

$$p = \left(\sqrt[n]{\frac{s_n}{s_0}} - 1\right)100 \tag{15-3}$$

In this form, p may be computed by logarithms. But when compound interest tables are available, a more convenient form of the equation is

$$(1 + p)^n = \frac{s_n}{s_0} \tag{15-4}$$

The compound interest rate for the previously mentioned tree is then

$$(1 + p)^n = \frac{400}{300} = 1.333$$

$$p = 2.9\%$$

The compound interest rate is based on the premise that the increment for each unit of time is accumulated, resulting in an increasing value of s_0. Thus, as the period increases the simple and compound interest rates will diverge more and more. For short periods, however, they will be almost the same.

To avoid the use of compound interest tables, Pressler based a simple rate of interest on the average value for the period, $(s_n + s_0)/2$, which has the effect of reducing the rate to near the compound interest rate. Pressler's growth percent p_p is

$$p_p = \left(\frac{s_n - s_0}{s_n + s_0}\right)\frac{200}{n} \tag{15-5}$$

For the previous example

$$p_p = \left(\frac{400 - 300}{400 + 300}\right)\frac{200}{10} = 2.86\%$$

It is essential to remember that growth percentages are ratios between increment and initial size. Thus, percentages change as the amount of increment, and the base on which it accrued, changes. As trees grow the base of the percentage constantly increases, and the growth percentage declines even though the absolute increment may be constant or even increasing slightly. In early life the growth percentage for a tree is at its highest because the base of the ratio is small; the percentage falls as the size of the tree increases. Although young trees may grow at compound rates for limited periods, growth percent is generally an unsafe tool for predicting tree or stand growth, because of the uncertainty in extrapolating growth percent curves.

Husch Bertram, Miller Charles I., Beers Thomas W., Forest Mensuration, Malabar, FL, Krieger Publishing Co., 1993