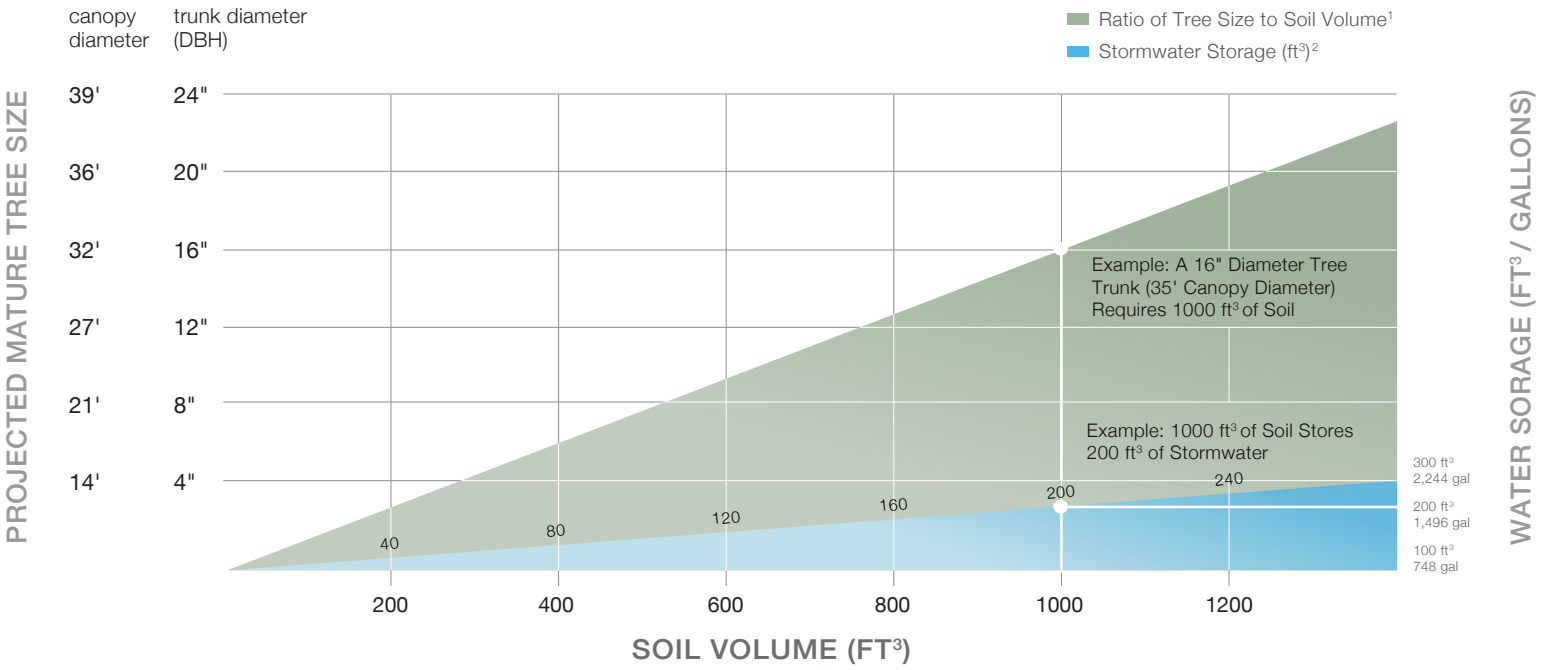
HOW MUCH SOIL TO GROW A BIG TREE?



RATIO OF TREE SIZE TO SOIL VOLUME

Soil volumes depicted in this chart are based on the amount of roots loam soil can support with optimum compaction for root growth.

Several studies[3,4,5] have calculated a relationship between tree growth and soil volume. Below is an example from one such study, and its soil volume methodology.[6]

Crown projection (drip line area)
x Leaf area index
x Evaporation rate
x Evaporation ratio
= Volume of water used by tree daily (water loss)

Water loss
x Percent water holding capacity of soil
= Volume of soil (to hold water used by the tree)

Volume of Soil
x Rainfall frequency (estimated number of days between rain events)
= Volume of soil (to meet demands of the tree for a certain period of time)

This soil volume methodology indicates that every 1 ft³ to 3 ft³ of soil results in 1 ft² of projected tree canopy diameter. Field observations indicate that trees that share soil may need less soil volume per tree. For example, 25-year old street trees sharing soil in Charlotte, North Carolina, with 700 ft³ of soil per tree have grown an average of 16" DBH (diameter at breast height) and have a 98% survival rate. 25-year old trees sharing soil in Bethesda, Maryland with 600 ft³ soil per tree have grown 14"- 20" DBH and continue to flourish.

STORMWATER STORAGE

The line on the graph is based on 20% soil water holding capacity in a bioretention soil mix. This is a conservative estimate based on bioretention research[7] and soil water properties.[8]

Total soil porosity
- Field capacity of soil
= Available water storage within soil

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