Trees and Antenna Gain

Live Trees contain moisture which is conductive, absorbs RF energy.

Dead trees, utility poles, and lumber are not conductive and absorb little RF energy.

Feb. 2018 QST authors KE4PT and W4RQ modeled ONE tree as a lossy cylinder and calculated losses for:

0.5 to 10 meter spacing between tree and vertical antenna
tree trunk *radius* of 0.17, 0.33, and 0.5 meter (7, 12, 19 inches)

Calculated loss on 14 MHz with antenna parallel to tree:

Thin (0.17m radius) tree: 1 dB loss with 0.5m spacing, 0.2 dB loss with 10m spacing.

Thick (0.5m radius) tree: 4 dB loss with 0.5m spacing, 0.5 dB loss with 10m spacing.

Loss is proportional to frequency.

Findings:

Tree trunks mostly absorb VERTICAL polarized RF energy.

Tree trunk PARALLEL to antenna: Softwood and Hardwood have similar absorption.

Tree trunk PERPENDICULAR to antenna: Softwood has less absorption, Hardwood has much less absorption.

The author assumes absorption is mostly in the bulky trunk, not much in the branches or leaves.
Conductive areas less than ¼ wavelength in size are essentially invisible to the RF signal.
Conductive areas in branches and leaves have more effect on UHF than on HF.

A large tree functions as a REFLECTOR when spaced 0.2 wavelength from a vertical antenna, giving the antenna modest forward gain and a small front-to-back ratio.

	Permittivity Range (higher number means more absorption)
Human muscle tissue	92-200
Salt water	79
Softwood parallel to antenna	46-72
Hardwood parallel to antenna	32-59
Softwood perpendicular to antenna	38-59
Hardwood perpendicular to antenna	12-31
Dead wood	2-9

Recommendations:

Vertical antennas should be located as far as possible from trees.

The more nearby trees you have, the more it makes sense to use a horizontal polarized HF antenna.

My mobile experience (vertical antenna) is that HF signals drop noticeably when I move from field to forest.