Some Basics About Tree Supported Antennas

Amateur Radio operators are often faced with the challenge of using trees as antenna supports. To minimize wire sag and optimize the antenna’s height and performance, the antenna wire span needs to be tensioned. Because trees sway in the wind and can break or damage the wire and support ropes, the antenna must have some form of tensioning system...or as a poor alternative, an excess length of rope can be added as slack to compensate for the distance that the trees sway. Slack can be added by easing off on the support halyard but since this also lowers the antenna it is not a good way to compensate for tree sway. Reducing the height above ground usually reduces antenna gain...an undesirable characteristic that degrades on-the-air performance.

An antenna installation that has an excess amount of slack in the wire but no tensioning mechanism can also experience sudden and repetitive “snapping” forces during wind gusts that can weaken and eventually break the insulators, wire and support ropes.

Lower height means lower performance

Loss of height translates to loss of performance and this is a compelling reason to properly tension any wire antenna. Here is a typical example of how much antenna height will be sacrificed by adding slack to compensate for tree movement.

Let’s assume that you have a 136’ dipole antenna tensioned to 25 lbs. It has a feed point insulator and 50’ of 6” ladder line having a combined center weight of 3 lbs. The ends of the antenna are supported by trees at 50’. At 25 lbs tension the feed point (area of highest radiation) will sag 6.9’ and will be 43.1’ above ground. Take the same antenna and add just 3’ of halyard slack to compensate for tree movement and you will add another 8.3’ of sag. The antenna’s area of highest radiation will fall to just 34.8’ above the ground and 30% lower than the ends.

Tensioner™...three ways better than a counter weight

A popular and time proven way to tension antennas has been to apply opposing tension with a ground level counter weight. A support rope is looped through the tree top with one end secured to a high grade pulley so that the pulley can be hoisted to its position in the tree. A second rope is attached to the antenna and passed through the pulley and fastened to a counterweight on the ground. The support rope and pulley is then pulled to its position near the tree top. Finally the antenna rope and counter weight are adjusted so that the weight hangs freely and tensions the antenna wire. The other end of the antenna is tied off to its support tree, pole or tower.

When the support tree sways in the wind the counter weight moves up and down and keeps tension on the wire. The size of the counter weight is dependant on the weight of the wire (plus any center insulators and feedline), length of span, and some acceptable amount of sag. The longer the unsupported span, the heavier the counter weight needed to off-set the normal sag caused by the weight of the antenna. Sag can never be totally eliminated but common practice is to control it to 10% or less of the span. The added weight of center insulators, baluns and feed lines significantly increases sag. Counter weights typically range from 15-50 pounds.

First...and very important... is improved antenna height. Tensioners can be positioned higher in the tree than a counter weight pulley, often 10-15’ higher

When installing a counter weight system it is seldom possible to position a tree top pulley physically close to the tree trunk and not have the antenna/counterweight rope in contact with the branches below it when the wind blows. If the counter weight rope rubs against branches while it moves up and down, chafe and wear will take place and the rope will eventually fail.
The remedy to this problem is to extend the length of line supporting the pulley but this also lowers the antenna height. When the pulley line is extended, the combined vector forces of the horizontal antenna tension and downward force of the counter weight will cause the pulley to reposition to a point out beyond the branches where the counter weight rope is free of all abrasive contact with branches. Unfortunately the vector effect of doing this lowers the antenna height by the same amount of horizontal distance that the pulley is positioned away from the trunk of the tree. For example if it is necessary to have the pulley 15' away from the tree trunk so that the counter weight rope clears branches, then the height of the antenna is automatically reduced by 15’ from where it could otherwise be attached higher up. If it were possible to run the antenna support rope straight to a pulley (or Tensioner) at the tree trunk, it would be positioned 15’ higher. This is why a Tensioner supported antenna can be positioned higher in the tree top.

Second... Tensioners can handle gust “jolts” and are maintenance free. When a Tensioner receives a strong jolt during a gust there is no inertia to overcome before it smoothly extends and does it’s job. Compared to antennas supported by a system of ropes, pulleys and a counterweight, the Tensioner’s stored energy does not need to be transferred up the tree to the antenna. It’s already there. This eliminates the problem of rope and pulley wear and tear caused by the high inertia stress when a counterweight is jerked upward during wind gusts. A 25 lb counterweight can easily need more than 100 lbs of force to overcome it’s inertia during a wind gust. This is tough on the entire system.

Third... CC&R’s, cluttered appearance and safety factors involving the counterweight need to be considered. Neighbors and family may not take kindly to seeing a cement block, stack of bricks or sash weights or similar counter weight bobbing up and down in the yard. Children may also be enticed or fascinated by the swinging counter weight and this could be a safety and liability issue. CC&R’s that have previously had a blind eye may now become an issue.

Tensioners use just one support line and hide inconspicuously in the tree top canopy. Olive drab camouflage color blends in with leaves and branches.