ECONOMICS OF UTILITY LATERAL TRIMMING[1]

by Richard A. Johnstone

Abstract. *The implementation of lateral trimming, proper* crew scheduling, tree removal and/or replacement and growth regulator injections were proposed in 1982 as techniques necessary for a utility manager to stretch available funds in order to maintain a reliable electric system. Expectations were exceeded at Delmarva Power as these techniques allowed the budget to be reduced while reliability was improved.

Résumé. En 1982, la réalisation d'élagages latéraux, d'une programmation adéquate des équipes, de l'abattage et/ou du remplacement des arbres et de l'injection de régulateurs de croissance fut présentée comme un ensemble de techniques nécessaires aux gestionnaires de réseaux électriques pour diminuer les ressources *financières requises afin de maintenir une bonne fiabilité du* système de distribution d'électricité. Les espérances le la compagnie "Delmarva Power" furent dépassées puisque ces techniques ont permis de diminuer les budgets nécessaires à l'entretien, tout en augmentant la fiabilité du réseau.

The maintenance of trees growing near electric distribution facilities is a high budget item for utilities, but it is also one of the first areas to receive budget cuts during lean years. For a utility Forester to maintain a reliable system, management techniques must be modified to stretch the available funds. Techniques that need to be implemented are lateral trimming, proper crew scheduling, tree removal and/or replacement, and the use of tree growth regulators.

Techniques

The standard method for trimming trees was the shearing method. With this method the trimmer picks a plane a set number of feet below the conductors and tops or "rounds over" the tree. The arbitrary cuts produce stubs and resulting multiple sprouts from adventitious buds grow prolifically. The next trim cycle requires even more cuts than the first because of the multiple sprouting. Clearance is also diminished because the trimming is normally done above the old, dead stubs produced during the first cycle (Figure 1). Three basic items are wrong with this method: 1) the stubs produced by arbitrary cuts die back and begin to rot providing avenues into the tree for insects and disease, 2) the multiple sprouts are of juvenile wood which grows very quickly back into the conductors and, being weak, the sprouts are easily whipped into the conductors causing power interruptions, and 3) the reduced clearance caused by trimming above the old stubs dictates that each subsequent cycle must be shorter than the previous cycle if reliability is to be maintained.

Lateral or natural trimming on the other hand requires the trimmer to pick out the branches which are growing towards the conductors and remove them back to the next limb which is growing laterally. Properly placed natural cuts produce few sprouts and growth rates are more natural. The next trim cycle requires less cuts since the problem branches were removed during the previous cycle and regrowth is controlled (Figure 2). The benefits of lateral trimming are: 1) lateral cuts made along the branch bark ridge encourage compartmentalization and reduced sprouting, 2) regrowth is directed away from the conductors and, being of mature wood, is strong and grows slower, and 3) reliability can be maintained and trim cycles extended since each cycle reduces the number of problem branches and encourages good lateral branching.

The second area which requires study is proper crew scheduling. To do this, one first must know exactly what needs to be managed. Delmarva

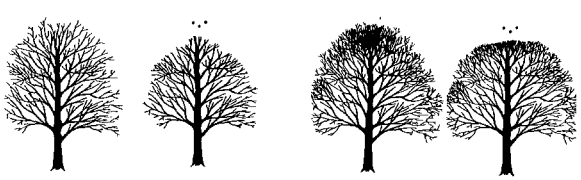

Figure 1

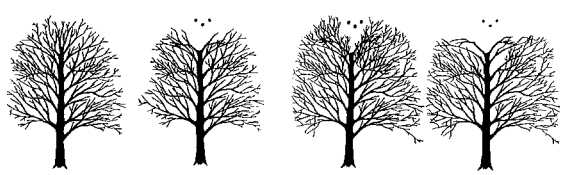

Figure 2

[1]Presented at the annual conference of the International Society of Arboriculture in Keystone, Colorado in August, 1987.

Power serves a 5700 square mile wide area on a peninsula made up of the state of Delaware and the Eastern shore of Maryland and Virginia. My area of responsibility is the Southern Division which stretches over 200 miles long in the three states and serves 180,000 customers with approximately 1,000 miles of transmission and 4600 miles of overhead distribution lines.

The Southern Division is divided into twelve operating districts with a general office in Salisbury, Maryland. Districts are very effective in handling the electrical needs of customers, but they are not very effective in handling trees. Simply because a district has "X" number of customers and "X" number of pole miles does not mean it has proportionate number of trees and needs "X" number of dollars for vegetation maintenance.

The Forestry Department has divided Delmarva's Southern Division into four areas based on approximately 30,000 yard trees per area. (A yard tree being one in a residential yard as opposed to a woods or wall-trimmed tree). In each area we have assigned a tree foreman who is responsible for all vegetation maintenance within that area. The number of tree trimming crews assigned to an area is based on the number of trees that need to be trimmed and the manhours required to do so. As you will see, the number of manhours required can change.

The tree foreman then divides his area according to the circuit feeds and assigns his crews. Originally we would assign one crew to trim a geographic area which would take that one crew 2½ to 3 years to make a cycle. However, to more effectively utilize our supervision and that of the contractor, we now assign 2 or 3 crews together to trim a larger geographic area which will take the total crew contingent 2½ to 3 years to make a cycle. By working together, though, we do not mean side by side, that poses other problems. The crews simply work in close proximity to each other.

Determination of what circuit to trim is based on the number of primary tree-related interruptions, importance and voltage of the circuit feed, the number of customers served and visual tree conditions. Once crews are assigned to a circuit they remain there until the circuit is completed. Crews are not moved for customer requests - only for emergencies.

When a customer request for trimming is received, the tree condition is inspected and the customer is notified as to when trimming will take place on their circuit. We explain that all trees on the circuit will be trimmed at the time. The exception is a request for removal of a tree which will benefit our reliability.

The third technique involves tree removal and/or replacement.

If a manager is only concerned with short term costs, then it makes economic sense to trim all the trees and remove very few, hence, the recent popularity of unit price bidding. However, if your long term goal is to reduce your vegetation maintenance expenditures per pole mile worked, then it makes economic sense to eliminate as many problem trees as possible, even if the removal cost includes the replacement of the tree with a low growing ornamental.

Removals also include danger trees in wooded areas. Our foremen are constantly vigilant for timber operations which will normally leave one row of trees adjacent to our lines. It is much easier to assist a timber company in removing these trees safely during their logging, than to remove them from the conductors at 3:00 a.m. during a thunderstorm.

Injection of growth regulators, the fourth area, has received much attention in the last few years. Delmarva utilizes tree growth regulators where we feel we will get the most return - on the trees who growth rates require trimming in less than 2½ years. Since we trim by circuit feeds, we do not want one or two trees to grow excessively and cause an interruption between trim cycles. Growth regulators help us to get all species of trees on the same cycle without sacrificing reliability or the integrity of the trees.

Results

Now that we have instituted these management techniques for over five years, what have been our results? First, let's look at productivity (Figure 3). In 1982 the trimming of 59,000 trees required 68,000 manhours (1.15 mhrs/tree). As we improved on supervision and scheduling and the crews improved on lateral trimming, productivity improved through 1984 when 63,000 trees were

trimmed in 70,000 manhours (1.11 mhrs/tree).

1985 marked the beginning of the second 2½-3 year trim cycle. Note how the number of trees trimmed continues to rise but manhours drop suddenly, through 1986 when 67,000 trees were trimmed in 67,000 manhours (1.00 mhr/tree). What this shows us is that a lateral trimmed tree is easier, and subsequently faster to trim the second time around. If trees have been sheared in the past, the first lateral trim is a corrective trimming to remove cabbage heads and large branches containing rot. The second lateral trim finds the tree healthier and in good natural form. Consequently, not as much wood needs to be removed and fewer manhours are required to trim it.

To emphasize this even more we took a sample area composed of several towns and compared the number of trees trimmed and manhours worked in the 82-84 cycle vs 85-87 cycle. In the 82-84 cycle of the sample area, 25,254 trees were trimmed in 32,093 manhours (1.27 mhrs/tree). In the 85-87 cycle of the same area, only 20,689 trees needed to be trimmed and this trimming required only 22,490 manhours (1.09 mhrs/tree) (Figure 4). Properly trimmed trees not only require less manhours on their next cycle, but some may not even need trimming. We experienced an 18% reduction in trees needing to be trimmed and a 30% reduction in manhours necessary to trim them.

Manhours on the second cycle are also reduced simply because the trees are on a planned cycle. If a tree is trimmed prior to its growing through the primary conductors, it is much safer and easier for it to be trimmed. Thus a crew can take fewer manhours to perform the necessary work.

A good cycle of laterally trimmed trees can have a marked impact on service reliability as well. Our tree-related interruptions steadily declined between 1980 and 1986, except for a period following a budget cut and Hurricane Gloria. This improvement in reliability was quite impressive, with 56% fewer tree related interruptions in 1986 than in 1980 (Figure 5).

I mentioned earlier that the number of crews assigned to an area depends on the number of trees needing to be trimmed and the manhours necessary to do so. This holds true for the entire division. Since we average on the second trimming cycle 18% fewer trees needing to be trimmed and 30% less manhours, and our tree-related interruptions continue to decrease, the number of tree trimming crews required should decrease as well.

During the 82-84 cycle we maintained twenty crews to perform the necessary tree trimming. As

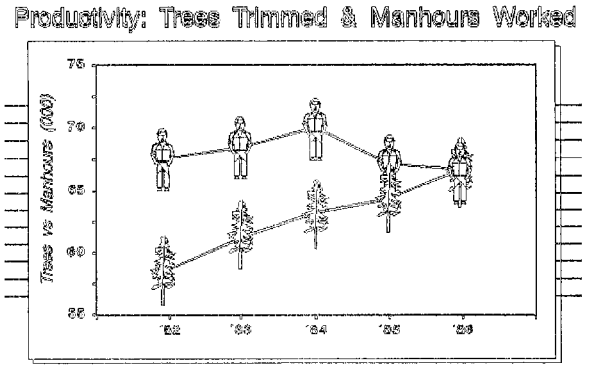

Figure 3

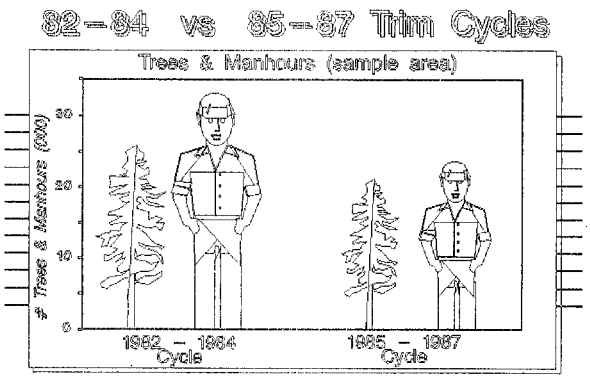

Figure 4

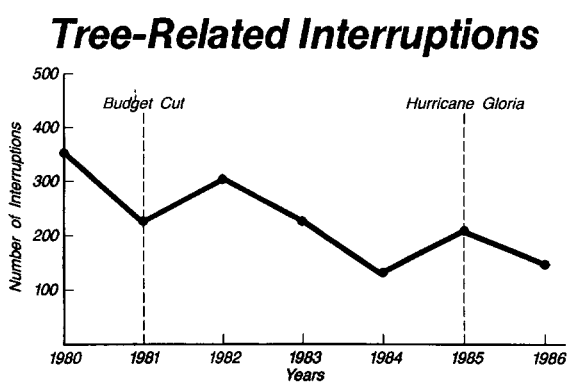

Figure 5

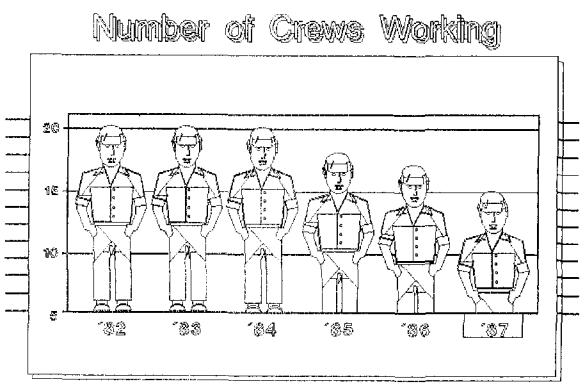

Figure 6

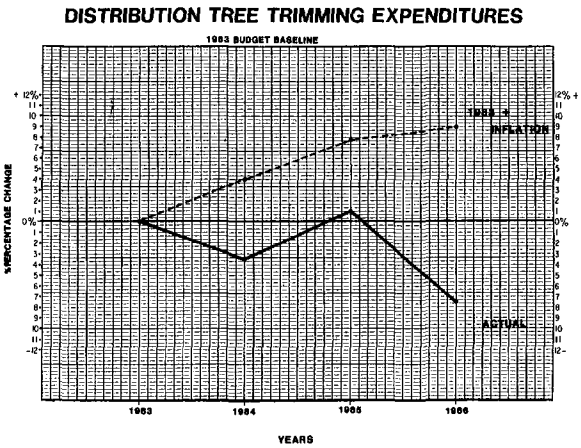

Figure 7

we entered the second cycle, 85-87, it immediately became apparent that the same number of crews would no longer be necessary. We have steadily decreased the number of crews so that by 1987 we only employ fifteen crews to maintain the same miles of circuits that twenty crews worked three years previously, a 25% reduction in our workforce (Figure 6).

What effect has this had on our budget? During my discussion on service reliability, I mentioned that tree-related interruptions had declined steadily except for a period following Hurricane Gloria and a budget cut. After the budget cut, I explained to our management that if our maintenance budget was left intact, then we should be able to reduce it *ourselves* in the future after the system had been cleaned up.

Up through 1982 some of our tree work was capitalized due to the purchase of small utility systems, so we used 1983 as a maintenance budget baseline year. If inflation is factored in, then 1986 expenditures should be 9% higher than 1983 expenditures. In reality, though, our 1986 budget was 7.4% less than our 1983 budget (Figure 7)!

Summary

Lateral trimming, proper crew scheduling, tree removal and/or replacement and growth regulator injections are techniques which were instituted to help stretch available budgetary funds so that a reliable electric system could be maintained. At Delmarva we not only were able to reach our goal of stretching funds to maintain reliability, we actually exceeded our goal by reducing funding and improving reliability—reliability, which 93% of our customers rate as being good to excellent!

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