A MANAGED SYSTEM FOR DISTRIBUTION FORESTRY [1]

by S.T. Griffiths

Abstract. The maintenance of vegetation that affects or has the potential to affect electric distribution lines goes beyond the periodic treatment of existing trees and brush. Utility managers must understand and continuously address why the brush and trees are there. Tree and brush density has to be managed as a prerequisite to actually doing the physical work. The managed system, applied to distribution forestry maintenance, sets performance standards for doing the work and utilizes reliability as a measure of effectiveness. The system which is based on the distribution feeder, categorized by customer type, right of way location and/or landscape is dynamic and can be changed or adjusted in response to quantitative results from the performance indices. These performance indices, when fully developed, will help the manager to determine which areas of the operation require corrective attention.

The treatment of vegetation affecting an electrical distribution systems costs a lot of money, and for some, this expenditure represents the highest cost component of distribution maintenance. I will explain how Ontario Hydro proposes to manage its distribution forestry program. Initially, let me state some basic statistics on Ontario Hydro:

We are a publicly owned corporation supplying electricity at the wholesale level to 321 municipalities serving 2.2 million customers and 103 direct customers. Our installed capacity is 24.7 million kW and utilizes 35% nuclear, 34% hydraulic and 31% coal. Our own distribution system has approximately 101,000 km (60,000 miles) of line and serves 760,000 customers. The service area covers 650,000 square kilometers (250,000 square miles), 1,000 km (600 miles) north to south and 1,600 km (1,000) miles) east to west. Utility arborists and foresters must know what kind of forests, or countryside, supports their system. Ontario is characterized by four forest zones; Deciduous, Great Lakes, Boreal and Tundra.

Our authority to do work is provided by government statute, the Power Corporation Act. This document gives us the legal right to maintain the vegetation as it affects our facilities. It is corporate policy to obtain occupation rights to clear and keep clear vegetation on our rights of way, and to treat any danger trees off the right of way. We have an electrical distribution system with over 100,000 ha (260,000 acres) of right of way, capable of supporting literally millions of trees.

Historically, the forestry operation was managed using the standard tree treated (trim or remove) as the basis for resource decisions. Unfortunately, its use did not give management sufficient knowledge for adequate control, and it was easily abused. For example, as crews became more mechanized in the 1960s and '70s, aerial lift devices were replacing manual climb crews. We found that aerial lift crews would treat more trees on any given right of way than manual climb. A man in the bucket, at one set up, would trim perhaps 3 or 4 trees, where a climber may ascend and trim only 1. The tree count goes up, manhour per tree decreases and more aerial devices are required, if this production information is to be believed. That's the reason utility management must look into why the trees are there, and implement the required processes to manage tree density and establish a tolerable workload. Some examples we use to manage tree density are (1) A chemical brush control program. (2) Tree replacement program. We remove weed trees and provide the landowner with a slow-growing replacement planted away from our lines. (3) Billing stuffers to customers and handouts to nurseries and municipalities on where not to plant trees. (4) Periodic newspaper advertisements.

Any managed system, whether manufacturing automobiles or clearing vegetation from power

1. Presented at the annual conference of the International Society of Arboriculture in Indianapolis, Indiana in August 1983.

lines, can be depicted as in Fig. 1. For utility arborists, it is clearing brush and trees to a certain reliability standard by means acceptable to the general public. Initialy one needs a plan that includes programmed cycles (to determine required clearances) and job specifications. One then must organize. At Ontario Hydro we have our 55 administrative locations headed by forestry foremen, functionally guided by forestry supervisors in the six Regions who, in turn are functionally guided by Head Office. Resources, either our own forces or external contractors, are given the required training for the work. Direction is the supervision given to crews, contractors, Areas and Regions. The control must be expressed both quantitatively (relationship of work done to production standards) and qualitative (relationship of work done to tree caused outages and adherence to arboricultural specifications).

Starting with the **plan,** Ontario Hydro has opted for the job package approach with the distribution feeder as the basis for planning and executing forestry work. In our system, there are approximately 2,400 feeders, which seems to be a good population for work management purposes. The feeder has advantages over other work packages, such as geography (land feature or political boundaries):

Clearing By Feeder	vs.	Clearing by Geography
1. Better Reliability		1. Political boundaries facilitate municipal contacts.
2. Crew knowledge of electrical system an asset for safety and storm repair.		
3. Facilitates planning program changes.		

The next step in the planning process is to categorize these 2,400 job packages by existing vegetation type, so feeders possessing similar landscape characteristics can be grouped together for quantitative (production) and qualitative (reliability) comparisons. We came up with nine different categories for feeders, which are described as follows:

Management unit categories

A. *Agriculture* (intensive farming). This includes all locations which contain a high proportion of intensive farming. An on or off-road aerial device could complete the majority of necessary work. Low tree densities are encountered and perhaps enhanced by the continuously managed land on both sides of the R/W by farmer and road authority.

B. *Rangeland* (marginal farming). This includes all locations having adjacent land classified as marginal for farming. On or off-road equipment can complete the majority of the work. Tree density and brush problems are greater than in the agricultural setting.

C. *Urban residential.* This consists of locations high in customer density; hence, is characterized by having a large number of primary and secondary services and three-wire "bus." Mature tree trimming and removals are the major portion of the work-load. An on-road aerial device can complete the majority of the necessary work. There are few brush control problems, e.g. subdivisions and beach locations.

D. *Rural estate.* This encompasses all residential areas of much lower customer density than category C and usually has higher tree densities. Work can normally be completed by on-road equipment. The trees in question make up a significant portion of the landscape scene and constitute a higher dollar value.

E. *Mixed-hardwood* (on-road). This includes non-agricultural land containing a high percentage of on-road trim work. The major work load involves the treatment of hardwood tree species. There is a high density of trees per kilometer and brush control is a substantial portion of the cycle right of way maintenance program.

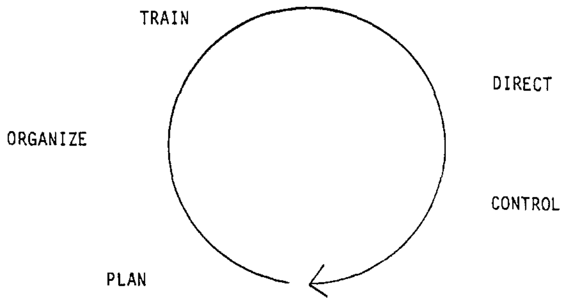

Figure 1.

F. *Mixed-hardwood* (off-road). This is identical to category E except the majority of the work requires specialized off-road equipment.

G. *Mixed-Conifer* (on-road). This includes non-agricultural land having largely on-road access. The major work involves the treatment of coniferous tree species.

H. *Mixed-Conifer* (off-road). Identical to F except that the majority requires off-road equipment.

I. *Inaccessible.* Includes all of those isolated situations in which there is no access for mechanical equipment. A climbing crew is mandatory, e.g. island locations, backlot construction.

To ensure consistency in defining these categories, a decision key was developed for the supervisors' use to establish the correct category for each feeder job package. With all this in place, our plan is established with annual forestry programs on a cycle basis. I'll not dwell on the Organize, Train and Direct components of this system but move on to Control (Fig. 1). **Control** is defined by Webster's as verify, regulate, or check. Utility managers should identify the various factors that give them an idea of how well any operation is proceeding.

At Ontario Hydro, the various work functions that will be standardized for comparison are (1) Line clearing (tree trimming and removal), with standards developed for mh/tree, mh/km and $/km. (2) Chemical brush control, mh/km and $/km. (3) Brush cutting will not have a standard since it's non-routine work. (4) Distribution Station (D.S.) site maintenance, $/D.S. by site class. (This item of the maintenance program is relatively insignificant in terms of dollars spent, so I'll not dwell on it; only to say that all 800 of our D.S.'s are divided into three site classes, depending on the sensitivity of location and landscape; each site class has its own general maintenance specification and standard).

There are other means of assessing work location performance; the standards allow the manager to assess performance regularly, even daily. The other measures that, over a longer time span, can be utilized by managers give a complete picture of any operation are (1) Reliability; customer outages caused by trees. (2) Percent of off-cycle work to total line clearing program. Are crews running all over the countryside instead of working in their assigned units? (3) Percent of brush cutting to chemical brush control. This is an indicator of local resistance to chemicals. (4) Comparisons of work done by category to standards. (5) Percent of trees removed of the total trees treated. An average removal rate of 30-40% is required so tree densities will not increase over the clearing cycle. (6) Past cycle history of forestry programs.

Since we clear rights of way for system reliability, we can and should utilize reliability data in planning our programs. We may ultimately have different programmed cycles for the various categories. Our existing clearance cycles were derived by utility foresters sitting around a table, based on professional experience of how much clearance we could give trees without being accused of a "bare earth" policy. Not good enough, we were told by auditors. Cycles must be based on hard reliable data. Reliability will also let us test our work specs, for example, leaving "skirts" vs. removing them. Also, it can be used to assess the performance of supervisors.

As an example, let us assume a feeder has 20 km of line, with equal customer and tree density and is split by a municipal boundary (Fig. 2). If planned clearing is done on a municipal or geographical basis, in this example you have a 50% chance of working on either side of the town boundary. If you clear on a feeder basis, from line to load working outward from the D.S., your reliability (outages caused by trees) will be 50% better than the non-electrical method.

Another control factor is the job audit. This assesses how well each job (line clearing, spray, etc.) is planned and executed. We are now implementing a formalized audit, which is similar to quality control by inspectors. In our audit process,

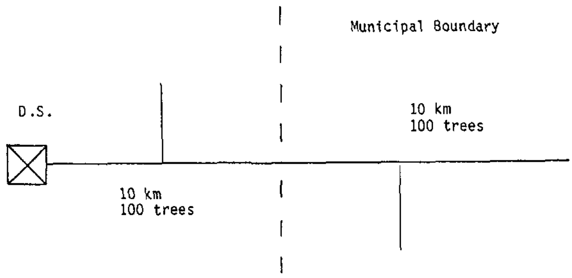

Figure 2.

regional supervisors randomly assess not only the work done (adherence to specifications) but also the actual carrying out of the work.

We can now refer to the managed system illustrated in Figure 3. The use of control factors serves to alert supervisors and managers to problems or areas requiring their attention. Solutions to identified problems may be quick and relatively simple, such as disciplining a supervisor, or they may be long term and complex, such as changing specifications or clearing cycles in response to improved system reliability. The advantages of this system are many. We believe that we will develop better control over our operations and thus can react quickly and positively to problems. The recognition that this system is dynamic will allow us to make intelligent changes when necessary, with predictable results.

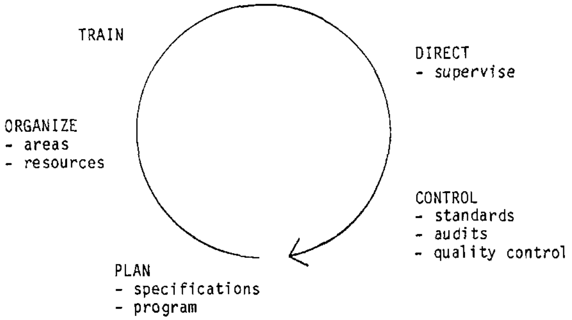

Figure 3.

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ABSTRACT

WHITCOMB, C.E. 1983. **Increasing survival rates of large trees after transplanting.** Am. Nurseryman 157(12): 79-80.

The demand for large trees following construction and grading continues to increase. In many instances, two- and three-inch-wide trees are not acceptable to clients. However, landscape contractors and nurserymen have observed that large trees transplanted with tree spades generally perform poorly. A study was conducted with *Magnolia grandiflora* (southern magnolia) to understand the stress large trees incur following transplanting. When the branch surface area is plotted proportionately to the size of a particular kind of tree (regardless of the thickness of the living cell layer), one begins to appreciate why large trees undergo more stress than smaller ones following transplanting. For example, a tree with a one-inch stem diameter has a stem surface area of living cells of 580 square inches. However, a tree with a three-inch stem diameter has a stem surface of living cells of 5,200 square inches. Consider the priority of carbohydrate distribution in a woody plant. In a rose plant in full sun, 82 percent of the carbohydrates produced went to young shoots, 13 percent went to other above-ground plant parts, and only 4.3 percent went to the roots. A three- to five-inch recently transplanted tree that has lost many of its roots will run into problems. Thus building up carbohyrate reserves in the stems and roots prior to transplanting is extremely important. And the larger the tree is, the more critical it is to build reserves to meet food demands immediately after transplanting.