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COMPUTERIZED PROGRAM FOR RIGHT OF WAY VEGETATION MANAGEMENT[1]

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Because utility rights of way create a major visual impact and in fact create permanent changes to the landscape over which they traverse, they often become one of the most highly criticized aspects of utility line construction and subsequent management. This is because we're directly affecting major natural resources of land, timber, as well as other natural resources. It has been estimated that within the United States alone, there are over 50 million acres of rights of way which is equivalent to an area of land greater in size than all six New England states combined (includes highways, railroads, power lines, telephone, and pipeline rights of way). With the magnitude of such a land base, and the total potential impact which can result from management or mismanagement of these lands, it becomes of utmost importance that management of this land base be maintained at the highest level.

A high level of management cannot be attained unless basic functions of good management are met. Without long-range planning and positive identification of management goals and objectives, efficient management is not possible. Proper R/W vegetation management implies the art of managing vegetation at the lowest long-term costs with due consideration for natural resource values as well as engineering needs.

Field inventories and good records are two basic ingredients of any successful vegetation and/or land management program. *Inadequate* field inventory data more often than not result in inefficiencies in terms of planning and overall management. Likewise, the lack of an adequate system of records also results in gross inefficiencies in achieving long-term management objectives.

With adequate basic field data, it is possible to maximize environmental quality at reasonable costs and still maintain the integrity of the power line or other utility for which the R/W is being maintained. Factors which must be considered in arriving at decisions regarding management methods and techniques to be employed on R/W systems include:

1. vegetative cover types
2. size and density of vegetation
3. accessibility
4. terrain
5. environmental factors
6. associated land uses

It has been said that the most economic control for unwanted plants is other plants. The elimination of certain plants from a plant community may modify that community favorably or unfavorably and, therefore, the totality of the existing plant communities should be taken under consideration in vegetation management activities. If this is true, it then becomes of utmost importance that those of us responsible for R/W management become aware of the various vegetative cover types which occur on our rights of way so that proper management decisions can be made which will be ecologically sound as well as economically feasible.

The use of the computer in analyzing field data and maintaining adequate records is a basic step toward the management of vegetation at the lowest long-term cost with the highest of conservation values.

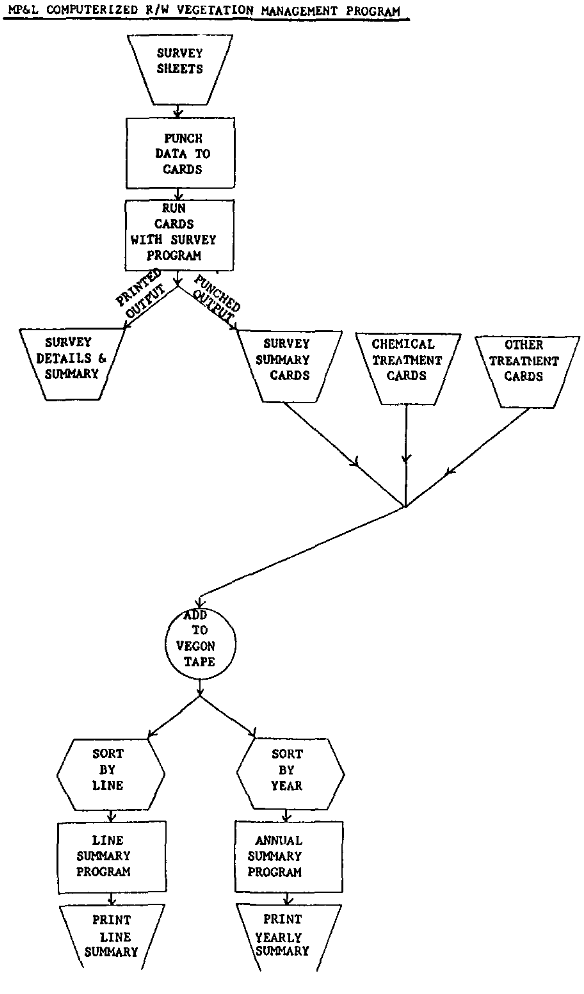
Our program of computerized R/W vegetation management evolved from an overall evaluation and review of our transmission line system including a cost analysis of maintenance work performed. We discovered that between the five years, 1968 through 1973, we had a 35% in-

[1]Presented at 51st Annual Convention of International Shade Tree Conference in Detroit, Michigan in August 1975.

crease in total line acres added to our system. This, of course, had the obvious effect of creating a substantial increase to our yearly maintenance budget. Instead of 14,000 acres of right of way, we now had approximately 22,000 acres to manage.

The need for a more sophisticated method of keeping records became evident when an attempt was made to document work accomplished on each line over a period of time. Furthermore, as the need arose to develop more detailed budget requests, it also became apparent that a more scientific approach for gathering inventory data on which to base our maintenance budgets was needed.

Figure 1.



This resulted in the development of our existing program in which we utilize our IBM 370 computer.

The program is basically outlined in the flow chart shown on Fig. 1. The basic input data consist of field inventory data and summaries of work performed, such as clearing and/or chemical treatment, etc. From these data, we derive three basic summary print-outs (1) survey details and summary, (2) line summary, and (3) yearly summary. Once the basic information has been entered on to the computer tapes, a variety of other programs can also be adapted relative to amounts of various chemical used in a given year, cost comparisons by method of treatment, as well as many other programs.

Figure 2.

Form No. 1343A
Date OCTOBER 1974

RIGHT OF WAY VEGETATION INVENTORY REPORT
MINNESOTA POWER & LIGHT COMPANY

Line No. 8 Division CENTRAL Page 1 of 1

Structure (plus ____) From	To	Span: Length	Span: Width	Tree & Brush Condition: Aspen	Balm G.	Oak	Maple	Elm	Ash	Pine	Spruce Balsam	Brush	Field	Density	Percent: Foliage	Basal	Clear	Crossing	Comments
I.E. STA	1				(DATA INCLUDED IN STR. # 1-2)														
1	2	510	150	3		3			3			2		4		80		4	
2	3	433		3	3	2						3		3		60		4	
3	4	682		3		2	2					2		3		60			D. T.
4	5	495		3		3	2					2		3		50		1	Hy. 210
5	6	430	150	3		3	2		2			3		4		80			END 15L PARALLEL
6	7	635	80	4			3				2	3		3		90			11 - 100%
7	8	525		3							2	4		3		40		1	11 - 90% (Hy. 210)
8	9	300		4							1	2		2		40		4	11 - 90%
9	10	967		4		3	3				3	3		3		60		6	11 - 50% (No Xing)
10	11	333		2			4				3	2		2		70			11 - 100%
11	12	757		3	3		3				3	2		2		80			11 - 100%
12	13	623		3	3		3				3	3		2		70			11 - 100%
13	14	340					4				1	3		3		60			11 - 100%
14	15	980		3	4	3	3				3	3		3		80		6	11 - 100%
15	16	465		3	4						3	2		3		50			11 - 100%
16	17	975	80	3	4		4				3	3		3		10		6	11 - 10%
17	18																		
18	19																		
19	20				REMAINDER OF #8 LINE IS INCLUDED WITH														
20	21					#1 - 2 & 15 LINE SURVEY													
21	22																		
22	23																		
23	24																		
24	25																		

Height: 1 - 0 - 3'; 2 - 3' - 6'; 3 - 6' - 9'; 4 - over 9'
Density: 1 - Scattered; 2 - Light; 3 - Medium; 4 - Heavy
Crossing: 1 - Primary road; 2 - Secondary road; 3 - Trail; 4 - Railroad Crossing; 5 - River; 6 - Fence
Aspen: Popple; Birch; Basswood
Field: 1 - Pasture; 2 - Cultivated; 3 - Swamp; 4 - Meadow; 5 - Plantation
Comments: DT - Danger Trees; 1 - 10 - Widen 1 side 10' - 10% of span; 11 - 10 - Widen 2 sides 10' - 10% of span

The survey detail and summary print-out is derived from field data collected on our R/W vegetation inventory report form (Fig. 2). The field data are collected on this form on a structure-by-structure basis. Vegetation is recorded by species according to height classes, i.e., 0-3 feet, 3-6 feet, 6-9 feet, and over 9 feet. Vegetation is further classified as scattered, light, medium, or heavy density, and an estimate or percentage of a particular span requiring treatment, i.e., basal or foliage spraying and/or reclearing. Other pertinent information is also gathered, such as occurrence of farm land, Christmas tree plantations, highways, river or stream crossings and other pertinent environmental data, as well as occurrence of danger trees and R/W widening requirements. Measurements of R/W widths are also made at various points where changes are evident.

Distance between structures is obtained from engineering records maintained in the office. The appropriate data from the inventory report are then placed on standard IBM cards for transfer to magnetic tapes which are then added to the data base for the line and year summaries.

The structure-by-structure field inventory report has many uses. Besides its use as the basis for input for the detailed computer summary printout, it provides the contractor with information regarding the nature and quantities of work to be accomplished on a span-by-span basis. The field survey report also provides invaluable information pertaining to R/W conditions such as location of areas where vehicle crossings are impossible, environmentally sensitive areas and actual types of vegetation to be treated by structure location. It also shows the contractor the basis on which brush acres are computed.

The field inventory report is furthermore used as a tool in arriving at decisions relating to management techniques which are employed on a given right of way. The species composition, height classes and density, for example, play an important role in prescribing method of vegetation control, i.e., cutting or spraying, and the type of chemical to be used. Another very useful aspect of this report shows the location of danger trees and R/W widening requirements (Figure 3).

Although field data are presently accomplished by an on-the-ground inspection, we are investigating the feasibility of gathering this data by use of low altitude 35mm aerial photography through a cooperative research project with the University of Minnesota, College of Forestry. Preliminary results of this technique look favorable. Providing we can obtain adequate detail in species identification and height classification, we will no doubt change to this system of gathering our basic field data. A preliminary cost analy-

Figure 3.

SURVEY OCTOBER 1974 LINE 8 CENTRAL DIVISION

STRUCTURE NUMBER	LENGTH	WIDTH	LINE ACRES	PER CENT	BRUSH ACRES	DENSITY
0001 TO 0002	510	150	1.756	80.	1.405	HEAVY
0002 TO 0003	433	150	1.491	60.	0.895	MEDIUM
0003 TO 0004	682	150	2.348	60.	1.409	MEDIUM
0004 TO 0005	495	150	1.705	50.	0.852	MEDIUM
0005 TO 0006	430	150	1.481	80.	1.185	HEAVY
0006 TO 0007	635	80	1.166	90.	1.050	MEDIUM
0007 TO 0008	525	80	0.964	40.	0.386	MEDIUM
0008 TO 0009	300	80	0.551	40.	0.220	LIGHT
0009 TO 0010	967	80	1.776	60.	1.066	MEDIUM
0010 TO 0011	333	80	0.612	70.	0.428	LIGHT
0011 TO 0012	757	80	1.390	80.	1.112	LIGHT
0012 TO 0013	623	80	1.144	70.	0.801	LIGHT
0013 TO 0014	340	80	0.624	60.	0.375	MEDIUM
0014 TO 0015	980	80	1.800	80.	1.440	MEDIUM
0015 TO 0016	465	80	0.854	50.	0.427	MEDIUM
0016 TO 0017	975	80	1.791	10.	0.179	MEDIUM
TOTALS -			21.453		13.229	

SCATTER - 0.0 LIGHT - 2.562 MEDIUM - 8.077 HEAVY - 2.590

TOTAL LENGTH IN MILES IS 1.79

sis for this type of aerial photography indicate average costs of $3.00 to $5.00 per line mile, which is approximately one half of our current costs for our on-the-ground inspections.

Line Summary (Fig. 4)

The individual line summary gives a computer print-out of all activity concerning a particular line. This information includes the line number, date of treatment, location by structure number, method and type of treatment, i.e., hand or mechanical clearing, ground foliage or basal spraying and/or aerial spraying, type of chemical used, number of acres treated, total cost and average cost per acre.

The primary value of this line summary lies in its use as a permanent reference which indicates type of treatment by year and the total number of acres treated as well as costs incurred. The summary of acres treated by respective years furthermore indicates progress or lack of progress which is being made with regards to "brush" acres treated. It furthermore shows the number of years a particular line has been under management and gives a relative measure of the effectiveness of various herbicides for controlling vegetative growth as indicated by number of brush acres.

The information from which the line summary is made is also the basis for our yearly summary report. This print-out summarizes work which has been accomplished on a year-by-year basis and indicates total number of acres treated along with total cost and cost per acre by treatment. This information becomes quite useful for budgeting purposes.

Another program which we plan to incorporate in our computer is a list of property owners by line number, legal description and structure number, where special considerations have been made for "no spraying," etc.

We have found it convenient to file this data along with other information relating to the management of individual rights of way into a multiple divider classification folder. Each folder contains six separate divisions:

1. R/W summary
2. history, including line summary computer print-out
3. maps and drawings
4. correspondence and special conditions
5. work reports
6. field survey data and computer summary print-out

We also have a yearly folder in which we maintain our yearly computerized summaries, budget information, etc.

One might ask why such detailed record systems. It can be summed up in basic environmental and economic concerns. Right-of-way maintenance costs are inversely related to the stability of plant community development, i.e., the greater the stability of the plant cover types, the lower the long-term maintenance costs (Fig. 5). This is based on the principle that shrub communities are not readily invaded by trees once

Figure 4.

MINNESOTA POWER AND LIGHT CO. 90 LINE

-VEGETATION CONTROL HISTORY-

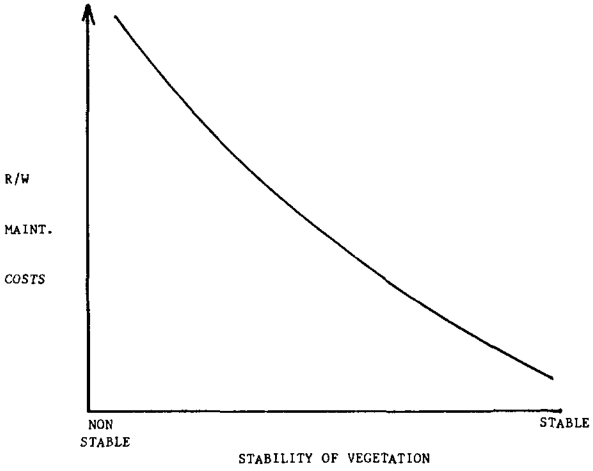
SUMMARY OF 90 LINE

LINE	DATE	STRUCTURE FROM	STRUCTURE TO	METHOD	TREATMENT	CHEMICAL USED	ACRES	COST	COST/ACRE
90	0/67	1	195	HAND & MECH	CLEAR		565	167000	295.58
90	8/68	1	195	AERIAL SPRAY	CHEMICAL	TOR 101	620	24490	39.50
90	7/72	1	195	GROUND SPRAY	CHEMICAL	TOR22K,DICAM	278	16686	60.02

SUMMARY BY TREATMENT FOR 90 LINE

TREATMENT	ACRES TREATED	TOTAL COST	COST/ACRE
CHEMICAL	898	41176	45.85
CLEAR	565	167000	295.58
SURVEY	0	0	0.0
EVALUATE	0	0	0.0

Figure 5.



the original component of trees are removed, i.e., they become more stable. In order to attain maximum potential benefit of natural vegetative plant communities on right-of-way systems, it is vitally important to have adequate information pertaining to vegetative cover types so that management decisions can be made which are both economically feasible as well as ecologically sound. Furthermore, an adequate system of records pertaining to R/W vegetation management is likewise essential in order to efficiently achieve long-term management objectives.

Minnesota Light and Power Company
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ABSTRACTS

Cannon, W.N. Jr., and D.P. Worley. 1976. **Dutch elm disease control: performance and costs.** USDA Forest Service Research Paper NE 345, NE Forest Expt. Station, Upper Darby, Pa.

Saving the elms has been a community goal in many of our cities and towns. Some communities are meeting that goal; some are holding their own; some have failed. In many areas highly-valued American elm trees have been virtually eliminated by Dutch elm disease. The methods of disease control have been aimed at blocking the transmission of the fungus to healthy elms by elm bark beetles and through root grafts between diseased and healthy elms. Municipal programs to suppress Dutch elm disease have had highly variable results. Performance as measured by tree mortality was unrelated to control strategies. Costs for control programs were 37 to 76 percent less than costs without control programs in the 15-year time-span of the study. Only those municipalities that conducted a high-performance program could be expected to retain 75 percent of their elms for more than 20 to 25 years. Communities that experienced the fewest elm losses had a well founded program, applied it conscientiously, and sustained their efforts over the years.

Gibbs, J.N. and J. Dickinson. 1975. **Fungicide injection for the control of Dutch elm disease.** Forestry 48(2):165-176.

In the last few years much research has been conducted in Britain and North America on the injection of soluble formulations based on benomyl and its breakdown product carbendazim (MBC) for the control of Dutch elm disease caused by *Ceratocystis ulmi.* The superiority of the benzimidazole fungicides, and in particular of carbendazim (MBC), over other fungicides was shown by injection experiments on both artificially inoculated and naturally infected young elm. With carbendazim the degree of control depended in great measure on the formulation, and some evidence was obtained that the commercial formulation of carbendazim hydrochloride (Lignasan) produced in 1974 was less effective than an experimental formulation of the same chemical. Benefits from injection with Lignasan were most marked on trees below 25 m in height. The effect of various factors such as time of day, season, weather conditions and tree size on the rate of fungicide uptake are considered.