

COMPOSITION AND INCIDENT OF ROADSIDE LITTER
IN THE MEDICINE BOW MOUNTAINS, WYOMING
Mark L. Mason

Prior to the establishment of a litter survey or control program, it is useful to estimate the density and composition of existing litter and the rate at which it accumulates. Litter composition and accumulation rates were established on both roadside plots and truck turnouts in the Medicine Bow Mountains of Wyoming. The study revealed that the litter composition at truck turnouts was different from that along the roadside; litter density decreased linearly with distance from a human settlement; highest litter accumulations occurred during the highest traffic volumes; and maintained areas had significantly lower litter accumulation rates; there were approximately three times more pop-top tabs than aluminum containers. Variables affecting study plot location were (a) locations vulnerable to wind, (b) higher elevations with early and late season snow cover, (c) distance from a human settlement, and (d) high-use recreation areas.

Preliminary studies also provide time-travel factors that allow management to design litter survey or control programs. Some of the factors that were found to affect plots/day/team were (a) quantity of litter on plot; (b) plot size; (c) counting versus counting and collecting litter; (d) distance between plots; (e) vegetation density, height, and type; (f) road width; (g) slope of roadside; and (h) available vehicle and manpower. Management considerations for litter studies should focus on a flexible statistical design to contend with missing data and adjusted sampling dates.

Since litter control programs are subject to budget limitations, litter collection crews may be best used after peak litter accumulation periods. If most managed areas do in fact receive substantially lower litter accumulation rates, then it may be to the taxpayers' advantage to have roadside vegetation managed to conceal litter.

INTEGRATED VEGETATION MANAGEMENT ON
LOS ANGELES COUNTY ROADS
Martin Pruett

Since the advent in the late 1940s of modern hormone-type herbicides, we have seen highway mileage increase to nearly 4 million miles. A major part of this growth has been in the form of high-speed turnpikes, the Interstate system, as well as extensive improvements and upgrading of state and county highways. This tremendous mileage growth along with increasing travel speeds and a more sensitive public eye have placed great demands on the shoulders of the landscape architect and the highway maintenance engineer.

The County of Los Angeles is one of extremes, and there is a variety of climatic and geographical conditions. On the coastal plain near the ocean, the vegetation grows year-round. In the nearby mountains, the weeds grow very fast in the late winter and spring due to the heavy rains and warm weather. In the desert area, the rainfall is relatively light and the growth of weeds is not as great as in the coastal areas.

The County is divided into road divisions, and we have 28 crews that use five 100-gal and ten 500-gal spray rigs. For special problems like tumble weed, we have three grinders that reduce the tumble weed

hauling to 1/10 of what it used to be.

We continue to use nearly every implement that has ever been developed to control vegetation and are experimenting through the Agricultural Commission with several types of biological control. Our Agricultural Commission provides a training officer for our spray crews each year to fulfill legal requirements.

On some stands of Russian thistle, we have released a moth that tunnels in the stem of the plant. The impact of this insect is not yet clear. We have noticed a build-up of larva and heavy tunneling and what we thought were dead and dying plants, but we are having trouble relating the amount of insect damage to the actual harm to the plant. We should know in a few years just what value it might have. We have also been experimenting with a weevil for the control of puncture vine. In years of good rainfall and good plant growth conditions, weevils sometimes cannot suppress plants and then outbreaks of puncture vine occur. However, the weevils catch up later and suppress the plant growth. The objectives of the roadside maintenance program are to control unwanted growth along the roadsides, to reduce roadside fires, to eliminate the unsightly appearance of unwanted growth, to prevent pavement breakage from plant roots, and to improve visibility for greater driver safety and to improve drainage.

Areas to be kept free of vegetation range from 18 in to 14 ft wide along the road shoulders. Clear visibility is important for vehicle safety and vegetation control and is an important fire protection measure.

In prior years, the County either denuded the system through mechanical means or a surface application of oil; however, increasing costs have led to the adoption of longer-lasting chemical treatments. The use of the highly efficient herbicides in roadside vegetation control has greatly reduced our time commitment to this discipline. The chemicals used in the past season include Hyvar X and Korvar I in the coastal plains. Lorox was used in areas requiring short-term control, Fenamine used for Russian thistle control, Princep 80 used in the mountain areas near pine trees, and Phytar 560 used for spot treatment in the spring. Economics is a key reason for the use of chemicals in a vegetation control program. The development of herbicides has made it possible for many maintenance units to virtually eliminate hand cutting of brush and weeds. Weed-free highway rights-of-way can be an important part of any district's good neighbor policy.

PENNSYLVANIA'S ROADSIDE MANAGEMENT PROGRAM
Robert Ross

In Pennsylvania, we think of the state's 90 000 miles of roadside as the front yard for its 12 000 000 residents and the untold millions who travel through the Keystone state to other points in the Northeast. However, there is no attempt to maintain these yards in the manner normally attributed to yard or lawn type maintenance as highways are commercial arteries and the roadside treatment must be attuned to this priority with roadside amenities managed as a secondary consideration.

The Pennsylvania roadside management program is fundamentally based on the two ingredients common to most highway problems, i.e., need and resources. An individual, educated in the biological sciences, is employed in each of the 11 engineering districts.

The state roadside programs are formulated in Harrisburg's central office and implemented at the district levels with modification to suit local needs as dictated by population, traffic, terrain, and other environmental factors. The district roadside unit is involved in all facets of design, construction, and maintenance that relate to the roadside and its environment. In this capacity, roadside slopes and soil areas can be designed, graded, rounded, finished, and vegetatively treated to yield the best finished product with maintenance in mind. In many cases, the pre-design public hearings commit the department to specific practices that, if not performed in concert with the project construction, would possibly be delayed indefinitely due to subsequent lack of funds, traffic congestion, political changes, and many other factors. Through this complete-project concept, all construction projects throughout the state, regardless of location, financing, or systems classification are given comprehensive consideration and treatment.

The 14 specific herbicide materials purchased on an annual basis have played a major role since the early 1950s. Roadside vegetation management along the 1200-mile Interstate Highway System and limited access highways has been centered around the culture of the legume-Crownvetch. These plantings have been virtually maintenance free for 20 years as the legume is self-feeding; controls erosion; smothers most weeds, litter, and volunteer trees; and provides both attractive bloom and foliage. Along older sections of these two classes of highway, vegetation succession is taking place to a climax forest ecology. In the lower-class roads, which constitute the larger percentage of the state's highway system, the climax vegetation is established and management of its encroachment through trimming, removal, and the use of herbicides continues.

Currently, we expend more than \$4 million annually on brushing, trimming, and tree removal in an effort to keep highways open for vehicular traffic, and these costs keep increasing as the emphasis on natural regeneration, reduced mowing, reduced herbicide use, and inflation continues. In order to combat increasing costs, we evaluated the technique of helicopter herbicide application for Canadian thistle control along several sections of Interstate and limited access highway in May and June 1979. We will be evaluating this technique of application for tree and brush control by using Krenite in late August. To date, this technique is very efficient and appears to offer a new dimension in the management of roadside vegetation.

CHEMICAL ROADSIDE VEGETATION MANAGEMENT PROGRAM
IN NORTH CAROLINA
W.D. Johnson

The North Carolina Department of Transportation's Landscape Unit has developed a very progressive herbicide and growth regulator program in an effort to facilitate the control of vegetation along our roadsides and reduce the hand labor and machine operations that would otherwise be necessary to properly control the vegetation. The main operations that are parts of this herbicide growth regular program are briefly described here.

There is a great savings potential in the cost of routine mowing through the use of growth regulators. The control of broadleaf weeds must also be included when attempting to control the rate of growth of grasses. Savings from this program range from approximately \$25 to \$40/acre/growing season.

In 1980, approximately 14 000 acres were treated and we estimated potential savings of \$560 000 by the reduction in the number of routine mowings. Generally, we hope that more than 50 percent of the area only will be mowed one time with the remaining parts possibly requiring two mowings. The normal number of mowings without treatment is 5-6 per season. We have used MH-30 and Embark as the two growth control agents with spring application and some limited fall application. The MH treatment is the only one that we have used that will allow for season-long control with just the fall cleanup mowing. Embark has shown excellent results when combined with a spring mowing after application and then, of course, the fall cleanup mowing. Also, 2,4-D is applied with either MH or Embark in a spring application for broadleaf weed control. In some instances, it is necessary to follow up in early June with another weed control spraying; however, we are attempting to go through the season with only the fall cleanup mowing. We have gotten excellent results from a 2,4-D-MCPP-Dicamba mixture for this follow-up spraying.

Over the years, we have used a large number of products in an attempt to control the vegetation under guardrails, as the specialized mowing and maintenance of vegetation would otherwise be very expensive. We have now begun to shy away from some of the long-term residual herbicides. Our current program involves a Roundup-Surflan or Roundup-Simazine treatment or a combination of these two preemergence herbicides with Roundup.

It seems obvious that various herbicides would provide significant savings over hand labor to remove vegetation that has grown into the joints of concrete-capped islands or through asphalt islands. We use residual type herbicides such as Spike or Pramitol under many of the asphalt islands and use a Roundup-Spike treatment normally for vegetation that has broken through if runoff is not a problem. One of the most effective treatments that we have used on concrete islands is to clean out the existing vegetation and blow out the joints with air pressure and then repour the joints with liquid asphalt containing Primitol 25E. At this point in time, we do not know how long this protection will last.

Brush control is important adjacent to bridges so that larger trees do not grow and affect the structure itself. The main brush control agent now being used is Krenite and we have found that the no-brownout characteristic is very beneficial. We also chemically prune limbs with this product. We are now beginning to use Garlon and a mixture of 2,4-D-MCPP-Dicamba on brush.

Vines and brush are the main problems along right-of-way fence lines that are visible to the highway. Krenite has worked well in controlling trumpet creeper and other vines and brush in this area. We are now experimenting with some Banvel pellets in areas not adjacent to wood lines.

As a clean out for existing vegetation, we have found no equal to Roundup. We are using Treflan 5G, Caseron 4G, and, in some cases, Surflan as preemergence treatments.

In portions of North Carolina, the Bermuda grass grows well, and we use Roundup to control this aggressive grass to prevent the failure of asphalt pavements. We have also used some Spike treatments placed immediately before the paving operation.

To control the vegetative growth around signs, delineators, and other stationary objects, we have used Pramitol 5PS and Spike 5G pellets. Runoff can cause serious problems when an excessive amount of pellets is placed on areas with any kind of slope.

Roundup is our main product for control of Johnsongrass. Asulox appears to have some potential for the control of Johnsongrass, particularly where