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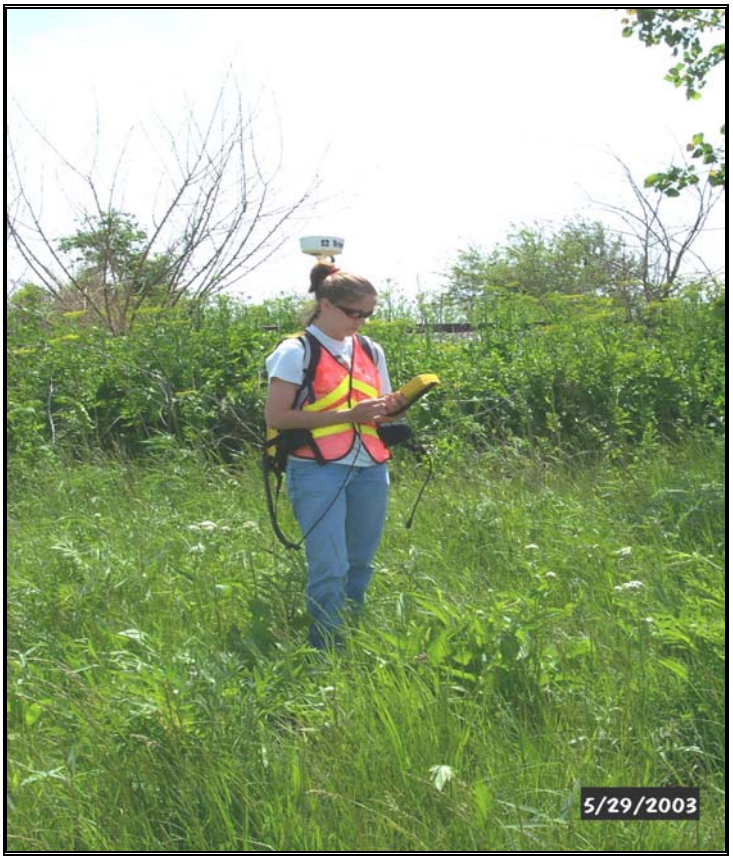
DEVELOPMENT AND IMPLEMENTATION OF AN ENVIRONMENTAL ROADSIDE INVENTORY

Phase 1 – Native Prairie Remnants
Phase 2 – Roadway Features



DEVELOPMENT AND IMPLEMENTATION OF AN ENVIRONMENTAL ROADSIDE INVENTORY – RI01-007 STATUS REPORT

January 2004

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Objective: Develop an environmental roadside inventory (using GPS and GIS technologies) that will be incorporated into the district roadside management plan. A spatially accurate roadside vegetation inventory will be created through GPS data recording along a 36-mile section of Route 36. Special emphasis will be placed on environmentally sensitive areas within MoDOT rights-of-way in order to develop a more comprehensive and responsible roadside vegetation management plan for District 3. This information will be incorporated into a GIS system and will then be used to develop mowing, herbicide and vegetation management strategies for the corridor. The resulting database will also prove valuable for identifying and managing possible environmental impacts associated with route improvements in the future.

The techniques, data, and implementation experiences resulting from this project will be shared with roadside managers across the state. Other districts can then benefit from the experiences in District 3 in establishing their GIS-based roadside vegetative management strategies.

Methods and Results:

The summer of 2001 was spent identifying plant species as well as learning how to use the hardware and software applications. Although some experimentation with the mapping of individual plants and patches of species was conducted, our focus was largely on mapping the boundaries of prairie remnants within the study corridor. Although the prairie remnants throughout the corridor were once part of a larger, unbroken tract of pre-settlement prairie, some differences in species composition were apparent within different areas of the remnants. In order to make broad comparisons of species composition within the remnants, we decided to divide up them into 200 feet sections or quarter mile sections. We used two different sizes of sections in order to compare the functionality of the two methods. By late August 2001 all prairie remnants within the study corridor were identified and their boundaries mapped. These data were then incorporated into a GIS and the remnants were projected onto a Digital Ortho Quarter-Quadrangle (DOQQ) base

map. Based on this, we determined that there are 50 acres of prairie remnant within the study corridor.

During December 2001, we were able to re-hire our intern that had worked on the project during the previous summer. A two-week period was spent organizing the data that had been collected during the summer, and plans were made for data collection beginning in May 2002.

Individual plants and patches of species were mapped within the prairie remnants beginning in May 2002 and continuing into August 2002. Species that were mapped were chosen based on their relevance to roadside managers. All plants were mapped during their blooming season in order to ease identification in the field. Twenty-six native prairie forb species and two non-native noxious weed species were identified and mapped within the project corridor (Table 1). Plants were mapped as either individual points in cases where a single plant was present, or as polygons where large patches occurred. Each plant within the patch was counted and the number recorded in the database. Additional data such as the number of plants blooming or not blooming, evidence of digging, or herbicide damage was sometimes collected. This data collection resulted in the mapping of over 33,000 plants as either individuals or members of a patch. Those numbers include 222 individual plants of the Prairie Hyacinth (*Camassia angusta*), a plant listed as rare and uncommon in the state of Missouri. This data is being provided to the Missouri Department of Conservation. Other plants of interest discovered during data collection included a naturally occurring hybrid between the Downy Gentian (*Gentiana puberulenta*) and the Bottle Gentian (*Gentiana andrewsii*) that had not previously been observed in Missouri.

In addition to the mapping of individual plants and patches of species, in instances where a species was so common throughout a section of remnant that it could not be easily mapped, we recorded that species as a "predominant blooming species" for that section of remnant. These data were collected for each remnant section three times during the summer of 2002: mid-June, mid-July, and mid-August. These data were kept in separate databases "hot-linked" to each section of remnant within the GIS. By selecting a remnant section in the GIS, the associated database with the predominant blooming species data could be viewed. Combining these data with the species actually mapped gives a good picture of what the species composition is within any section of prairie remnant throughout the corridor.

Table 1: Species Mapped During Summer 2002

Date	Species	Scientific Name	# of Plants
5/23 & 28	Cream wild indigo	*Baptisia bracteata*	21
5/29	Indigo bush	*Amorpha fruticosa*	209
6/3	New Jersey tea	*Ceanothus americanus*	77
6/5-6	Foxglove beard tongue	*Penstemon digitalis*	605
6/6	Moth mullein	*Verbascum blattaria*	57
6/10-12	Pale purple coneflower	*Echinacea pallida*	3293
6/10, 18-20	White wild indigo	*Baptisia alba*	48
6/13	Prairie alum root	*Heuchera richardsonii*	245
6/18-20	Prairie hyacinth	*Camassia angusta*	222
6/20	Sneezeweed	*Helenium amarum*	-----
6/20	Purple meadow rue	*Thalictrum dasycarpum*	800
7/1	Butterfly milkweed	*Asclepias tuberosa*	218
7/2	Black-eyed Susan	*Rudbeckia hirta*	473
7/8-10	Gray-headed coneflower	*Ratibida pinnata*	2352
7/11-16	White prairie clover	*Dalea candida*	1305
7/11-16	Purple prairie clover	*Dalea purpurea*	485
7/15-23	Rattlesnake master	*Eryngium yuccifolium*	3880

Table 1 continued

Date	Species	Scientific Name	# of Plants
7/15-23	Culver's root	*Veronicastrum virginicum*	3403
7/15-24	Rosinweed	*Silphium integrifolium*	9003
7/24	Swamp milkweed	*Asclepias incarnata*	200
7/25-31	Prairie blazing star	*Liatris pycnostachya*	1930
7/31-8/8	Blue vervain	*Verbena hastata*	2805
7/31-8/7	False sunflower	*Heliopsis helianthoides*	449
7/31-8/7	Wild bergamot	*Monarda fistulosa*	105
8/6-8	Showy tick trefoil	*Desmodium canadense*	761
8/6	Winged loosestrife	*Lythrum alatum*	13
6/3-5	Multiflora rose (I)	*Rosa multiflora*	143
6/12	Musk thistle (I)	*Carduus nutans*	19

Total Plants Mapped —33,121

(I) - Non-Native Noxious Weed

Methods and Results (cont.)

The summer of 2003 was spent mapping selected native prairie species, mapping noxious weed populations in various locations throughout the district, and assisting General Headquarters Roadside Operations staff with mapping of areas throughout the state that are to be converted to wildflower and native grass plantings with the help of the Missouri Department of Conservation. We also began work on mapping maintenance assets (signs, culverts, guardrails, etc.) within the project corridor in order to study the feasibility of tracking these with GPS/GIS technology. Table 2 shows the species that were selected for mapping in 2003. Most species, with the exception of wild quinine, were species mapped in 2002. Table 3 compares 2002 populations with those of 2003. The numbers indicate that either the populations of most plants increased from 2002 to 2003, or more individual plants were blooming or discovered in 2003. Many more individual plants of prairie hyacinth were discovered and these data will again be provided to MDC.

Noxious weed populations were mapped on highway 61 in Ralls, Pike and Lincoln counties, and along highway 36 within the project corridor. Three species of noxious weeds – musk thistle, common teasel, and cut-leaved teasel – were focused upon. Although we had also mapped multiflora rose (another noxious weed) throughout the project corridor, populations of this species were scattered and usually consisted of individual plants whereas the thistle and teasels were often found in large patches that were difficult to count. Thus, we decided to treat them separately and keep track of them separately. This also makes sense from an application standpoint since control measures for these two groups of plants would most likely differ. Spraying operations to control multiflora rose would most likely consist of low volume spot treatments of herbicides whereas control measures for the thistles and teasels often require broadcast equipment or much larger volume spot treatments. Table 4 shows the population size of these species not in actual numbers, but rather in square meters and acres. Additionally, within the GIS, teasel patches are classified as scattered, medium, or high in regards to their density. Thus, we can keep track of the relative abundance of these plants within a patch after control measures have taken place and we can assess the effectiveness of a given control measure. Plans are underway to add control measures and the dates that they took place to the GIS.

Roadside Operations staff at General Headquarters requested our assistance with mapping areas throughout the state that are to be converted to wildflower and native grass plantings with the help of MDC. This is a $1 million federal enhancement fund project. Table 5 shows the areas and acreages that were mapped. Our staff provided this information, along

with maps, to MDC for inclusion in bid packets being sent to contractors wishing to bid on the project.

Our intent at the beginning of the summer was to split efforts between mapping plants (prairie species and noxious weeds) and mapping maintenance assets. In order to do this, we doubled our personnel devoted to the project and purchased another GPS unit. However, problems with the new unit, training of new personnel, and unexpected problems within the work unit slowed down our progress with the maintenance asset portion of the project. We were able to map the assets of interest to us within a small section of the corridor and display them in a GIS, but development has not proceeded further. We would like to continue with this aspect of the project as we feel that it has great potential for asset management in the field.

Table 2: Species Mapped During 2003

DATE	SPECIES	SCIENTIFIC NAME	# OF PLANTS
05/22	Cream wild indigo	*Baptisia bracteata*	47
05/29-06/04	Wild quinine	*Parthenium integrifolium*	1,054
06/09-16	Pale purple coneflower	*Echinacea pallida*	18,580
06/04-17	Prairie hyacinth	*Camassia angusta*	4,559
06/24	Butterfly milkweed	*Asclepias tuberosa*	92
08/04	Prairie blazing star	*Liatris pycnostachya*	2,482
	Multiflora Rose (I)	*Rosa multiflora*	185

Total Plants Mapped – 26,814
(I) – Non-native Noxious Weed

Table 3: Comparison of Populations of Plants in 2002 and 2003

SPECIES	2002 Population	2003 Population
Prairie Hyacinth	222	4,559
Pale purple coneflower	3,293	18,580
Butterfly milkweed	218	92
Cream wild indigo	21	47
Prairie Blazing Star	1,930	2,482
Multiflora Rose (I)	143	185

(I) – Non-native Noxious Weed

Table 4: Noxious Weed Species Mapped in 2003

SPECIES	SQUARE METERS	ACRES
Common Teasel (HWY 61)	16,664	4.1
Cut-Leaved Teasel (HWY 61)	18,418	4.6
Cut-Leaved Teasel (Rt. 36)	12,863	3.2
Musk Thistle (HWY 61)	8,677	2.14
Musk Thistle (Rt. 36)	1,658	0.41

Total Area of Noxious Weeds Mapped: 58,280 square meters 14.45 acres

Table 5: Areas to be Converted to Natives

LOCATION	**ACREAGE**
Independence, MO	61.64
Kingdom City, MO	46.27
Lamar, MO	32.38
Bethany, MO	45.34

Total Acreage: 185.63

Future Plans:

Much progress has been made in developing an environmental roadside inventory, but much remains to be done. Additional data needs to be collected in order to make the database both more complete, and more functional. We would like to continue mapping and collecting data about additional species as well as re-mapping the sampling of the species. This will allow us to continue to see trends in the populations of these species to help determine if our vegetation management practices are encouraging the preservation and establishment of desirable native species and if our efforts to eradicate non-native noxious weeds are effective. We are still working with staff in the Planning Division at General Headquarters to

convert data collected in the field as a result of this project into a format that can be incorporated into the computer system of a GPS-equipped herbicide applicator truck to see if the operator of the truck will be prompted when coming into the vicinity of both desirable species and target species. If data such as these can be used in this manner, herbicide applications can become more accurate and targeted resulting in less use and the saving of money. However, we continue to be plagued with software incompatibility problems and overcoming these obstacles does not look hopeful. We are focusing on converting our data over to the new Arc8 technology that may solve some of these problems as well as give us new insight in how to proceed with the maintenance asset portion of the project.

We still plan to develop a training manual and meeting with the roadside and maintenance staff from other districts to help them incorporate these methods into their own programs. Due to lack of funding, other districts have been reluctant to start programs of their own. As the funding outlook within MoDOT improves, it is my hope that other districts will begin their own GPS/GIS programs.

Presentations and Publications:

This study has continued to receive attention from the public and from within MoDOT. The following is a list of presentations and publications that are the result of this research problem:

"Using Spatially Oriented Databases as a Tool to Manage Roadside Prairie Remnants" Chris Shulse, Ashli Houchins, Theresa Wren, Stacy Armstrong. Proceedings of the 18th North American Prairie Conference. In Press. Presentation given at national conference June 2002. Manuscript is in press and should be ready early spring 2004.

"Hybridization of *Gentiana* in the Tallgrass Prairie" Ashli Houchins. Senior Research paper and presentation, Culver-Stockton College, Canton, Missouri.

"Roadside Vegetation Management Using GPS and GIS Technology." Chris Shulse. Presentation and Paper given at Missouri GIS Conference and Highway Engineering Convention in March 2003.

In addition to the above, this project has been the subject of a local newspaper article, a state-wide Adopt-A-Highway newsletter, a couple of statewide transportation research newsletters, and a picture of our personnel using the GPS equipment has been included on the MoDOT intranet homepage.