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RESEARCH BULLETIN

NDOT RESEARCH IN PROGRESS:

MAPPING ECOSYSTEMS ALONG NEVADA HIGHWAYS

As part of NDOT's effort to develop highway landscape and aesthetics policies, a research project, conducted by Dr. Paul Tueller at the University of Nevada, is under way to inventory the major plant communities and general soil classification units along the various highways across the state and to recommend the best management practices for vegetation remediation based on the appropriate ecosystems and soil types. A number of considerations go into the development of specifications for the re-vegetation of disturbed areas. Among these are the following: species selection/species mixtures; seeding procedures; irrigation; fertilization; and erosion control.

To determine the most appropriate and successful species for use on any highway rights-of-way, emphasis will be given to indigenous, long-lived plants, including perennial grasses, herbs, and shrubs. Emphasis will also be given to species that can be established with little or no maintenance by NDOT over the long term and can create defensible space for wildfire along the highway corridors. Species selected for remediation purposes will be evaluated for drought tolerance, minimum annual rainfall needs, salt and alkali tolerance, seedling vigor, growth habit, suitable soil groups, seeding rates, PLS (Pure Live Seed), availability, and general costs of native seed sources. Some possible seeding procedures include drilling or broadcast dispersal, placing greenhouse grown materials onto the areas of concern, container grown plant species, mycorrhizal inoculants, site preparation such as mulching or hydro-mulching, and supplemental irrigation to facilitate initial

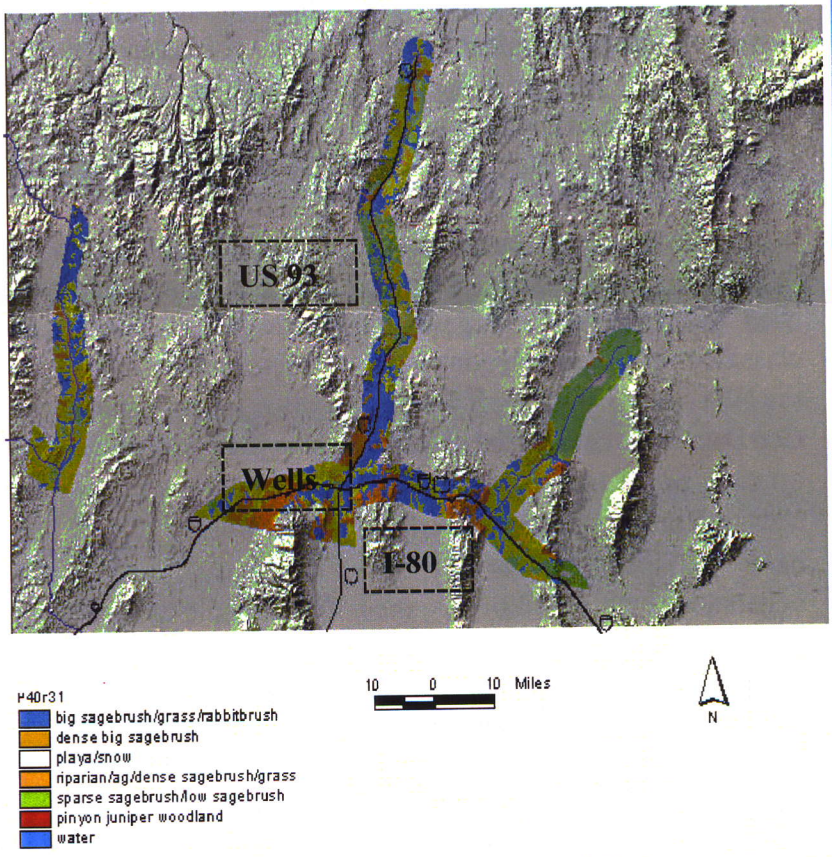


Figure 1

In This Issue

establishment. Specifically, drip systems or a sprinkler system could be used for initial establishment of plant species. Other irrigation options include a portable 1 to 2 acre drip system that could be moved from site to site as areas are re-vegetated. Some sites, such as disturbed areas deficient in nitrogen or phosphorous, may require certain soil amendments to assure seeding success. Additive nutrient selection is based on the nutrient deficiencies of a site and the ability of a plant to utilize the additional nutrients.

Vegetation maps along with NRCS (Natural Resources Conservation Service) soils data will assist in determining the best vegetation for remediation purposes. A five-mile buffer along each highway was clipped to Landsat 7 Thematic Mapper Images of Nevada. These provide a first cut analysis of the general kinds of dominant plant communities found along the highways in Nevada. Field data was acquired by driving all highways with frequent stops primarily at mile markers to document the dominant vegetation. These data are being used to develop the vegetation classifications. Soil polygons from the NRCS SSURGO (Soil Survey Geo Data Base) data will be overlaid on each set of images to provide additional information upon which to base the specifications for re-vegetation. In addition, the researchers are recording the location of invasive and noxious weeds and recording vegetation types known to offer high fire hazard.

The clipped landsat images were classified to create vegetation maps with dominant vegetation types. An example of a classification north of Wells, NV is shown In Figure 1. The vegetation map is overlaid onto USGS digital elevation map.

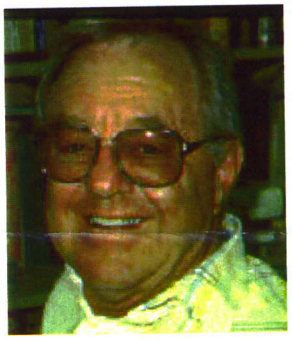
A preliminary re-vegetation specification was created for the Elko and Wells, NV areas. The site is dominated with big sagebrush with a number of perennial grasses. Big sagebrush soils are often deep and relatively dark although they usually have little organic matter. The precipitation at the site is approximately 12" annually in the form of snow in winter and early spring. The goal is to place vegetation on a disturbed site that will compete with noxious weeds, control erosion, have low fire hazard, not unduly attract wildlife, and be aesthetically pleasing. Researchers have listed a preliminary set of procedures or specifications that could be used on such a site. For instance, the proposed species mixture includes:

Pseudoroegneria spicata- blue bunch wheatgrass
Leymus cinereus-basin wildrye
Poa secunda-Sandberg bluegrass
Melilotus officinalis-yellow sweet clover
Sanguisorba minor-small burnet
Linum lewisii- prairie flax
Artemisia tridentata-big sagebrush
Chrysothamnus nauseosus-rubber rabbitbrush

An example of seeding procedures:

1. Shape site to slopes no steeper than 3 to 1.
2. Possibly replace topsoil.
3. Drill at .5739 pounds per thousand square feet. Additional soil preparation such as disking may be required.
4. Mulch 68.88 pounds per thousand square feet of straw material that is tacked to the ground with jute netting.
5. Possibly add an appropriate NPK (Nitrogen, Phosphorous, Potassium) fertilizer and mycorrhizal inoculants to facilitate growth and establishment.

These are the preliminary steps taken to write a re-vegetation specification for highway remediation projects. Currently, vegetation maps in other parts of the state are being created to assist with creating specifications. The final product will be a compilation of digital vegetation maps and best management practices for every dominant vegetation type in Nevada.



Dr. Paul Tueller, a professor of Range Ecology at UNR for over 35 years, works on various aspects of vegetation and soils on Nevada Range Lands.

Product Evaluation Committee (PEC) Meeting Recap

FIELD TEST PROCEDURES

As stated in chapter 2 of the NDOT Research Manual, products that cannot be accepted under current specifications, and have not been adequately field tested by other state DOTs or national testing organizations, may require evaluation under in-service conditions. The latest revision to the Research Manual includes a new approach to field-testing procedures. This approach offers opportunity to the affected divisions/districts to conduct some types of field tests at their discretion without the PEC being involved at the initial state of product evaluation. Three types of field-testing are now considered for product evaluations: 1) formal field-testing; 2) a trial installation; and 3) a product demonstration.

Formal field testing involves product systems, or product lines such as protective coatings or bridge deck overlay systems. Products and/or materials needing this type of testing are placed as experimental features within construction contracts and may result in the formation of test decks to determine their performance and durability under in-service conditions. Upon completion of the field test, the Research Division makes a final recommendation to the PEC through the submittal of a comprehensive final report detailing proposed specifications and acceptance criteria if applicable.

In cases where long-term performance (durability) is not an issue, e.g., a pre-engineered/tested structures-related product, a field test may consist of **a trial installation**. In such cases, the primary issue is the constructability of the product, or the design process leading to the bid process. In most of these instances, the product is incorporated into a construction contract after the criteria to be evaluated is determined by the affected division.

In some cases, a district or division may wish to have a production **demonstration** to determine operating and/or functional characteristics under local conditions. Usually the type of product being evaluated will be a single product, e.g., a raised pavement marker. This is the least formal type of field test, yet requires documentation in the form of a work plan. NDOT maintenance personnel generally complete the installation and the test section is evaluated based on established criteria. Any resulting action such as specification revision or QPL establishment must be acted on by the PEC and concurred with by the Deputy Director.

Armorflex mats installation with lifting beam

APPROVED

Cellular Erosion Control Mats

Based on a recommendation by the Hydraulics Engineering section, the PEC approved specifications and an initial general QPL for cellular erosion control mats. The cellular erosion control mats are specified in subsection 610.03.04 of NDOT Standard Specifications.

Cellular mats, or articulated concrete block revetment systems (ACB's), provide a flexible alternative to riprap, gabions and rigid revetments. These systems consist of preformed units, which interlock, are held together by steel rods or cables, or abut together to form a continuous blanket or mat to produce an erosion resistant

lining. ACB's are organized into classes based on sustaining a minimum permissible shear stress. As stated in FHWA HEC-23, failure of a system is defined as the "loss of contact between an articulating concrete block system and the subgrade soil." Applications for cellular mats include bank line, abutment revetment, channel bed armor and pier scour protection.

Since 1996, manufacturers of various ACB's have requested that NDOT evaluate and approve their systems for use on NDOT projects. In the past, hydraulic engineers used these systems on a case-by-case basis based on available information and the specific requirements of their projects. Recently, Hydraulics explored baseline characteristics of various cellular erosion control mats and developed minimum specification requirements and a general QPL. Currently, this QPL encompasses two already known and used cellular erosion control mats from Petraflex and Armortec. Cellular erosion control mats listed in the general QPL will be selected by the designer based on specific project criteria.

RD&T Program

Questions and Answers about the NDOT R, D&T Program

In the previous issue of our newsletter (Summer, 2001), we answered questions regarding research ideas, research problem statements and the department's statement evaluation process. The following are answers to questions with respect to research proposal evaluation and project management processes.

1) What are the requirements for a research proposal?

In March of each year the Research Division issues requests for proposals (RFPs) to prospective researchers based on prioritization results from the research problem statements. Proposals are due on the date specified on the RFP, usually around the first of May and should contain the following elements:

A) title; B) principal investigator; C) problem statement; D) background summary/literature review; E) proposed research; F) anticipated benefits; G) products and implementation plan; H) duration/schedule; I) facilities; J) budget; and K) NDOT involvement (other divisions).

2) What is the process for selecting and approving a research proposal?

After research proposals are received and reviewed for completeness, the Research Division will send prioritization ballots to the Research Advisory Committee (RAC) members. They prioritize each proposal based on the established criteria and send the ballots back to Research for compilation. The results are then presented at the RAC meeting as a starting point for discussion of project priorities. By means of consensus, the RAC establishes a prioritized list of projects. The recommended list, along with the minutes of the RAC meeting, is then submitted to the Research Management Committee (RMC) for their review and approval. The RMC will make the final decision as to which research activities will be included in the Annual R, D&T Work Program. Once the Work Program is finalized, the Research Division will submit the planned work to the local FHWA office for final program funding approval.

3) What are the prioritizati criteria?

The proposed research studies are generally prioritized based on the following criteria: A) addresses a critical need; B) strong commitment for the proposed research by the affected division/district; C) results of the literature search; D) high probability for success and implementation within a usable time frame; E) adequacy of research staff and facilities; and F) proposal submitter's record of past performance for NDOT.

4) How is an active research project managed?

Besides the Research Division, technical panels are established to manage active research projects. They are composed of, as a minimum, the principal investigator, the affected division representative, a Researc Division representative and a representative from the FHWA Division Office. The duties and responsibilities of the technical panel including the following: A) finalize the project scope of work and set the project budget; B) monitor the project's progress as compared to the proposed scope of work; C) provide technical guidance; D) review quarterly progress reports, interim reports and the final report; and E) make a recommendation for implementation.