GRASSLANDS

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RESEARCH REPORTS

NARROW GRASS HEDGES AS A CONSERVATION TOOL FOR EROSION CONTROL IN AGRICULTURAL AREAS

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ABSTRACT

Soil erosion is a major concern in agricultural areas around the world. Many methods have been used to reduce or slow soil loss from agricultural fields, especially erosion from areas of concentrated flow channels. Narrow, stiff grass hedges have been used to slow runoff and reduce soil loss caused by concentrated flow erosion in many countries. However, few quantitative data are available concerning the effectiveness of such hedges in controlling soil loss. This study was designed to measure the effectiveness of narrow, stiff grass hedges as a conservation tool for reducing soil loss from agricultural fields. Miscanthus [Miscanthus sinensis Andress] and eastern gamagrass [Tripsacum dactyloides L.] were used to establish grass hedges on the contour, across concentrated flow erosion areas, in agricultural fields. Miscanthus hedges were established using transplants. Eastern gamagrass hedges, used to supplement the miscanthus hedges, were established from seed. Miscanthus and eastern gamagrass grew rapidly and, within two years, formed dense hedges that slowed runoff and reduced soil loss from the field. Ground surveys made in 1991 and 1995 measured 8 to 15 cm of sediment deposited above hedges. Deposition patterns were related to the original topography with low areas having the greatest deposition. In most years, crop yields were reduced in the two rows nearest the hedge. We found that narrow, stiff grass hedges can be an alternative conservation tool for reducing soil loss and dispersing runoff from areas of concentrated flow channels in agricultural fields.

INTRODUCTION

Soil erosion is a major concern in many parts of the world (Brown & Wolf, 1984). Of special concern is concentrated flow erosion which occurs along narrow flow paths where water concentrates along shallow drainage ways and causes incised channels and gullies (Foster 1986). Grass filters and buffer strips, planted 5 to 15 m wide, have been widely used and have been an effective conservation tool for trapping sediments and some chemicals (Magette et al., 1989; Daniels & Gilliam, 1996). However, the effectiveness of these strips is reduced as flow increases, particularly, in areas of concentrated flow (Flanagan et al., 1989). Planting narrow, stiff grass hedge on the contour across areas of concentrated flow is an alterative conservation method for slowing runoff and reducing soil loss. Grass hedges have been used in many countries to reduce soil loss (NRC, 1993).

In recent years a renewed interest has developed in the use of narrow, stiff grass hedges for reducing sheet, rill, and concentrated flow erosion (Kemper et al., 1992; NRC, 1993; McGregor & Dabney, 1993). Research has shown that narrow, grass hedges disperse water, trap sediment, reduce ephemeral gully development (Dabney et al., 1993, 1995), and reduce wind erosion (Aase & Reitz, 1989; Aase & Pikul, 1995; Siddoway, 1970). Grass hedges slow concentrated flow by dispersing runoff across a wider area and promoting sediment deposition in the ponded backwaters above the hedges (Dabney et al., 1993, 1995; Meyer et al., 1994) and enhancing terrace formation (Aase & Pikul, 1995). Use of narrow grass hedges is an inexpensive biological conservation practice that is compatible with tillage systems when they are planted along the contour (McGregor & Dabney, 1993).

Grass hedges differ from other types of grass barriers (i.e., buffer strips, filter strips) in that they are narrow, planted with stiff, erect grasses, and are designed to stimulate the formation of terraces by deposited materials. A dense stand of coarse, stiff, grass stems planted in hedges across concentrated flow paths, causes ponding of runoff water above the hedge that allows time for eroded particles in the flow to be deposited. The deposited material fills low places in the field so that water from future runoff events is even more broadly dispersed and less erosive. Narrow, stiff grass hedges should be planted in lines along the dominate contours and across concentrated flow areas of the field (Kemper et al., 1992). Design, spacing, and lateral extent for these grass hedges in concentrated flow area depend on runoff rates, topography, and other factors (Dabney et al., 1993; Kemper et al., 1992).

Vetiver [Vetiveria zizanioides (L.) Nash] is the most famous grass used in hedges for reducing erosion. Vetiver has been used in many tropical countries for erosion control, but most of the reports about its effectiveness are based mainly on empirical observations and anecdotal reports rather than quantitative studies (NRC, 1993). The World Bank promotes the use of vetiver for erosion control (World Bank, 1990). In 1991 the United States Department of Agriculture (USDA), Agriculture Research Service (ARS), in cooperation with the USDA Natural Resource Conservation Service (NRCS) and several Universities began a research program to evaluate the use of narrow, stiff grass hedges as an alternative conservation practice for controlling soil loss from concentrated flow erosion areas. Vetiver was a candidate species, but it quickly became evident that this species could not withstand the low temperatures in temperate regions. Other grasses included in these studies were miscanthus [Miscanthus sinensis Andress] and indigenous grasses such as eastern gamagrass [Tripsacum dactyloides L.], switchgrass [Panicum virgatum L.], tall fescue [Festuca arundinacae Schreb.], perennial tall wheatgrass [Elytrigia elongata (host) Nevski] and others.

The purposes of the current study were to establish

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narrow, stiff grass hedges across developing concentrated flow erosion areas in agricultural fields near Beltsville, Maryland and to determine their effectiveness to slow concentrated flow erosion, slow ephemeral gully development, capture eroded material, and reduce the loss of soil from the fields.

METHODS AND STUDY SITES

Two study sites were chosen. The first site was on the South Farm of the USDA, ARS, Beltsville Agricultural Research Center (BARC), Beltsville, Maryland. This field has a history of strip cropping on the contour and row cropping with alternating years of corn (Zea mays L.) and soybeans (Glycine max (L.) Merrill) on alternate strips. Slopes in the field are between 10-15% with a total slope length of 250 m. Cropping strips are approximately 50 m wide. Corn is no-till planted into the soybean stubble while soybeans are planted after minimum tillage (surface disking) to incorporate the corn residue. Two concentrated flow erosion channels were observed in the field, starting near the crest of the slope and crossing three cropping strips before joining to form a single flow area near the base of the slope. On April 17, 1991, miscanthus was transplanted along the contour between strips of crops and across concentrated flow erosion channels below the point at which the two concentrated flow areas joined near the base of the slope. Miscanthus clumps (2-5 cm in diameter) were transplanted using 2-5 cm clumps at 10 to 15 cm intervals. Transplants were made on the contour, between strips of crops, to reduce interference with farm operations and to reduce disturbance to the hedge during the field and harvest operations. In May 1994, the hedges were repaired by transplanting miscanthus to fill gaps in the original hedges. Also in May 1994, eastern gamagrass was planted using stratified seeds to fill gaps and extend the length of this miscanthus hedge.

Corn and soybean yields were measured on either side of this grass hedge in the South Farm field in 1993, 1994, 1995, and 1996. Yield sampling was done by harvesting crop rows 1, 2, 4, 8, 16, and 32 away from the grass hedge. In each sample row, four (4) five meter sections of crop were harvested. Samples of the harvested crops were dried and weighted. In 1993 no treatment was made to the hedge. In 1994, 1995, and 1996, half the length of the hedge was kept trimmed to 75 cm height (which is about the height of the soybeans at maturity) during the growing season in an attempt to reduce competition with the crops near the hedge.

In April 1991, shortly after the original transplanting of the hedge, a topographic survey was made at the hedge site. In August 1995, a second topographic survey was made for comparison with the original topographic surveys. Lines were surveyed 5 cm below and 5 cm and one meter above the hedge.

The second study site is on the East Farm of Beltsville Agricultural Research Center. This agricultural field has a slope of 10 to 15% with a total slope length of about 200 m. The field had a history of being planted in either corn or soybeans. A concentrated flow erosion channel was visible in the field. In April 1991, a tile drain was installed beneath the approximate location of the concentrated flow channel. On May 23, 1991, after the installation of the tile drain, miscanthus was transplanted into a hedge at the lower edge in this field where overland flow exited the field and entered a wooded area. Miscanthus was transplanted in 2-5 cm clumps at 10 to 15 cm intervals. In 1991 and 1992, the field was surface plowed and planted in corn. After the corn was harvested in September 1992, clover was no-till planted in the field to provide a winter cover.

During the winter and spring of 1992/1993, a conservation plan was developed for this field to reduce soil loss. This plan directly affected our activities at the East Farm field by changing the farming practices from a single field to a field with five strips of crops. However, this plan did not affect the original grass hedge. On March 24, 1993, two new miscanthus hedges were transplanted on the contour between the newly developed strips of crops. The three miscanthus hedges grew actively during 1993 and are well established. After the 1993 growing season, row crop agriculture was stopped in the field. From 1993 to 1995, the field was planted with small grain/clover that provides continuous cover. In 1996 corn was again planted in alternate strips. In 1994, gaps in the grass hedges were filled and grass hedges extended in length by planting stratified eastern gamagrass seeds. In 1995, a topographic survey was made along the grass at the edge of the field for comparison with surveys made in 1993. Lines were surveyed at 5 cm below and at 5 cm and one meter above the grass hedge.

RESULTS

Miscanthus and eastern gamagrass rapidly formed dense hedges. Beginning with 2-5 cm clumps planted 10 to 15 cm apart in 1991, grasses in both fields grew to a width of 20-30 cm and a height of 2.5 to 3.5 m by 1994. At the South Farm, miscanthus was two meters tall at the end of the first (1991) growing season. Trimming this grass to 75 cm along half its length during the 1994, 1995, and 1996 growing seasons did not affect its growth or expansion. Miscanthus quickly developed new growth and continued to expand after each trimming. Each spring, the grass hedges were trimmed to a height of approximately 30 cm to remove the prior year's growth. Trimmed material was left in the field where it fell.

In 1994, eastern gamagrass was planted from stratified seed to fill gaps and expand the length of the grass hedges at both field sites. These plantings were successful with high rates of seed germination, although eastern gamagrass is difficult to germinate when the seed is not stratified or vernalized (Dewald et al. 1996). Eastern gamagrass grew rapidly to form a hedge 30-60 cm tall and 10-15 cm wide by the end of the 1994 growing season. In 1995 and 1996, these eastern gamagrass hedges continued to grow and have developed into dense grass hedges of 0.2-0.3 m width and 1-2 m height.

Topographic surveys (Fig. 1) of the grass hedges at the East Farm in 1995 showed 10 to 15 cm of deposition above the hedges after four years. The deposition area extends at least 1 meter above the hedge. More detailed surveys are needed to determine the full extent of the deposition pattern near this hedge. This hedge at the lower edge of the field is capturing eroding soil particles that have moved from the field. However, this field was in continuous grass/clover cover between 1993 and 1995 so that the soil loss and concentrated flow area development was reduced during those years. Observation of the area near this hedge in 1994 and 1995 showed the lack of well defined concentrated flow channels that were evident in early spring of 1991 and 1992. Only during large rainfall events did surface erosion occur in this field. The lack of the development of the concentrated flow channel could be due to a) reduced runoff from the field due to the continuous crop cover or b) development of the terrace area above the hedge that further disperses the water as it approaches the grass hedge.

Surveys above and below the hedge on the South Farm site in 1995 showed 8 to 15 cm of deposition above the hedge (Fig. 2). Greater deposition occurred along the hedge in the areas where concentrated flow channels (depressions in the topographic survey) cross the border between the strips of crops. A general smoothing of the topography is occurring above the hedge. This smoothing is attributed to the ability of the hedge to slow and spread water across a wider area as it crossed the grass barrier. This ponding of water would allow the sediment load carried in the runoff to be deposited over a wider area.

A comparison of topographic surveys made in April 1991 and August 1995 along the same survey line (5 cm up the slope of the grass) at the South Farm also showed an 8 to 15 cm depth of deposition (Fig. 3). Again the deposition is greatest in areas where concentrated flow had eroded the deepest channels before establishment of the hedge. The measured deposition along this survey line is also greater in the low areas. That is also evident in Figure 2 where a comparison was made between above and below survey lines. The August 1995 survey line in Figure 3 is the same as the "above" survey line in Figure 2 showing that the comparison of above and below the hedge survey line probably give a conservative estimate of total deposition.

At the South Farm site, an extensive area of deposition of material is present approximately 50 meters above and west

of the center of the hedge. Whether this deposition area is due to the hedge cannot be determined, since survey data are not available for comparison, but this area of deposition has clearly developed since the hedge was established. There is also evidence of the development of new concentrated flow areas below the hedge that is of concern. More extensive surveys of the area above and below the hedge needs to be made to evaluate the full extent of the deposition patterns and rates and the potential erosion channels below the hedge.

Studies of crop yields near the hedge at the South Farm site were begun in 1993 after the hedge was well established. These studies were to determine the effect of the hedge on crop yields near the hedge and to determine the distance at which the hedge effects could be measured. In 1993, substantial decreases in yields of corn and soybeans occurred near the hedge (Fig. 4). For soybeans, yields reached maximum level at approximately two meters from the hedge. For corn, yields reached maximum level at approximately six meters (2-3 rows) from the hedge. Rainfall was below average during the 1993 growing season. The hedge grew to heights of 2-3 m shading the adjacent rows of soybeans. In the early part of the growing season the hedge shaded adjacent rows of corn although the corn eventually grew to heights greater than the hedge. With the same seeding rate, plant populations were reduced in the first two rows near the hedge.

In 1994, half the length of the hedge was kept trimmed to a height of 75 cm. Only the first row of soybeans showed yields that could be related to the proximity of the hedge. Shading was the probable cause of decrease in yields of soybeans next to the hedge that was not kept trimmed. Few soybean plants developed and matured in the row closest to the hedge. The differences in yield patterns with distance from the hedge between 1993 and 1994 were probably due to rainfall. In 1994, rainfall was slightly above average and adequate for the hedge and the crops growing near. The well-established roots of the perennial miscanthus hedge could deprive the crop of moisture in dry years.

Yields in 1995 and 1996 were similar to those in 1993 yields and lower in the rows near the hedge. However, yields were only affected in the first two rows for both soybeans and corn. Keeping the hedge trimmed to 75 cm did not affect yields of corn or soybeans.

DISCUSSION

Grass hedges were established easily and expansion by shoot production has been rapid and vigorous. During the six-year study, no evidence has been found that miscanthus produced viable seeds in the field. While these hedges are very robust and are capturing eroded materials, the cost of purchasing miscanthus shoots and labor needed to transplant the shoots may reduce farmer acceptance and application of miscanthus hedges as conservation tools. The use of an indigenous grass that could be seeded and used for other purposes should have greater farmer acceptance. Switchgrass and eastern gamagrass are good candidates for use in the eastern United States. Eastern gamagrass was planted successfully using stratified seed thus making the establishment of hedges easier and cheaper. Farmers can use conventional farm equipment to plant eastern gamagrass and switchgrass using seeds (Dewald & Louthan, 1979; Dewald et al., 1996). The use of indigenous grasses also reduces the chances of introducing unwanted competitors to agricultural fields. While our emphasis has been on narrow (< 1 m) grass strips, developing stiff grass strips 1-5 m wide with indigenous grasses could provide both erosion protection and the potential for harvesting as a forage and feed crops.

Grass hedges are effectively trapping eroded materials under field conditions. Two to four centimeters of eroded material have been deposited yearly immediately above the hedges established at Beltsville, MD. Similar results have been found at other locations (Proceeding Grass Hedges Workshop 1996, unpublished). Grass hedges trap two-thirds of the sediment from small plots (McGregor & Dabney, 1993; Dabney et al., 1993). The grass hedge row works as a porous filter that slows the water but lets it pass. Water is ponded above the hedge row slowing its velocity and allowing time for part of the eroded material in suspension to be deposited. The deposition is in the area above the hedges rather than in the hedge row. Laboratory flume studies have shown that hedges of switchgrass, vetiver, and miscanthus caused backwater depths up to 40 cm and trapped more than 90% of sediment greater than 125 m. Trapping efficiency was more closely related to particle size than to flow rates. Sediment was trapped up slope of the hedge rather than being filtered by the hedge. However, once the material reaches the hedge, it passes through (Meyer et al., 1995). Over time, grass hedges can cause the development of terraces (Aase & Pikul, 1995) that flatten the slope and broadens the flow area, resulting in larger ponding areas and greater storage capacities, increased settling times, and lower flow rates through the hedge (Dabney et al. 1996).

Soil deposited above established hedges will flatten the slope. Concentrated flow areas above the hedge fill rapidly. However, incised areas below the hedge may be increased due to the increased erosive power of the water passing through the hedge that has increased carrying capacity due to the sediment deposited above the hedge. This erosion below the hedge should be controlled. In time, terraces may be complete so that the areas between hedges are flattened and erosion reduced. The use of stiff grass hedges should not be seen as a panacea to reduce erosion but as another conservation practice in the arsenal of weapons to manage the landscape. Other conservation practices should be in place on the field to prevent the movement of soil so that the need for hedges is reduced.

Four years of yield studies suggest that stiff grass hedges will probably affect yields of crops in the first few rows adjacent to the hedges. Lyes et al. (1984) found that vegetative barriers could affect yields at distances up to twice the height of the barrier. The reduction of yields is probably due to shading and reduced water availability although many other factors (i.e., nutrient supply, deposition) may contribute to changes in yields (Lyles et al., 1984). In our study, field observations noted fewer plants grew in the row near the hedge and in areas where deposition was the greatest.

CONCLUSIONS

In a series of recent studies, quantitative data showed that narrow, stiff grass hedges act as filters to slow and broaden the flow area, resulting in ponding that increases settling times for suspended material to be deposited. This causes the development of terraces that further reduces the steepness of slopes giving even larger areas for the water to spread and slow its velocity.

Use of narrow, stiff grass hedges should not be seen as a panacea but as another conservation practice to control soil loss from agricultural fields. Continued efforts to control soil loss at the point of detachment are critical and should be continued. Proper management of stiff grass hedges is required. With the development of terraces, there is an increased potential for the development of sediment patterns that may concentrate flow passing through the hedge creating conditions for the development of erosion problems immediately below hedges.

While grasses such as vetiver and miscanthus are good candidates for narrow, stiff grass hedges, indigenous grasses should be used when possible to reduce the potential for the introduction of exotic material into new environments. Planting hedges of indigenous grasses in wider strips (2 to 5 m) also raises the potential for harvesting or grazing these strips. Thus, soil loss could be reduced and the farmer could have a crop that could provide added income.

ACKNOWLEDGMENTS

The authors express our appreciation to Personnel from the NRCS National Plant Material Center at Beltsville, Maryland who helped transplant the miscanthus. We also thank Tim Badger, Farm Manager at the Beltsville Agricultural Research Center, who helped find study sites and allowed us to plant strange grasses in the fields where he attempts to eliminate competitors for the field crops. Carole and Karen Ritchie provided field assistance during the topographic surveys.

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Figure 1. Topographic survey of the grass hedge made in 1995 at the BARC East Farm at Beltsville, Maryland, USA. Survey lines were 5 cm below the hedge, 5 cm above the hedge, and 1 m above the hedge.

Figure 2. Topographic survey of the grass hedge made in 1995 at the BARC South Farm at Beltsville, Maryland, USA.

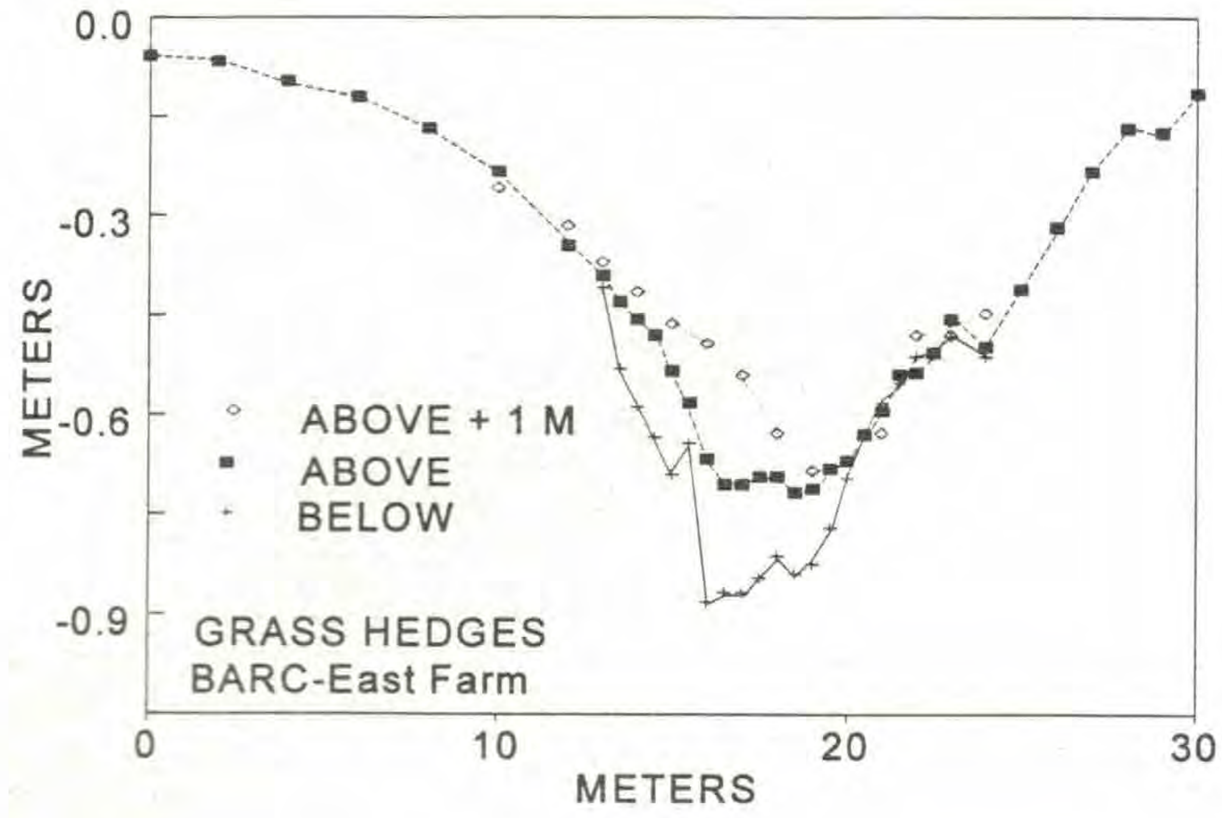

Figure 1. Topographic survey of grass hedge made in 1995 at the BARC East Farm at Beltsville, Maryland, USA. Survey lines were 5 cm below, 5 cm above the row and 1 m above the row.

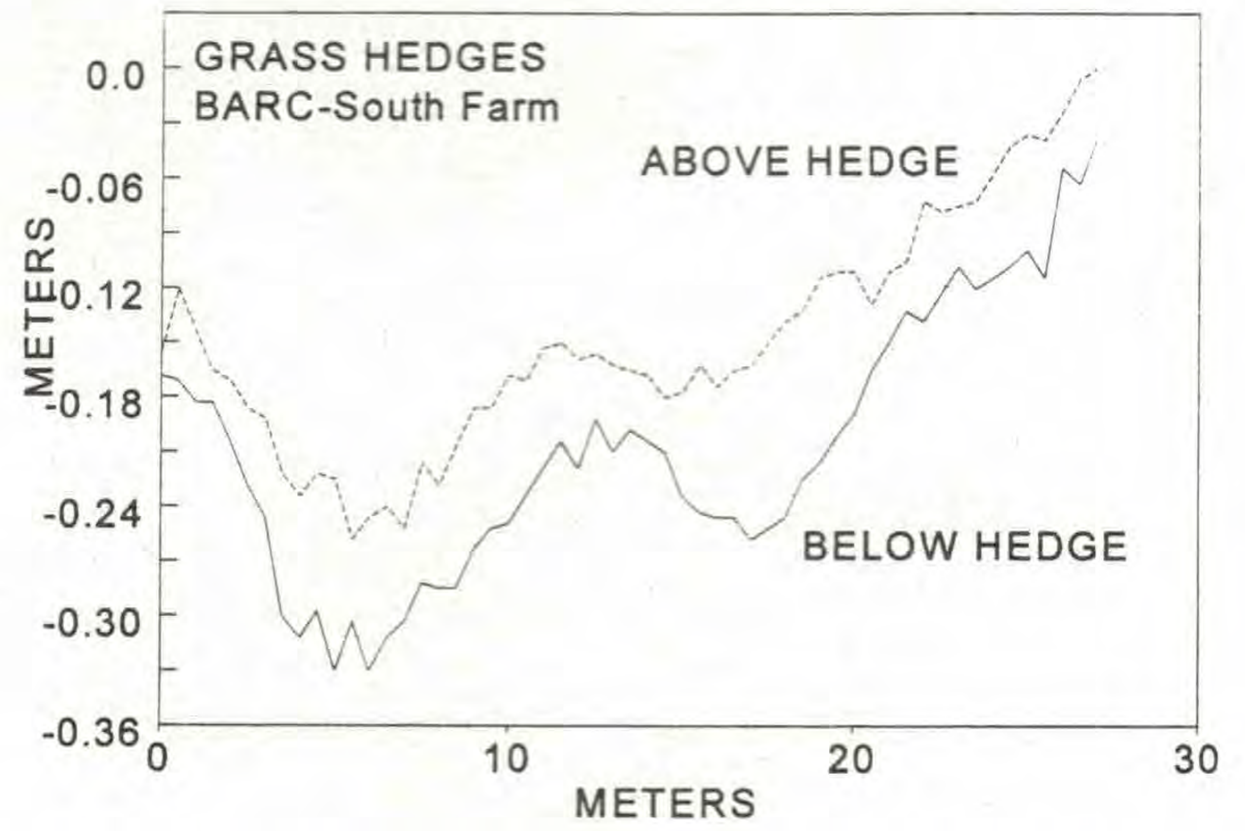

Figure 2. Topographic survey of grass hedge made in 1995 at the BARC South Farm. Surveys were made 5 cm below and 5 cm above the row.

Survey lines were 5 cm below the hedge and 5 cm above the hedge.

Figure 3. Comparison of topographic surveys of the same line (5 cm above the hedge) at the BARC South Farm made shortly after the hedge had been transplanted in April 1991 and again in August 1995.

Figure 4. Relationship between crop yield and distance from grass hedge.

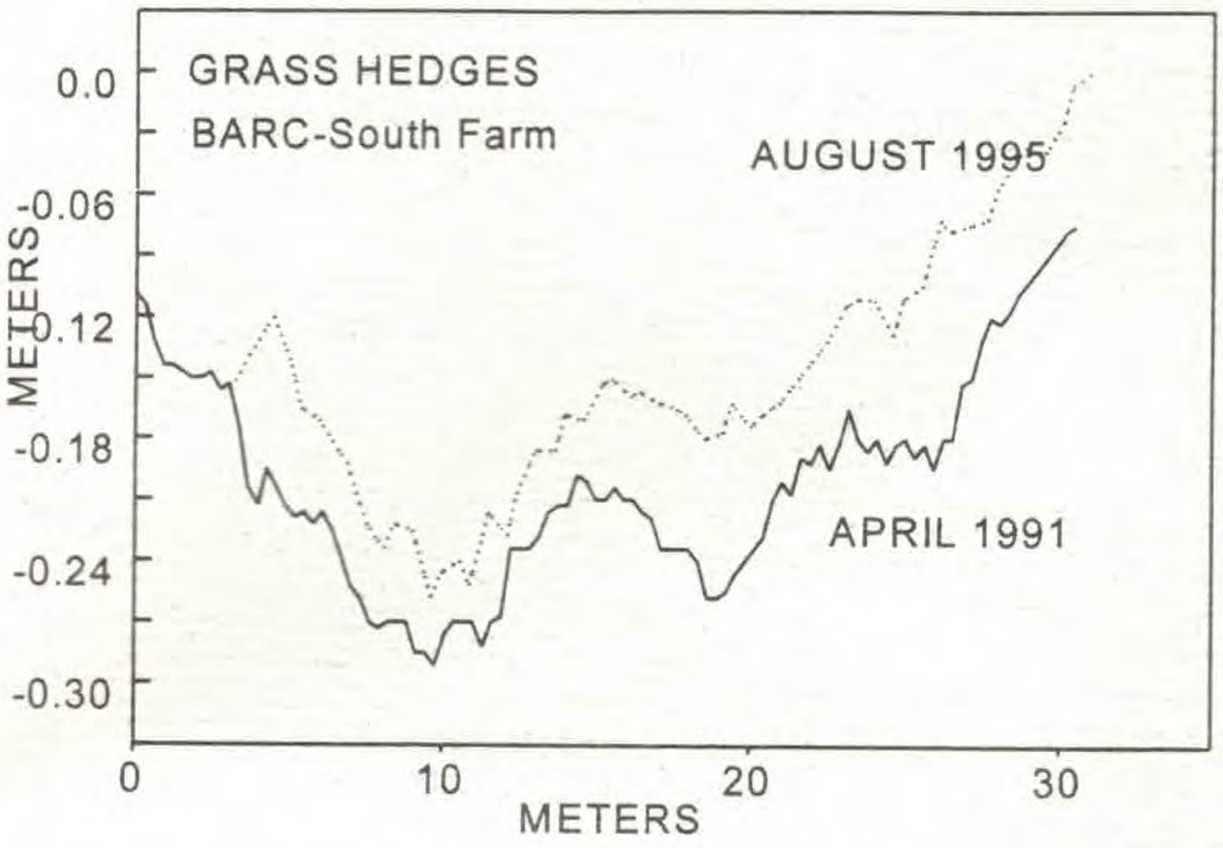

Figure 3. Comparison of topographic surveys of the same line (5 cm above the grass hedge) at BARC South Farm made shortly after the hedge had been transplanted in April 1991 and again in August 1995.

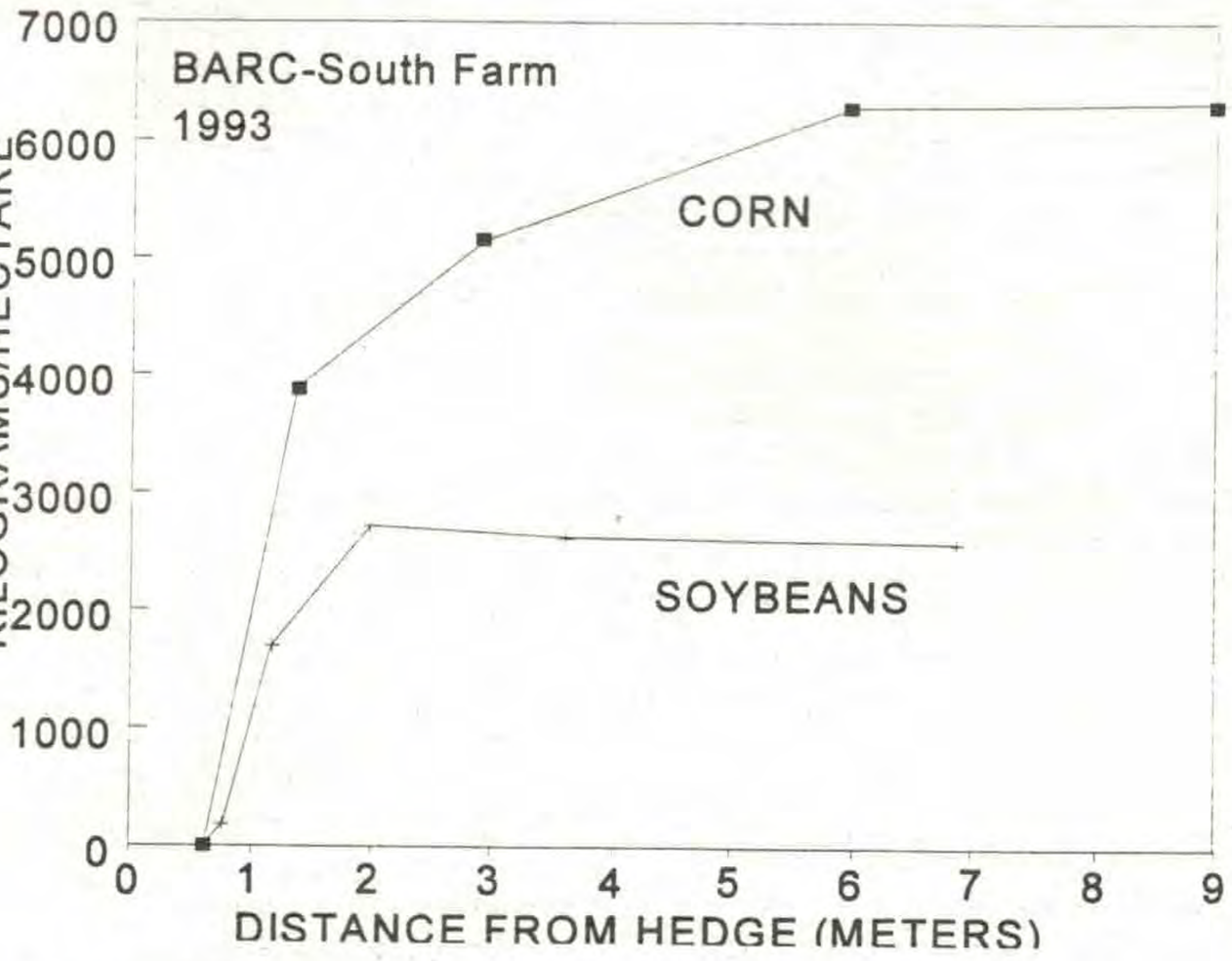

Figure 4. Relationship between crop yield and distance from the grass hedge.

GRASSLANDS NOTES AND OBSERVATIONS

WHY NATIVE?

Pat Kennerley
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When asked this question, I had to stop and think, why did I plant native grass? Despite all the obvious merits of native planting, there was no question, only native grasses were appropriate for our property. We moved from the Bay Area to the foothills and in so doing discovered an entirely different way of life. We purchased nine acres one mile from the center of town in the quaint hamlet of Nevada City, California We not only left behind insane traffic and gridlock, we left a lovely home with manicured lawns and planter boxes filled with annuals that required water and care, If we were to leave for even a weekend, much less an extended vacation absence, we had to hire a garden sitter After a year of searching for the perfect lot for our log home, we found a beautiful but neglected piece of property with magnificent old cedar, pine, black oak, maple, madrone, dogwood, manzanita and of course about five acres of berries and poison oak..,. .. . not all is perfect in paradise. We couldn't even see the contour of the land for the berries were impenetrable and taller than our heads. We could envision the potential of the property and were determined to return it to it's natural beauty. Man had almost destroyed the land by clear cutting huge old pines, dumping years of garbage and allowing the berries to run rampant We set out to reverse the damage and restore the land; which of course demanded native grasses. We knew how lovely the stately old trees would look with a carpet of green at their feet, interspersed with swaths of wildflowers It was a setting that would only be right as a natural landscape; lawn and petunias just wouldn't do! After months of preparation we were ready to seed Since native grass seed is very fine and very expensive, we chose a method of planting that would ensure optimum success, hydroseeding We contacted Ron Ettlin of Nevada County Farm Supply and after explaining what we wanted to achieve, we were encouraged by his enthusiasm. He felt this was the beginning of a trend for the future.

The procedure was fascinating, He first sprayed a mixture of chopped newspaper, water, fertilizer and seed with a cornstarch binder, Next came a layer of finely chopped certified straw (no weeds or spray) and finally a coat of tactifier and mulch which consisted of cornstarch and color, We did this in late September. It was still quite warm and we decided it would be a monumental task to keep it all wet enough to germinate; so we chose to water only a small area and compare it to natural germination, Actually we gained nothing, While our watering brought about early grass, the rest caught up as soon as the rains started, Mother Nature was not kind to California this past winter, Our new grass did very well until winter turned to summer in February and by the first of April the heat was taking it's toll, We are in the process of getting temporary water to all the seeded areas until it is well established, On the open dry hillside above the house we seeded Molate Fescue (Festuca rubra), On the lower slope that enjoys the shade of the old trees and more moisture, we seeded a mixture of the Molate Fescue and Slender Hairgrass (Deschampsia elongata), We also have areas of seasonal seeps and two springs that we are planting with 200 seedlings of Deergrass (Muhlenbergia rigens), People who visit our property are astonished by the abundance of wildlife compared to their places a relatively short distance away, We have flocks of hundreds of bluebirds, goldfinches, juncos, finches, robins and assorted phoebes, hummingbirds, rufus sided towhees in lesser numbers. The bluebirds like the openess of the grass for their fledglings and the others enjoy foraging in it.

So, basically, I "went native" because I feel it's the way our land was meant to be.

Establishment of a Native Grass Nursery

Dana Sandifer, Revegetation Coordinator
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Abstract

A main facet of restoration efforts in the Grass Valley Creek (GVC) watershed has been the revegetation of recontoured stream channels, landings, roads, and bare slopes subject to persistent sheet and rill erosion. Due to the large part revegetation plays in the restoration project, the use of native ecotypes found within the watershed is a primary concern of the Trinity County Resource Conservation District (TCRCD). To ensure that planted species are as genetically similar to those already growing in the watershed, the TCRCD began a seed collection program of native grasses, forbs, shrubs, and trees. Concerns regarding having this seed propagated in conditions dissimilar to those of the project area inspired the development of a nursery near the watershed to grow plants in the same soil and biological conditions. Cost for its establishment is defined mainly by labor costs, as the nursery is located on land donated for use to the TCRCD. Pallets also donated by local businesses are adapted for racks to hold the plant tubes. Seven different species of native grasses have been sown and approximately one-fourth of those have already been planted in the watershed. New seed is sown each spring and fall, and the amount of plants propagated may increase as the TCRCD acquires more materials. Species of forbs may also be attempted in the future.

Introduction

Since 1992 the TCRCD has been involved in restoring the Grass Valley Creek watershed, an area identified as the largest contributor of sediment to the Trinity River, which has proved detrimental to local fisheries. Seventy-five percent of the watershed consists of decomposed granitic (DG) soil, which is highly erosive and difficult to stabilize once it is disturbed. The high annual yield of sediment has been increased by past logging activities, including roads and landings constructed in or adjacent to stream corridors, and removing trees from steep slopes. A major component of the restoration activities has been the revegetation of the watershed through seeding decommissioned roads and landings and planting bare sheet and rill slopes. The TCRCD's goal for the future is to obtain plant materials exclusively from the watershed, in order to utilize those ecotypes that exist as a result of the unique environmental conditions present in the area. To do this, a large scale native seed collection was implemented in 1994 and 1996 to establish a seed bank for grasses, forbes, shrubs, and conifers. Plants are not only propagated for planting from this seed, but some are now being propagated near the watershed to keep the plants growing in a similar biological environment.

The TCRCD nursery was initially established to propagate native grass plugs in similar soil and climate conditions as that of the watershed and to reduce the costs of having plants propagated at commercial nurseries. It is hoped that propagating seed in similar site conditions to those from which it was collected will result in more vigorous, site-acclimated plants. It may also help reduce the possibility of disease or other weaknesses resulting from propagation in a nursery with a completely different climate and elevation. The TCRCD nursery may also be used in the future to experiment with growing other species that are specific to the GVC watershed and not yet available from commercial or government nurseries.

Planning Considerations

In considering establishment of a nursery in a rural area, the main concern was finding suitable land that was level, easily accessed, and had irrigation. The TCRCD was fortunate to have the use of private land, including an irrigation system, donated for the nursery. .

Design Criteria

The area of the nursery is approximately 1,500 sq. ft. (30' x 50'), and is located in a pasture normally occupied by either llama or cattle. A fence consisting of barbless wire and metal posts was first erected around the nursery to protect the plants from livestock. The area was first mowed to remove existing vegetation, black geotextile cloth was then laid down to reduce regrowth under the nursery plants. An additional three inch layer of DG was spread over the blanket to reduce the amount of heat it absorbed.

Racks to hold the plant containers were built out of wood palettes donated from local businesses. Each pallet was converted into a "box" by removing the crossbeams from one side of the palette, then placed on the ground with the open side facing upwards. Plastic CalTrans emergency fence (netting) with a mesh size of one inch by two inches was stretched across the top of each pallet and nailed in place. This netting was used to hold the individual plug containers. Each rack varied in size, holding from 200-700 containers each.

For planting containers, both six inch and eight inch plastic plugs (i.e., tubes) were used. The smaller tubes were used primarily for slower growing species such as *Achnatherum,* and the larger tubes for faster growing species such as *Elymus.*

In developing a soil mixture for the nursery, the idea was to grow the plants in soil similar to that in which they grow naturally and into which they will be transplanted. Initially, the soil mixture consisted of five parts DG to one part peat moss. However, due to the lack of mineral content and soil structure, there was a problem with the soil streaming out the holes in the bottom of the tubes. To remedy this, the bottom one inch of the tubes were first filled with peat moss, with the remainder of the tubes filled with the soil mixture. The plants grew well in this mixture, but the soil mixture hardened and adhered to the plastic tubes, making them difficult to remove from their containers. The plugs were also extremely heavy compared to others plugs, which made them cumbersome to pack into sites. The soil mixture was then changed to 3:1 (DG to peat) for the second sowing. The results of this mixture are not yet known, as these tubes were sown in March of this year.

Operation and Maintenance

Species sown included: *Achnatherum lemmonii* (Lemon's needlegrass), *A. occidentale* (western needlegrass), *Elymus glaucus* (blue wildrye), *E. elymoides* (bottlebrush squirreltail), E. *trachycaulus* (slender wheatgrass), *Festuca idahoensis* (Idaho fescue), and *Poa secunda* (pine bluegrass). All species were sown at three to five seeds per tube. New seed is sown each spring and fall as plants are planted, with three people working for one to two days.

The irrigation system for the nursery consists of one Rainbird sprinkler, which draws water pumped directly from an adjacent creek. The sprinkler is set up in the middle of the nursery and is turned on and off manually (this is in part due to the need to share water privileges with the landowner and because timers cannot be used much of the year due to freezing temperatures). Plants are watered for at least one half hour every day in the summer and once a week during dry spells in the spring and fall. No irrigation is needed during the winter. Additionally, the nursery grounds are weeded as needed throughout the year.

Cost

The total cost for the construction of the nursery and initial sowing was $8,659.00. This translates into a per plug cost of $0.50. Now that the nursery is established the only costs incurred will be for continued sowing, watering, and weeding. Thus, the cost should be reduced to approximately $0.20 per plug.

Conclusion

The widespread concept of using native plant materials in restoration efforts has brought about several additional concerns for the overall health of ecosystems. If native seed or plants are being planted or broadcast into an area, it is important that original materials are collected from the same area so as not to alter the genetic base of existing local ecotypes. This can be accomplished by collecting seed from local stock and having plants propagated in a biologically similar environment to that of which they will be transplanted. Factors such as soil type, altitude, and precipitation contribute the genetic adaptations of individuals or stands within the same species, and this should be considered in any restoration effort.

Currently, only half of the TCRCD nursery space is being utilized. Nursery space used was limited at first by the amount of materials available and the experimental nature of the project. The TCRCD has now successfully grown 15,000 grass plugs and already planted 3,000 of those this spring. The TCRCD will continue to collect and sow native grass seed every year in order to supplement other planting stock. We plan on using the remaining nursery space as we acquire more materials and expand the types and numbers of plants we grow. In addition to native grasses we will soon be growing species of *Lupinus* and *Lotus.*

For groups or individuals considering growing plants for their own projects, this type of small-scale nursery is an easy way to propagate grass plugs or other plants, and may be accomplished at a minimal cost. Much of the cost for the TCRCD nursery involved labor, but this can be reduced dramatically with volunteer workers and donated materials. This type of project can also be an excellent tool for education, involving children and community members with production, maintenance, and growing success.

Author's notes: Through the four years I have been involved in the Grass Valley Creek Watershed Restoration Project, it has often been difficult to find information on forest restoration practices, as most testing and research is usually held in the Central Valley or the foothills of California. Hopefully this article will be of assistance to others working on similar projects as our own—although it can be implemented for many projects—and inspire ;those who are to contribute information as well.

ECOTYPES VS SITE SPECIFIC

Dennis Fox
Bakersfield, California

It has been proposed that all seeding specHicationss require that the seed origin be site specific. There has been no DNA evidence presented that shows this as a necessity to biodiversity, and it has become apparent that, in many instances, not only are the proponents of site specificity displaying agendas contrary to the misson of the Association, but also the results would be counterproductive. On the positive side, the proponents' hypothesis has shown two areas that need discussion: preservation and nomenclature. I will address these with two antitheses proposals.

Labeling

What is rarely mentioned in the discussion is the use of site as a factor in seed selection for probability of planting success in a non preserve project and the compatability of seed mixtures. Often these mixtures and their use is after an event and require greater quantities and availability than can occur by the ponderous and expensive process of gathering and growing from a small specific site. Agencies are required to act expeditiously, and the general publlic would not be impressed favorably, as they see their houses floating off on the Transpac yacht race under the percieved sponsorship of another example of political correctness. It is more in keeping with goals of the Association, and the democratic process, to use an expanded labeling process which can be computer accessed, easily typed with a minimum of equipment and reference mabriel, and comprehended by a large range of potenffal users. I will give a sample label and then flll it in according to a site I have picked to show the fallacy of using site specificity as a sole criteria (sic).

BRAND_____(_____) (_____)
COLLECTION SITE: Location_____

County_____USGS Quad_____

Elevation_____Aspect_____

Overstory_____Other_____

SOIL: Texture_____NRCS Series_____

Carbonates_____Cultural_____

Soil moist color indicators
Color_____ Salts_____
OrganicMatter_____
Drainage/Wetness_____
Brand: Nodding Needlegrass (Nasella Cemua) SJV 8,9
The term *brand* is just arbitrarily used and contains the bioregion and the Sunset Zones. While it may be desirous to look at other areas' labeling systems, these two terms should be retained. Bioregion is rapidly becoming the area of restoration concern and a rapidly adopted term officially. The sunset zone is familiar to the general public and landscape industries of the state. These two terms are general terms that can be computer headings.
Location: Arco Oil Preserve. Stockdale Hwye~ 43
County: Kern
Quad: Buttonwillow The USGS quads are on a readily accessible statewide map, to easily narrow the location. While further narrowing can be done with a legal description it can also be done as above with a readily available statewide map.
Elevation: 5C Five hundred foot increments are handy and already used
Aspect: NA flat area
Overstory: Valley scrub
Other: Abutting Tule Elk Preserve on East; Compatible with seeds from the preserve
Soil texture: clay; NRCS Series Corcoran Clay. This infers that this seed could be compatible over one hundred miles to the north, but not with the differing soils two miles to the south, east or west. Ph 7.6; Readily checked without spending funds or time for a lab test.. Carbonates:: None. Also readily checked at the site of collection or use with vinegar.
Soil moist color indicates former vernal flood plain put to ag. Color—grey; organic matter—none; salt—visible crust; drainage—wetness, poor drainage
CuHural: Plowed for generations fallow for approx. 10 yrs.
Disclaimer This is given to discourage overspecification by an agency which may be not only unrealistic, but also result in sole sourcing, which many agencies are attempting to discourage.

This model label will, hopefully, extract a few comments and it is hoped such comments will aid in presenting the most information in the simplest way.

RELIC STANDS VERSUS REPOSITORIES

Dennis Fox
Bakersfield, California

Relics are mementoes of dead things. They are often objects of cultish worship, the preservation of relic stands will further make ecotypes dead. Landowners of the relic stand sites will have an incentive to plow them under as they are theatened with loss of their land use. This is good if your object is control, whether of people or prices, It is, however, against the aims of the Association.

If the proponents of ecotype preservation be serious in their ardor, there is a well proven way to accomplish their aim. Collection and labeling of seeds for preservation in a repository has been done with many other plant species. If they were to donate seeds to a repository, where all growers could have access at a cost which would cover repository expenses only, they would accomplish the following: Encourage more ecotype usage Preserve the seeds for possible restoration to their native sites Facillitate the rapid use of a seed after an event so that exotics need not be used yet the soil stabilized.

It is hoped that these two proposals will diminish two concepts about California; that it is a state that destroys its heritage and is a stab where it is easy to bll when it's springtime, for that is when the rains come and the houses go.

CALENDAR

NATURAL RESOURCES MANAGEMENT WITH GIS AND REMOTE SENSING--
Course Level I: Oct 6-10; Course Level II: Oct. 13-17, Nov. 17-21
Contact: Joni Rippee, Univ. of California, ESPM
(510) 643-5429 rippee@nature.berkeley.edu

CalEPPC SYMPOSIUM '97--Oct. 10-12, Concord, CA
Contact Sally Davis, (714) 888-8347 sallydavis@aol.com

SOCIETY FOR RANGE MANAGEMENT FALL MEETING
'FROM THE MOUNTAINS TO THE SEA'--Nov. 5-7
Contact: Joni Rippee, Univ. of California, ESPM
(510) 643-5429 rippee@nature.berkeley.edu

ANNUAL CONFERENCE WORKSHOPS
TUESDAY, OCTOBER 21

California Grassland Restoration/Reconstruction Techniques, 8:00am-12:00 pm - Instructors: John Anderson, Hedgerow Farms; Tom Griggs, the Nature Conservancy; Bryan Young, Sacramento Co. Water Quality Division. Native grassland restoration/reconstruction has made significant progress over the past five years in California. The instructors for this workshop have implemented a large number of successful projects in Northern California and will use their combined experience to teach participants current state-of-the-art technology. Subject matter will include seed collection and purchase, site evaluation and preparation, species selection, seeding mixtures, weed control techniques (fire, herbicides, grazing, mowing), seeding and transplant techniques, equipment, and management. The course includes lectures, slide presentations and a collection of written material. Participants are encouraged to attend the afternoon Prescribed Fire Workshop which details the use of fire for management.

Using Prescribed Fire for Vegetation Management, 1:00 pm - 5:00 pm - Instructors: Oren Pollak, Regional Ecologist, the Nature Conservancy & Robin Wills, Fire Manager, the Nature Conservancy. A primer for land managers on the application of ecologically based prescribed fire this workshop covers the basics of planning and implementing a prescribed fire program. Appropriate timing, permitting, and the mechanics of a safe, successful prescribed burn is addressed. Participants will learn how to manage fire as a critical ecological process and as a weed control tool in restoration projects and will be able to ensure the safe use of this tool. Handouts are included. The instructors have over 20 years combined experience planning and applying prescribed burns within California.

Aquatic Ecology and Water Quality Monitoring, 8:00 am - 5:00 pm - Instructor: Jim Harrington, Aquatic Biologist, CA Dept. of Fish and Game, Pollution Control Lab and Monique Born. This interesting and informative workshop includes: an introduction to benthic macroinverte-brates and stonefly identification; elements of biological monitoring; definitions of bioassessment and biocriteria; uses for biological data; introduction to the CA Stream Bioassessment Procedures (CSBP); and the role of chemical monitoring. The class includes a field exercise demonstrating stream sampling procedures and protocol; data analysisand interpretation; and Chain-of-Custody forms.

Revegetation and Restoration Planning: The Basics, 8:00 am - 5:00 pm - Instructors: Gail Newton, CA Dept. of Conservation, Office of Mine Reclamation; Vic Claassen, UC Davis, Dept. of Land, Air, and Water Resources; Steven Goldman, CA Tahoe Conservancy; Deborah Hillyard, CA Dept. of Fish and Game. This popular one-day course has been offered to a full house since 1992. Participants will receive plans, outlines, and examples of specifications for revegetation and restoration suitable for mined-land reclamation, project mitigation, wetland compensation and habitat enhancement for threatened and endangered species. The information is presented in five modules: Site Characteristics and Potential; Soil Characteristics and Amending; Slope Protection and Erosion Control; Plant Materials and Installation; and Maintenance, Monitoring and Performance Standards. Course fee includes lunch and course materials. Check-in at the Veterans Building. The course will be held at the Holiday Inn Express across the street.

Soils and Geomorphology: the Basics for Ecological Restoration, 8:00 am - 5:00 pm - Instructors: David Kelley, Kelley and Associates Environmental Sciences, Inc.; Richard Herriman, Kelley and Associates Northwest. This course provides an overview of soil science and soil geomorphology principles and their relationship to successful ecological restoration analysis and design. Designed for soils-challenged professionals who work in systems where a basic understanding of soils is necessary it is specifically directed toward restoration-ists, landscape architects, biologists, and others who regularly make decisions involving soil behavior, natural soil units, degree of disturbance of landscapes, remediation of difficult sites, and stability of natural landscape positions for restoration planning. The class will include a notebook and a short field walk to look at soils of the urban landscape..

Space is limited for all workshops. Pre-registration is required.
7:00 - 8:00 am Check-in for morning and all-day

SERCAL/CNGA '97 CONFERENCE REGISTRATION FORM

To register, complete a separate form for each registrant. Please PRINT.
Please use the seperate forms on following pages of this issue to register for field trips and workshops.

Name _____

Affiliation _____

Address _____

City, State Zip _____

Phone, Day & Evening _____

(This is vital should we need to contact you regarding changes)

EARLY CONFERENCE REGISTRATION

Current SERCAL ☐ CNGA ☐ SLO County Parks ☐ ..... $80.00 _____

All Others ..... $100.00 _____

*Registration deadline is **Monday, September 15, 1997.** Registrations postmarked after this date will be returned and you may register at the conference. Late registration fees will be $100.00 for members and $120.00 for non-members. No refunds will be issued after September 15, 1997.*

POSTER & MERCHANDISE DISPLAY

Commercial ..... $100.00 _____

Non-Profit Organization ..... $20.00 _____

Thursday's BBQ LUNCHEON (included with registration) ☐ Vegetarian ☐ Carnivore

TOTAL to be ENCLOSED with REGISTRATION FORM..... $ _____

Please make check payable to SERCAL and mail c/o Susan Clark, 2701 20th Street, Bakersfield, CA 93301
For further information call the SERCAL office (805) 634-9228

SERCAL's Sixth Annual Meeting -- Conference Schedule

Jointly sponsered by California Native Grass Association

Wednesday Oct. 22, 1997

7:30 - 8:50 **Registration & Poster Set-up**

8:50 - 9:00 **Welcome** - Greg Sutter, SERCAL President & Edith Read, SERCAL President-Elect

9:00 - 11:00 **Plenary Session**: Diana Jacobs, Moderator
Water and Restoration in the 21st Century: Issues of the Sacramento-San Joaquin Delta
Keynote Speaker: Marc Reisner, author of *Cadillac Desert*
Panel Presentation: Dick Daniel, CalFed; Margrit Aramaru, Executive Director, Delta Protection Commission; Bruce Herbold, Environmental Protection Agency

11:00 - 11:15 **Break**

11:15 - 12:00 **Open discussion**

12:00 - 1:30 **Lunch**

1:30 - 3:00 **Panel Presentation & Discussion**: Gail Newton, CA Department of Conservation, Moderator
Funding Opportunites for Restoration
Paul Roggensack & Ken Harris, State Water Resources Control Board; Cherly McGovern, U.S. Environmental Protection Agency; Carrie Shaw, California Department of Fish and Game; Scott Clemons, Wildlife Conservation Board; Earle Cummings, Water Resources Wetlands Coordinator; Reed Holderman, Coastal Conservancy

3:00 - 3:15 **Break**

3:15 - 5:00 **Concurrent Sessions**

Session 1
Creative Community Partnering for Restoration
Sue Gardner, Chair

From Theoretical to Practical: Integrating College Students into Habitat Restoration, Ed Bedecarrax, City College of San Francisco

Riparian Restoration through Conservation Easement, Breck McAlexander, Kern River Preserve

Ten Year Retrospective on the El Segundo Blue Butterfly Habitat Restoration Area at the Los Angeles/El Segundo Dunes, Irena Nendez, Steven Patterson, Marie Campbell, Sapphos Environmental

The Ecological Restoration Culture: the New Naturalists, Craig C. & Susan Dremman, The Reveg Edge

Integrating GPS Locational Data in A GIS for Ecological Restoration, William Bushing, Santa Catalina Island Conservancy

General Trends for Building Partnerships in the Future, Sharon Farrell, Natural Resource Specialist, Golden Gate National Recreation Area

Resource Based Education - Transforming High School Students into Stewards through Ecological Restoration, Steve Hagler, Teacher, Galileo High School, San Francisco

Session 2
Riparian & Freshwater Wetland Restoration
Ken Reiller, Chair

Fish Friendly Farming: Creating a Market-based Incentive Program for Grapegrowers & Restoration in the Russian River Watershed, Laurel Marcus, Laurel Marcus & Associates

Biotechnical Bank Stabilization on the Petaluma River, Richard Nichols, EIP & Associates

Evalutation of Instream Structures to Improve Steelhead Trout (Onchorynchus mykiss) Habitat, Neil S. Lassettre, UC Berkeley

Mist Netting as a Tool in Revegetation Monitoring. Christopher D. Otahal, Coyote Creek Riparian Station

Building Freshwater Marshes, John Zentner, Zentner & Zentner

The Feather River Coordinated Resources Management Group Stream Rehabilitation Program, Rob Russell, Jim Wilcox, the Plumas Corporation

Session 3
Mined & Arid Lands Restoration
John Coy, Chair

Lower Cost Techniques for Road Revegetation on Desert Tortoise (Gopherus agassisii) Habitat in the Western Mojave, Daniel Patterson, Round River Ecological Services

Recovery of a Population of Hoover's Eriastrum Following Pipeline Construction, Beth Hendrickson, CA Department of Water Resources

Mojave & Colorado River Perennial Native Grassland Conversion within Historic Times, Craig Dremann, the Reveg Edge

Breeding Saltgrass for Land Restoration & Erosion Control, J.L. Thomas, S & S Seeds

Potluck: Desert Restoration Revisited at Joshua Tree National Park, Jane Rodgers, Joshua Tree National Park

5:00 - 6:00 **Poster Session -- Poster authors will be available during this time period to answer questions.**

Thursday, October 23, 1997

7:30 - 8:30 Registration & Poster Session

8:30 - 12:00 Plenary Session: CNGA Mark Stromberg, Moderator *Importance of Local Genetics in Restoration*
Lessons from the World of Commercial Forestry, Jay Kitzmiller, U.S. Forest Service Genetic Resource Center
Genetic Considerations in Native Grasses, Kevin Rice, UC Davis Dept. of Agric. & Natural Resources
Scope and Status of Native Grass Use and Research, Robert Peyton, UC Davis
California Brome Common Garden, David Amme, California Department of Parks and Recreation
National Native Ecotype Registry, Craig Dremman, The Reveg Edge
Plumas Forest-Wide Common Garden Study, Linnea Hanson, Plumas National Forest
Ecology of a One-Acre Grassland: Insights on Restoration and Community, David Self
Genetic Structure in Native Grasses: Implications for Restoration of Elymus glaucus and Bromus carinatus, Valerie Hipkins, USDA Forest Service, National Forest Genetic Electrophoresis Laboratory

12:00 - 1:30 Barbeque Luncheon -- Sponsored by SERCAL, California Native Grass Association & San Louis Obispo County. Open to all registered participants. **Cost included in registration fee.**

1:30 - 3:00 **Concurrent Sessions**

Session 1
Oak Woodlands: Protection Enhancement, and Creation
Pam Muick, Chair

Oak Woodland Restoration on the Coast-al Branch Pipeline, Jonathan Oldham, CA Dept. of Water Resources

Revegetation & Restoration for a Eucalyptus Removal Project, Jennifer Langford, Cal Poly San Luis Obispo

Competitive Effects of Intercropping of Alfalfa with Valley Oak and Blue Elderberry Seedlings, Jean G. Hubbell, Dept. of Biological Sciences, CSU Chico

Holistic Grazing Management: a Tool to Enhance & Restore Native Oak Woodland & Perennial Grassland Habitat, Joseph O. Morris, Rancher, San Juan Batista

Restoration of Maritime Chaparral, Coast Live Oak Woodland & Pismo

Clarkia at Black Lake Canyon, San Louis Obispo Co., Brooke Langle, Dept. of Biological Sciences, Cal Poly San Luis Obispo

Restoration of Oak Woodland at Rocky Canyon Quarry, San Luis Obispo Co., V.L. Holland, Dept. of Biological Sciences, Cal Poly San Luis Obispo

Session 2
Disturbance Ecology & Restoration Sustainability
Verna Jigour, Chair

Cry Guadalupe Island, David Amme, California Department of Parks and Recreation

Native Grasses, Mycorrhizae, and Soil-Surface Processes Restore Ecosystem Function, Ted St. John, Tree of Life Nursery

Perscribed Burning by Edict, Stephen Bakken, California Department of Parks and Recreation

Disturbance Management at Fort hunter-Liggett, Heinz Hormann, Environmental Protection Supervisor, Fort Hunter-Ligett

Stream Channel Maintenance as Controlled Disturbance: the Application of Disturbance Ecology to Maintenance of Multi-Objective Flood Control Projects, Larry Fishbain, Environmental H_20logy

Flooding Promotes Sustainability of Riparian Forest Restoration of the Sacramento River, F. Thomas Griggs, the Nature Conservancy

Session 3
Rehabilitation & Restoration of Off-Road Vehicle Impacts
Carrie Shaw, Chair

Program Under Development

3:00 - 3:15 **Break**

3:15 - 4:30 **Open Forum:** Edith Read, Chair *Curricula for Restoration Technician Certification*

4:30 - 6:00 SERCAL Board Meeting and Announcement of New Officers -- All are welcome to attend.
CNGA Business Meeting to be arranged

Restoration as Process through Philosophy, Ecology and Community

San Luis Obispo Lodgings Directory

Courtesy of San Luis Obispo Chamber of Commerce

Name	Address	Phone (805)	Toll Free (800)	Rates	/Amenities
Adobe Inn	1473 Monterey	549-0321	676-1588	2	BKWT
Apple Farm Court	2055 Monterey	544-2040	374-3705	3	FPRSTZ
Apple Farm Inn	"	" "	3AFHOPRST		
Budget Motel	345 Marsh	543-6443	458-8848	2	BHTZ
Coachman Inn	1001 Olive	544-0400		1	PT
Embassy Suites	333 Madonna	544-0800	864-6000	3	ABHPRSTZ
Holiday Inn Express	1800 Monterey	544-8600	465-4329	3	BHPRSTZ
SLO Coast Hotel	1292 Foothill	544-4678		1	DKT
Howard Johnson Lodge	1585 Calle Joaquin	544-5300	654-2000	2	DHPRT
La Cuesta Inn	2074 Monterey	543-2777	543-2777	3	BHPST
Lamplighter Inn	1604 Monterey	547-7777	547-7787	2	BKPSTWZ
Los Padres Motel	1575 Montrey	543-5017	543-5090	2	BTW
Madonna Inn	100 Madonna	543-3000	543-9666	3	SRTZ
Mid-Town Motel	475 Marsh	543-4533		2	PT
Motel 6	1433 Calle Joaquin	549-9595	466-8356	1	DHPT
Olive Tree Inn (Best Western)	100 Olive	544-2800	777-5847	2	HKPRT
Peach Tree Inn	2001 Monterey	543-3170	227-6396	2	TB
Quality Suites	1631 Monterey	541-5001	228-5151	3	ABHPSTZ
Royal Oak (Best Western)	214 Madonna	544-4410	545-4410	2	ABDHPRST
Sands Suites & Motel	1930 Monterey	544-0500	441-4657	2-3	ADHPTZ
Somerset Manor (Best Western)	1895 Monterey	544-0973	528-1234	2	HPRSTZ
Sunbeam Motel	1656 Monterey	543-8141		1	HTW
Super 8 Motel	1951 Monterey	544-7895	800-8000	2	KPT
Travelodge, SLO	1825 Monterey	543-5110	578-7878	2	DHPT
Travelodge, South	950 Olive	544-8886	"	2	HKSTWZ
Vagabond Inn	210 Madonna	544-4710	522-1555	2	ABDPRTZ
Villa Motel	1670 Monterey	543-8071	554-0059	2	BPTW

RATE CODES (Averages) : 1 = under $35, 2 = $35 - $70, 3 = $70 and up

AMENITIES:

A = Airport Shuttle	H = Handicapped Access	S = Spa
B = Breakfast	K = Kitchenette	T = Telephone
D = Pets	P = Pool	W = Weekly
F = Fireplace	R = On-site Restaurant	Z = Suites

WORKSHOP REGISTRATION

Please write a separate check for the workshop and include it with your Conference registration. In the event that a workshop is filled, we can return your check without affecting your Conference registration. Thank you for your cooperation.

Name _____

(note: if more than one person is participating, name should be the contact person for the group)

Address _____

City, State Zip _____

Phone, Day & Evening _____

(This is vital should we need to contact you regarding changes)

Please check your affiliation Current SERCAL ☐ CNGA ☐ SLO County Parks ☐

☐ *California Grassland Restoration/Reconstruction Techniques ..... $50.00 members ..... $75.00 non-members*

☐ *Using Perscribed Fire for Vegetation Management ..... $50.00 members ..... $75.00 non-members*

☐ *Aquatic Ecology & Water Quality Monitoring ..... $75.00 members ..... $100.00 non-members*

☐ *Soils & Geomorphology: the Basics for Ecological Restoration ..... $100.00 members ..... $125.00 non-members*

☐ *Revegetation & Restoration Planning: the Basics ..... $130.00 members ..... $155.00 non-members*

(This all day workshop includes lunch. Do you prefer vegetarian?)

_____ *people x $* _____ *workshop fee for SERCAL, CNGA or SLO County Parks = $* _____

_____ *people x $* _____ *workshop fee for non - members = ... $* _____

TOTAL Enclosed for Workshop Fees ..... $ _____

Please make check payable to SERCAL and mail c/o Susan Clark, 2701 20th Street, Bakersfield, CA 93301
For further information call the SERCAL office (805) 634-9228

Field Trips Highlight SLO Restoration Projects

The following field trips will be offered on Friday, October 24. Register early — space is limited to 20 people per trip and registrations will be accepted in the order they are received. All trips leave the Veteran's Building at 8:00 am and return at 2:00 pm, except for the Vandenberg trip which returns at 4:00 pm.

Morro Bay Watershed Restoration - Leaders: Allyson Biskner, San Luis Obispo County Department of Parks and Recreation; Mary Reents, Morro Group. This trip will visit Chumash Creek, Walters Creek, Chorro Flats, and Montana de Oro, all of which are within a short drive of the conference center. Chumash and Walters Creek are being studied in a Paired Watershed design to evaluate the effectiveness of Best Management Practice (BMP) implementation in improving water quality. These sites focus on the use of Rapid Bioassessment techniques, cattle exclusion, and revegetation. Chorro Flats, channelized and leveed, is a floodplain restoration and sediment retention project. Montana de Oro features mitigation/restoration of coastal dune scrub, coastal sage scrub, and manzanita chaparral.

Restoration of Oak Woodland - Leader: Tom Balkow, California Department of Water Resources. A trip to two sites addresses construction impacts resulting from the State Water Project in Santa Barbara County. Approximately 8700 oaks have been planted as part of this project, with the goal being a total planting of 11,000. Tom will discuss the techniques, successes, and failures of restoration efforts for valley oak, blue oak, and interior/coastal live oak.

Restoration and Wildlife Conservationon Vandenberg Air Force Base - Leaders: Chris Gillespie (VAFB Botanist), Nancy Read (VAFB Wildlife Biologist). Asst: Edith Read, Psomas and Associates. Vandenberg AFB encompasses one of the largest, most diverse natural landscapes in coastal southern California. Restoration and natural resource management of VAFB addresses impacts from grazing, missile launches, vehicles, and illegal public entry. Bring binoculars and camera to view natural areas generally inaccessible to the public. Chris will discuss the restoration of dunes, wetlands, and coastal sage scrub. Nancy will highlight the tour with a discussion of bird life, wildlife conservation, and management issues. The bus ride will be up to 1.5 hour each way — well worth the scenic drive!

Please indicate your society affiliation when registering. If you are willing to go on a trip that is not your first preference indicate by number your order of preference.

FIELD TRIP REGISTRATION

Please write a separate check for the field trip and include it with your Conference registration. In the event that a field trip is filled, we can return your check without affecting your Conference registration. Thank you for your cooperation.

_____ ***Morro Bay Watershed*** _____ ***Restoration of Oak Woodland***

_____ ***Restoration & Wildlife Conservation on Vandenberg Air Force Base***

Name _____

(note: if more than one person is participating, name should be the contact person for the group)

Address _____

City, State Zip _____

Phone, Day & Evening _____

(This is vital should we need to contact you regarding changes)

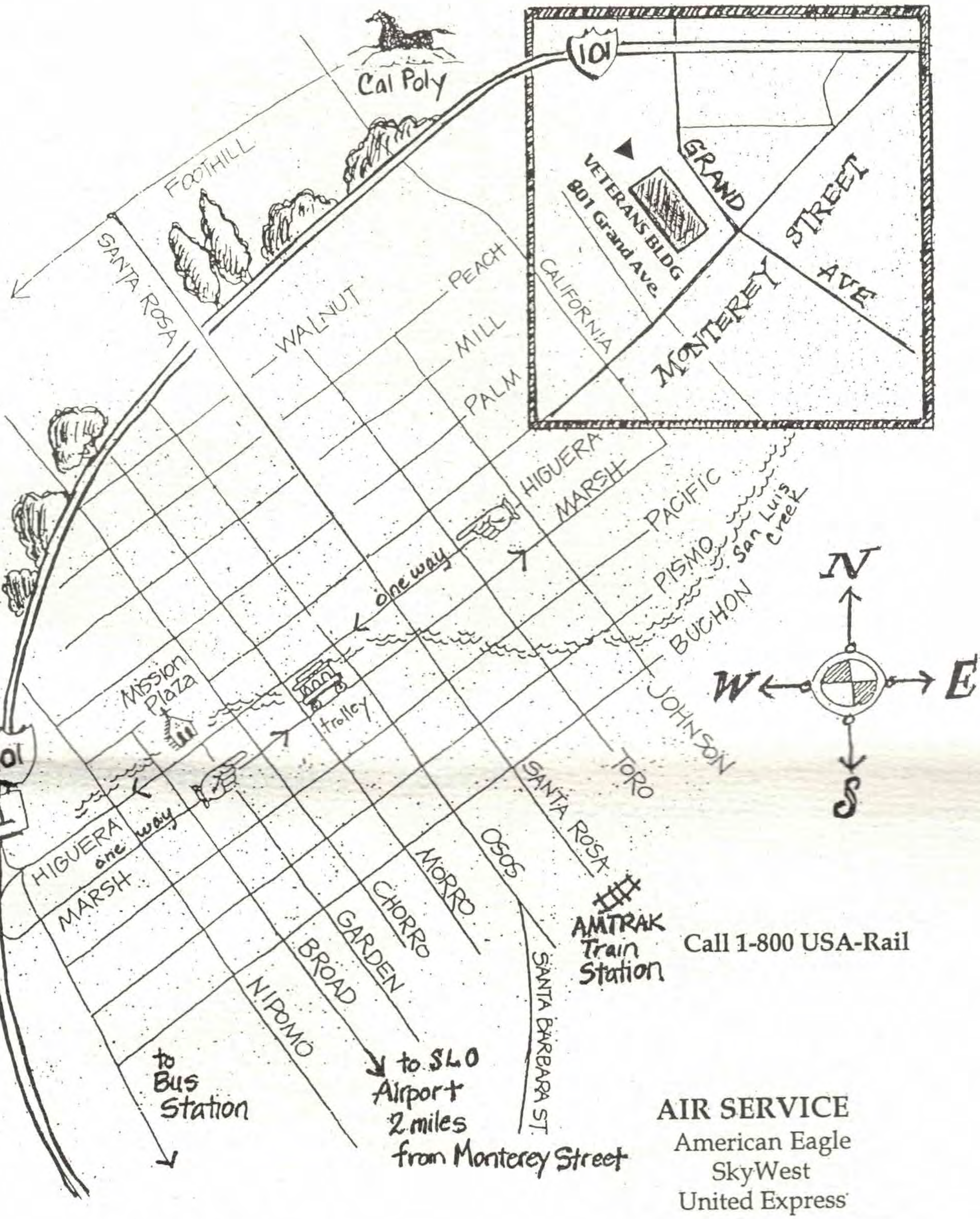
Current SERCAL ☐ CNGA ☐ SLO County Parks ☐..... _____ people x $25.00/person = _____

Non members ..... _____ people x $30.00/person = _____

TOTAL enclosed for Field Trip Registration ..... _____

All field trip fees include transportation and a box lunch. Vegetarian preferred? ☐

Please make check payable to SERCAL and mail c/o Susan Clark, 2701 20th Street, Bakersfield, CA 93301
For further information call the SERCAL office (805) 634-9228



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Benefits: Regular, Student, Retired, or a business on a Regular Membership--1 person at member rates at functions; Family, Commercial or Associate--all members of group@member rates.

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