United States
Department of
Agriculture

Soil
Conservation
Service

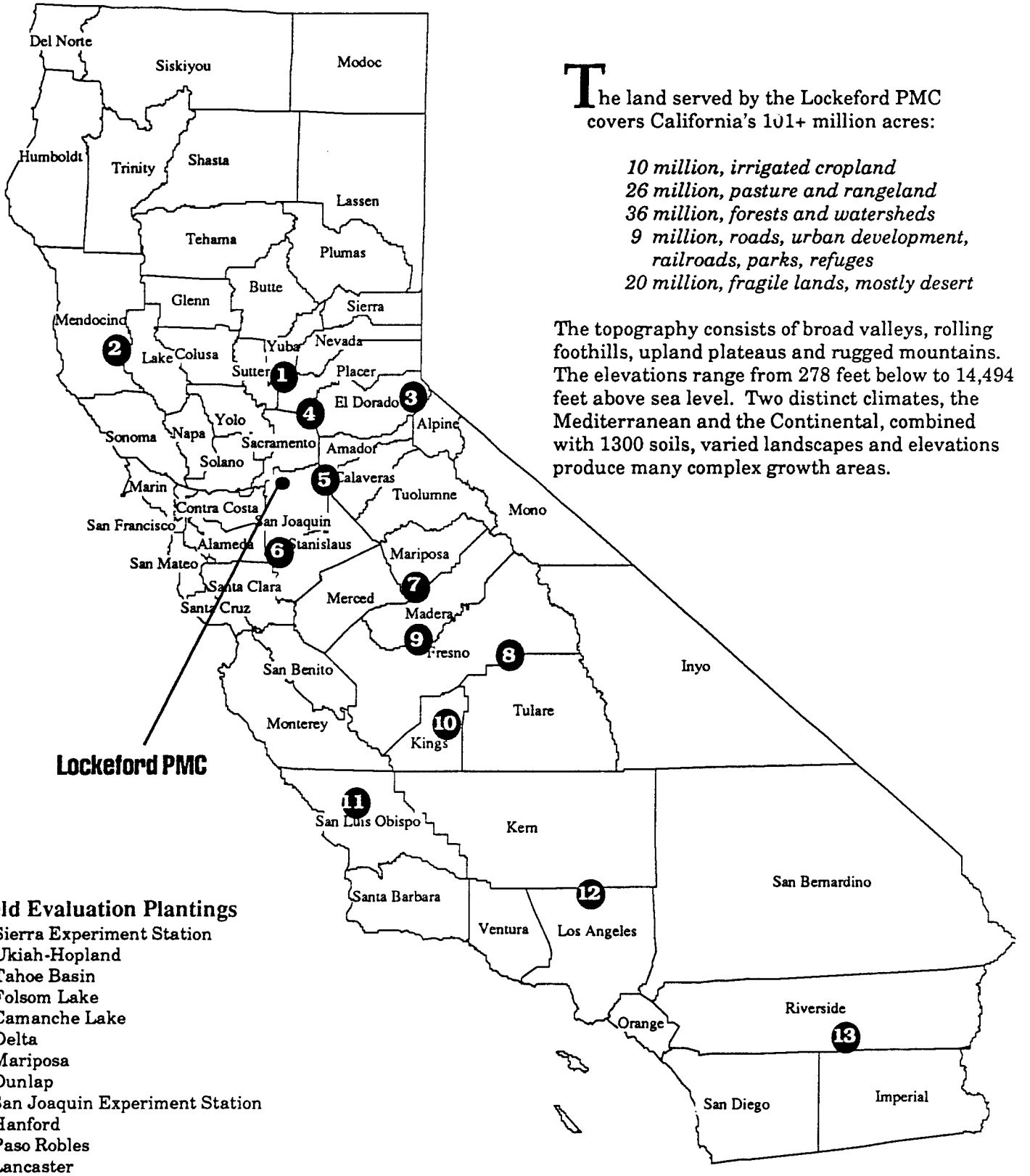
Lockeford
California

1984-1990

TECHNICAL REPORT

Lockeford Plant Materials Center

PMC Service Area



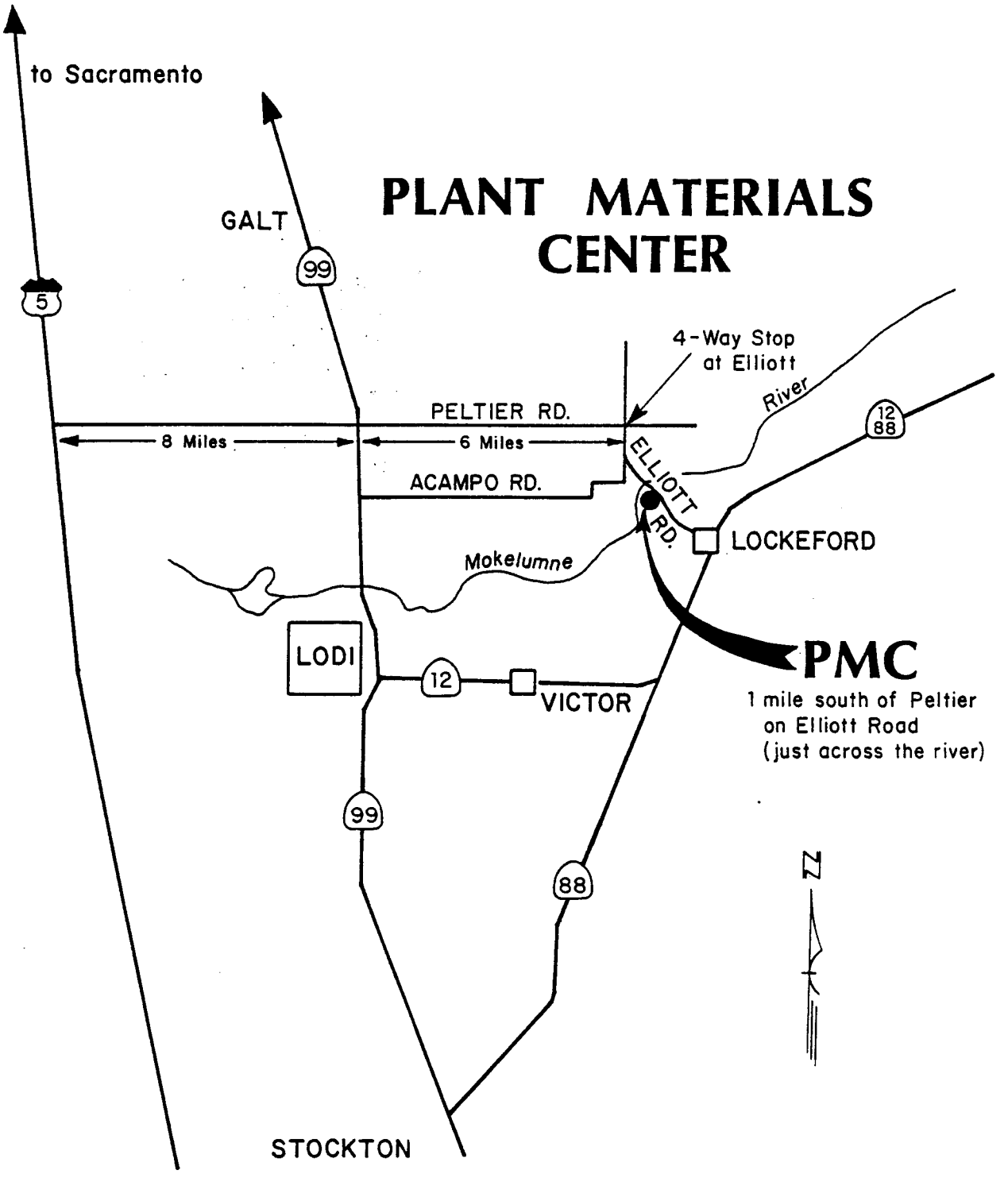
The land served by the Lockeford PMC covers California's 101+ million acres:

10 million, irrigated cropland
26 million, pasture and rangeland
36 million, forests and watersheds
9 million, roads, urban development, railroads, parks, refuges
20 million, fragile lands, mostly desert

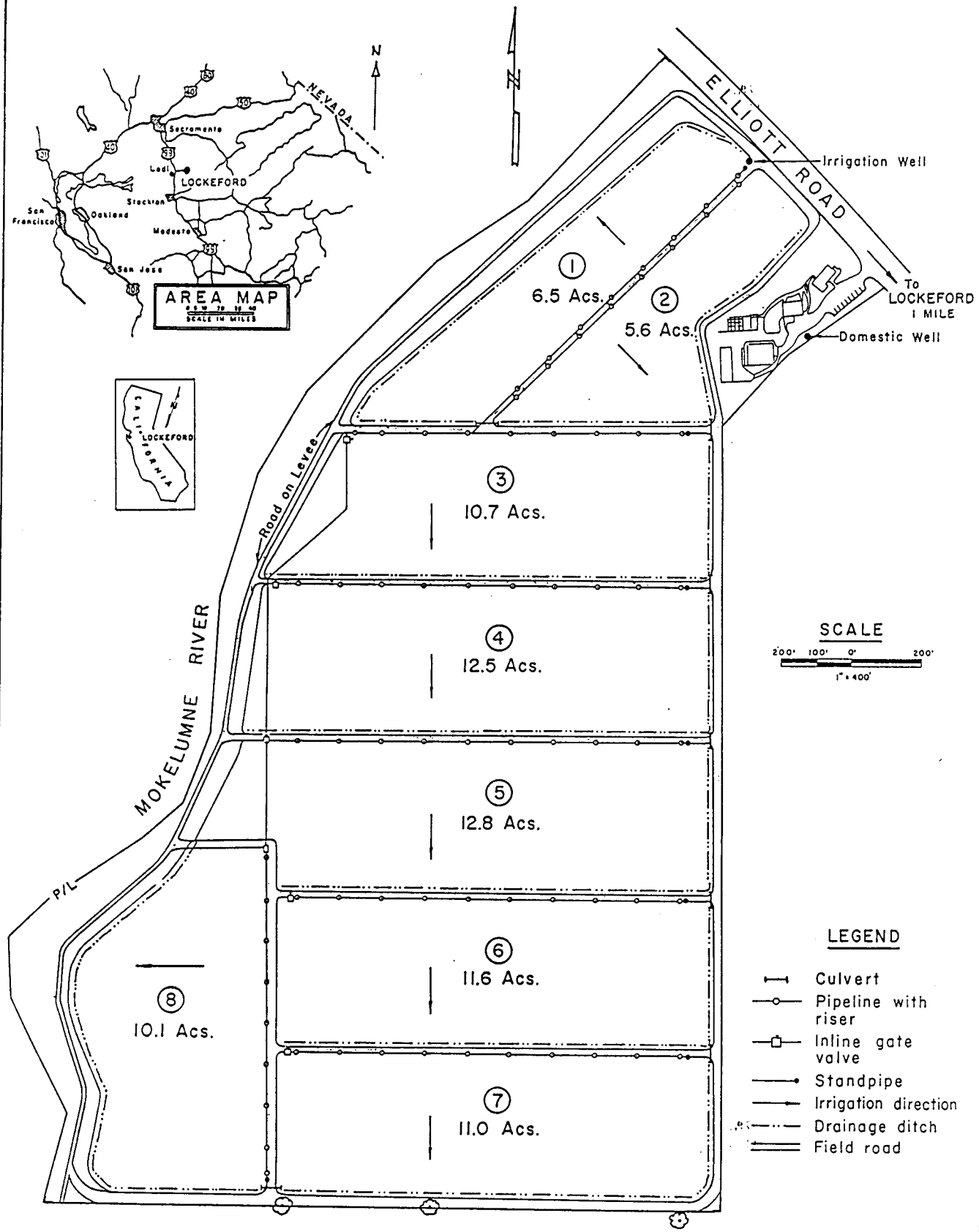
The topography consists of broad valleys, rolling foothills, upland plateaus and rugged mountains. The elevations range from 278 feet below to 14,494 feet above sea level. Two distinct climates, the Mediterranean and the Continental, combined with 1300 soils, varied landscapes and elevations produce many complex growth areas.

Field Evaluation Plantings

1 Sierra Experiment Station
2 Ukiah-Hopland
3 Tahoe Basin
4 Folsom Lake
5 Camanche Lake
6 Delta
7 Mariposa
8 Dunlap
9 San Joaquin Experiment Station
10 Hanford
11 Paso Robles
12 Lancaster
13 Palm Springs



Location Map



U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LOCKEFORD PLANT MATERIALS CENTER

LOCKEFORD, CALIFORNIA

LOCKEFORD PLANT MATERIALS CENTER
TECHNICAL REPORT
1984 - 1990

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This is a preliminary report of results from the Lockeford Plant Materials Center Activities; these results may change with continued investigations. Written authorization must be obtained from the authors before publishing data from this report.

Trade names are used solely to provide specific information and should not be considered a recommendation or endorsement by the Soil Conservation Service.

All programs and assistance of the Soil Conservation Service are available without regard to race, color, religion, sex, age, marital status, handicap, or national origin.

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INTRODUCTION

INTRODUCTION

The Lockeford Plant Materials Center (PMC) is a federally operated facility under the administration of the California State Office of the Soil Conservation Service. The Lockeford PMC produces plant material in cooperation with the California Resource Conservation Districts. The Lockeford PMC has cooperative agreements and or contracts for the development of plants and cultural techniques with: the University of California Agricultural Cooperative Extension, the California Department of Fish and Game, the California Department of Food and Agriculture, the California Department of Transportation, the California Department of Forestry, the United States Department of Defense, Naval Air Station, Lemoore, and the National Park Service, Yosemite National Park.

The plant materials program began February 1935 with the SCS Plant Materials Nursery at Santa Paula, California. In 1939 a 60-acre Plant Materials Center was established at Pleasanton, California. In September 1972 the Pleasanton PMC was moved to the current site at Lockeford.

The Lockeford Plant Materials Center is 106.7 acres of prime farmland located along the Mokelumne River near Lockeford, California. Irrigation water is available to all fields at the PMC. Initial and advanced evaluations of new plant materials are tested at this site. The Lockeford PMC is also responsible for seed increase plantings of potentially valuable plant species and for the maintenance of seed stock of California cooperative releases. Field Evaluation Plantings (FEPs) are conducted off the Center at problem sites in cooperation with federal, state, municipal agencies, and private individuals. From 1984 to 1990 the Lockeford PMC has had approximately 14 Field Evaluation Plantings, 7 seed increase plantings of potential releases and 14 seed increases of California releases.

PERSONNEL

The following personnel were located at the Lockeford PMC during the period of 1984 to 1990.

Position	Name	Start	End
Manager	Raimond Clary	10-02-83	01-31-87
Manager	Dave Dyer	03-03-87	Present
Asst. Manager	Gary Young	01-13-80	03-17-86
Asst. Manager	Gene Bishop	12-21-86	Present
Secretary	LouAnn Rodacker	03-19-73	Present
Farm Supt.	Clem Avitia	04-12-76	Present
Gardener	Dot Babski	06-30-81	04-15-89
Gardener	Jim Hutson	02-01-88	Present
Tractor Driver	Sal Robles	04-05-79	03-01-85
Tractor Driver	Robert Nedderman	07-85	11-86
Tractor Driver	Connie Lewis	07-05-88	06-15-90

WEATHER SUMMARY
for
1984 to 1990

The average annual precipitation is 16.0 inches. The majority of precipitation occurs from late October through March. A minor portion of our precipitation occurs from April through May. The average daily temperature is 57.4°F and the high daily average was 60.8, occurring in 1984. The average high temperature is 102.2°F with a high of 109°F occurring 7-18-88. The average low temperature is 22.8°F with a low of 18°F occurring 2-7-89 and 12-24-87. The highest temperature ever recorded was 114°F on July 14, 1972 and the lowest temperature ever recorded was 16°F on January 11, 1949. The growing season is based on a temperature of 32°F and may be as short as 200 days or as long as 275 days, but the average is 270 days in the western part of the county and increasing to 300 days in the eastern part of the county.

CONSERVATION PLANTS

Released by the Lockeford PMC

'Lassen' bitterbrush	Purshia	tridentata	1984	9033486
'Panoche' red brome	Bromus	rubens	1985	487414
'Sierra' sulphur flower buckwheat	Eriogonum	umbellatum	1987	421013
'Altura' greenleaf manzanita	Arctostaphylos	patula	1989	9041129
'Maleza' mountain whitethorn	Ceanothus	cordulatus	1989	9006521

INITIAL

EVALUATION

PLANTINGS

CRITICAL AREA PLANTING

Lockeford PMC

Elymus glaucus

Introduction

In 1986 an Initial Evaluation Planting (IEP) of *Elymus glaucus*, blue wildrye, was made at the Lockeford Plant Materials Center(PMC). The purpose of this *IEP* was to find a blue wildrye adapted to Major Land Resource Areas (MLRAs) 5, 15, 18, and 22. This is a California native perennial grass which could be used for critical area stabilization.

Elymus glacus, blue wildrye, is a tufted perennial grass found throughout California below 8,500 feet; common in the foothills and lower mountain slopes, usually in association with open stands of oak and conifers. In open areas, blue wildrye seldom occurs in any kind of a stand. As a forage grass the species is useful early in the season, but becomes too "stemmy" later on.

Materials and Methods

Approximately 34 collections were made and planted in field 3. The soil is a Columbia fine sandy loam, with a fine sandy loam surface and a silt loam subsurface. This is a poorly drained soil with an AWC of 0.085 to 0.125 in./in.

The plot design is a single-row, nonreplicated plot with each plot being 20 feet long and with 5 feet between rows. Plants were established in the greenhouse in Jiffy pots and then planted in the field. This IEP was evaluated for one year before being partially destroyed by mistake.

Results

In 1987, this planting was reduced to 4 accessions which showed promise in vigor and seed production. These accessions will later be moved into Field Evaluation Plantings for further observation. The final 4 accessions are:

Elymus glaucus	9032907
Elymus glaucus	9032970
Elymus glaucus	9032895
Elymus glaucus	9033078

WINDBREAK PLANTING

Lockeford PMC - Field 5

Introduction

In the years 1979, 1980, and 1981 an Initial Evaluation Planting for windbreaks was established at the Lockeford Plant Materials Center. Most of the trees and shrubs used in this planting were commercially available species being evaluated for their adaptability to the Mediterranean climate of the central valley (MLRA 17). Windbreaks are used to control wind erosion on cropland and protect farmsteads.

Materials and Methods

There were approximately 75 accessions planted in field 5 over 3 years. The soil is a Columbia fine sandy loam, with a fine sandy loam surface and a silt loam subsurface. This is a poorly drained soil with an AWC of 0.085 to 0.125 in./in.

The plot design is a single-row, nonreplicated plot with 10-12 feet between trees and 20 feet row spacing. The number of trees per accession was 10 or 6 and they were planted by hand. This Initial Evaluation Planting will be evaluated for 15 years in order to determine longevity, health, and vigor of best performing accessions.

Results

Although this Initial Evaluation Planting is no longer being evaluated, we are continuing to observe this planting. In 1988, accessions which were not performing according to standards were removed. There are 31 accessions remaining and this number will be reduced again in the near future. The remaining accessions are:

Cork oak	Quercus	suber	9018224
Coulter pine	Pinus	coulteri	9018210
Monterey pine	Pinus	radiata	9018213
Coast redwood	*Sequioa*	sempervirens	9018239
Osage orange	Maclura	pomifera	9018203
Catalina ironwood	Lyonothamnus	floribundus	9018202
Deodar cedar	Cedrus	deodara	
Guadalupe Cypress	Cupressus	guadalupensis	
Leyland cypress	Cupressocyparis	leylandii	
White ash	Fraxinus	americana	9026970
Green ash	Fraxinus	lanceolata	9026971
Eastern redcedar	Juniperus	virginiana	9026974
Ponderosa pine	Pinus	ponderosa	9007381
Sargents cypress	Cupressus	sargentii	9033263
Yellow pine	Pinus	echinata	907380
Bishop pine	Pinus	muricata	9021103
Italian stone pine	Pinus	pinea	9009012
Ponderosa pine	Pinus	ponderosa	9007382
Little-leaf Linden	Tilia	cordata	9027000
Poplar	Populus	hybrid	9006435
Poplar 'Jacometti'	Populus	euramericana	9042520
Poplar 'Caudina'	Populus	euramericana	9042518
Poplar 'Incrassata'	Populus	euramericana	9042519
Poplar 'Imperial'	Populus	canadensis	432347
Poplar 'Lombardy'	Populus	nigra italica	9042522

Russian olive 'King Red'	Elaeagnus	angustifolia	434029
Amur maple 'Flame'	Acer	ginnala	483442
Crabapple 'Roselow'	Malus	baccata	9005026
Eucalyptus	Eucalyptus	gunnii	9043455
Skunkbush Sumac 'Bighorn'	Rhus	trilobata	9004646

WINDBREAK PLANTING

Antelope Valley, RCD Nursery

Lancaster, CA

Introduction

In the years 1980, 1981, and 1982 an Initial Evaluation Planting for windbreaks was started at Lancaster (Antelope Valley RCD Nursery). Most of the trees and shrubs used at Lancaster were commercially available species being evaluated for their adaptability to the high desert area (MLRA 29,30). This area is known for its extremes in temperature (20°F - 105°F) with a low of 5°F and a high of 115°F.

Materials and Methods

There were approximately 60 accessions planted at Antelope Valley RCD Nursery over 3 years. The soil is a Greenfield sandy loam with a coarse sandy loam surface. This is a well drained soil with an AWC of 0.12 - 0.15 in./in.

The plot design is a single-row, nonreplicated plot with 10-12 feet between trees and 20 feet row spacing. The number of trees per accession was 10 or 6 and they were planted by hand. This planting was cultivated, fertilized, watered, and pruned by employees of the Antelope Valley RCD. This Initial Evaluation Planting will be evaluated for 15 years in order to determine longevity, health, and vigor of best performing accessions.

Results

This initial evaluation was originally to be evaluated until 1992, but after consulting with people in the Lancaster area, it was decided to continue evaluation until 1997. This decision was made because some of the best performing species may be short-lived and not suited for long-lived windbreak use. The best performing species at this time are:

Honey locust	Gleditsia	triacanthos	9021089
Aleppo pine	Pinus	halepensis	9021100
Chinese pistache	Pistache	chinensis	9021106
Black locust	Robinia	pseudoacacia	9021109
Deodar cedar	Cedrus	deodara	9021084
Arizona cypress	Cupressus	arizonica	9021085
Leyland cypress	Cupressocyparis	leylandii	9026957
Brutia pine	Pinus	brutia	9021097

WINDBREAK PLANTING

Desert Water Agency

Palm Springs, CA

Introduction

The study was undertaken in 1979 to evaluate the effectiveness of selected trees and shrubs for wind erosion control, noise abatement, dust control, beautification and screening.

Blowing sand damages agricultural land, residential and commercial land and buildings, vehicles, trailers, traffic signs, railroad tracks, and utility poles. It fills drainage ways and plugs culverts and bridges. It accumulates in roads, drive-ways, yards, carports, and patio areas. Various high value crops grown in the area are also severely affected by wind erosion unless protected by adequate wind barriers. The objectives of this project are to assemble, develop, select, and demonstrate vegetative materials that can provide multiple use benefits, i.e., wind erosion control, noise abatement, dust control, beautification, and screening. It is also planned to determine water requirements of the most effective plants.

Materials and Methods

The plantings are on land owned by the Desert Water Agency which is located in the SE 1/4 SE1/4 Sec. 35 T33S R4E. The soil at this site is *Carsitas* gravelly sand, 0-5 per cent slope. Test plants will be evaluated for 20 years to adequately determine the adaptability of the species. The spacing between rows is 15 to 20 feet and within row is: 4 feet for shrubs, 8 feet for small trees, 8 feet for junipers, 10 feet for large conifers, and 12-14 feet for broadleaf trees. Weed control will be done by the Indio Field Office with help from the Desert Water Agency. The Desert Water Agency will maintain and use a drip irrigation system.

Results

A 5-year report was made by the Soil Conservation Services (SCS) and the Desert Water Agency (DWA) in 1986. At this time the species considered the best performers for wind erosion are listed in this section. The SCS and DWA will complete a 10-year report in the near future.

During 1989 there was a realignment of responsibilities for the southern California desert. This area, MLRA 30 and 31, is now part of the Tucson PMC service area. All information and evaluation data on this project has been given to the Tucson PMC.

1986 Plant Selection

Evergreen Trees

- Cupressus arizonica
- Elaeagnus angustifolia
- Eucalyptus camaldulensis
- Eucalyptus polyanthemos
- Eucalyptus rudis
- Eucalyptus viminalis
- Olea europea
- Olneya tesota
- Rhus lancea
- Schinus molle
- Tamarix aphylla

Deciduous Trees

Fraxinus uhdei

Morus alba

Parkinsonia florida

Platanus racemosa

Ziziphus zizyphus

Evergreen Shrubs

Baccharis sarothroides

Dondonaea viscosa

Leucophyllum frutescens

Rosmarinus officinallis

Vauquelinia californica

PLANTS ORIGINALLY PLANTED AT

PALM SPRINGS

Scientific Name	Common Name
Encelia virginensis	Virgin river encelia
Chrysothamnus nauesosus	Rubber rabbitbrush
Atriplex polycarpa	Allscale (desert) saltbrush
Altriplex glauca	
Atriplex canescens 'Marana'	Fourwing saltbrush
Eucalyptus microtheca	Flooded boc
Casuarina cristata	
Casuarina helmsii	Helmsii she-oak
Baccharis sarothroides	Desert broom
Cassia wislizenii	Shrubby senna
Casuarina glauca	Swamp she-oak
Chaenomeles japonica	Japanese flowering quince
Chilopsis linearis	Desert willow
Larrea tridentata	Creosote bush
Rhus ovata	Sugar bush
Simmondsia chinensis	Jojoba (goat-nut)
Ceitis occidentalis	Western hackberry
Lycium cooperi	Cooper wolfberry
Maclura pomifera	Osage orange
Salazaria mexicana	Common bladdersage
Celtis reticulata	Net-Leaf hackberry
Parkinsonia aculeata	Mexican palo verde (Horse Bean)

Scientific Name	Common Name
Cupressus arizonica	Arizona cypress
Olea europaea	European olive
Olneya tesota	Desert ironwood
Vauquelinia californica	Arizona rosewood
Prosopis chilensis	Chilean mesquite
Franseria deltoidea	Triangle bursage
Eucalyptus viminalis	Manna gum
Eucalyptus rudis	Desert gum
Grevillea robusta	Silk oak
Pinus eldarica	Eldarica pine
Pinus halepensis	Aleppo pine
Platanus racemosa	California sycamore
Zizyphus jujuba	Chinese jujube
Morus alba	Fruitless mulberry
Pistacia vera	Pistachio
Populus fremontii	Fremont cottonwood
Franxinus uhdei	Evergreen ash
Pistachia chinensis	Chinese pistache
Eucalyptus polyanthemos	Silver dollar gum
Eucalyptus camaldulensis v. rostrata	River red gum
Eucalyptus pulverulenta	Silver mountain gum
Dalea wizlizenii	
Parthenium argentatum	Guayule
Lophocereus schottii	Oldman cactus

Scientific Name	Common Name
Cercidium floridum	Blue Palo Verde
Rhus lancea	African sumac
Sambucus mexicana	Mexican elderberry
Schinus molle	California pepper tree
Tamarix aphylla	Athel tree
Pinus brutia	Brutia pine
Casuarina cunninghamiana	River she-oak (beefwood)
Vitex agnus-castus	Chaste tree
Grayia spinosa	Spiney hopsage
Poncirus trifoliata	Trifoliate orange
Pithecellobium flexicaule	Texas ebony
Dondonea viscosa V. purpurea	Purple hop bush
Franseria dumosa	White bursage
Caesalpinia mexicana	Mexican poinciana
Elaeagnus angustifolia	Russian olive
Eriogonum fasciculaltum	California buckwheat
Isomeris arborea 'Dorado'	Bladderpod
Leucophyllum frutescens	Texas ranger
Cassia tomentosa	Woolly senna
Nerium oleander	Oleander
Punica granatum	Pomegranate
Ehretia elliptica	Sandpaper tree
Encelia farinosa	Desert encelia
Rosmarinus officinalis	Rosemary

Scientific Name	Common Name
Atriplex nummularia	Oldman saltbush
Retama raetam	White broom
Eucalyptus camphora	
Eucalyptus woolsiana	
Eucalyptus leucoxylon V. rosea	
Eucalyptus globulus	Blue gum
Eucalyptus amphifolia	
Acacia notabilis	Golden wattle
Eucalyptus gillii	Lerp mallee
Eucalyptus platypus	'Moort'
Eucalyptus salubris	Gimlet
Eucalyptus populnea	Coolibah
Eucalyptus thozettiana	Thozet's box
Eucalyptus erythronema	Sand mallee
Eucalyptus sargentii	Salt river yate
Eucalyptus phleba	
Eucalyptus brockwayi	Dundas mahogany

BANK AND SHORELINE STABILIZATION

Lockeford PMC - Field 3

Salix Species

Introduction

In 1982 an Initial Evaluation Planting (IEP) of *Salix ssp.* was made at the Lockeford PMC. The purpose of this project was to find a willow which would meet the needs of steambank and shoreline stabilization. Native willows are needed for Major Land Resource Areas (MLRAs) 14, 15, 17, and 18.

There are 30 species of willows native to California and 27 of these are shrubs or shrub-like. Willows favor streambanks and wet or moist areas and occur from sea level to Alpine slopes.

Some of the problems to be considered when making a willow selection are: tolerance to sediment build-up, inundation, low fertility, drought, and foliage which will produce a minimum of streamflow retardance. With an estimated 55 million tons of sediment being eroded annually from streambanks and riparian and wildlife habitats being threatened, it is important to find plants which can help solve this problem.

Materials and Methods

Approximately 110 collections were made during 1981-1982 from MLRAs 14, 15, 16, 17, and 18. Collections were made along major and minor streams, moist areas, or irrigation ditches. The soils at collection sites were riverwash, tailings, streambanks, and man-made areas.

The initial evaluation was conducted at the Lockeford PMC, field 3. The soil is a Columbia fine sandy loam. The plot design is a single-row, nonreplicated plot with 5 feet between trees and 15 feet row spacing. There were 6 plants per accession and plants were planted by hand. The standards were *'Streamco'* and *'Cottetii'*. The duration of evaluation was 7 years.

Results

After 7 years of evaluation, it was determined that none of the accessions were better performers than *'Streamco'* and *'Cotteti'*.

BANK AND SHORELINE STABILIZATION

Lockeford PMC - Field 3

Cephalanthus occidentalis

Introduction

In 1982 an Initial Evaluation Planting (IEP) of buttonbush, *Cephalanthus occidentalis* was made at the Lockeford Plant Materials Center (PMC). The purpose of this project was to find a buttonbush which would meet the needs of streambank and shoreline stabilization. Native buttonbush is needed for Major Land Resource Areas (MLRAs) 14, 15, 17, and 18.

There are 6 species of *Cephalanthus* found in Asia and 2 from North America. Only one occurs in California. Buttonbush is a medium to large shrub of 3 to 12 feet high. Buttonbush favors living stream beds and wet or moist areas.

Some of the problems to be considered when making a buttonbush selection are: tolerance to sediment build-up, inundation, low fertility, drought, and foliage which will produce a minimum of streamflow retardance. With an estimated 55 million tons of sediment being eroded annually from streambanks and riparian areas and wildlife habitat being threatened, it is important to find plants which can solve the problem.

Materials and Methods

Approximately 54 accessions were collected and planted in field 3 along with the *Salix spp.* collection. The soil at this site is a Columbia fine sandy loam, with a fine sandy loam surface and a silt loam subsurface. This is a poorly drained soil with an AWC of 0.085 to 0.125 in./in.

The plot design is a single-row, nonreplicated plot with 6 feet between shrubs and 20 feet row spacing. The number of shrubs per accession is 6 and they were planted by hand. This IEP was evaluated for 5 years in order to determine longevity, health, and vigor of best performing accessions.

Results

After 5 years, 3 accessions were selected for further evaluation and were moved into a cutting block along with a few willows from Oregon. The best performing accessions are:

Buttonbush	Cephalanthus	occidentalis	9033227
Buttonbush	Cephalanthus	occidentalis	9033235
Buttonbush	Cephalanthus	occidentalis	9033236

SPECIES

IN

ADVANCED

EVALUATIONS

CRITICAL AREA PLANTING

Elymus glaucus

Introduction

Blue wildrye, *Elymus glaucus*, is a tufted perennial; culms 50-150 cm tall, erect to spreading; foliage green or glaucous; blades thin, flat 8-15 mm wide; spikes 5-20 cm long, stiffly erect or, in some forms, more or less flexible and semi-nodding; spikelets 10-12 mm long, glumes thin, as long as or longer than the florets; lemmas smooth, scabrous or some times hairy, tapering into a straight or divergent awn 10-30 mm long.

Native, throughout much of California below about 8,500 feet; common in the foothills and lower mountain slopes, usually in association with open stands of oaks and conifers. In open areas, blue wildrye seldom occurs in any kind of a stand. As a forage grass the species is useful early in the season.

In 1988, 4 selections were made from the IEP block at the PMC. They are 9032907, 9032970, 9032895, and 9033078.

Materials and Methods

The 4 selected accessions were planted at 3 Field Evaluation Plantings (FEP) sites, (Sierra Field Station, Mariposa and Ukiah). Plot design was a 4-foot by 4-foot checkerboard randomized complete block design with 4 replications. Ten seedlings were planted in each of the 4 by 4 foot plots. Each site was evaluated during April or May of 1989 and 1990. Evaluation items consisted of percent stand establishment; foliage, abundance and uniformity; plant type, habitat and root system; seed amount and fill, winter injury, vigor; and resistance to disease, insects, cold and heat.

Elymus glaucus, 9032907, exhibited the best overall stand establishment, foliage abundance, vigor, and drought tolerance. This accession has been planted into a seed increase block so as to make seed available for field plantings.

CRITICAL AREA PLANTING

Pardee Lake, CA

This planting was started during the fall of 1974 on property owned by the East Bay Municipal Utility District. New plantings were started in 1975 through 1983, with the exception of 1977. The purpose of this FEP was to determine which grasses and shrubs were best suited for use on critical areas within MLRAs 18 and 22.

The FEP is located at 900 feet elevation on property northeast of Pardee Lake. The soil at the FEP is an Auburn-Argonaut complex on a 3-8 percent slope. The surface soil was removed from all test sites in order to simulate a critical area site.

Materials and Methods

Plot size was 10' by 10' and all plots were replicated 3 times except during 1974. The seeding rate was 40 lbs. per acre and the fertilizer rate was 400 lbs. per acre of 16-20-0. After seeding, the plots were raked, mulched with 4,000 lbs. of straw per acre, and to tack down the straw, 750 lbs. of turf-fiber was applied per acre. This procedure was followed for all successive plantings.

Shrubs were planted on a spacing of 3 feet by 3 feet. As with the grasses, approximately 4 inches of top soil was removed to simulate a critical area. Ten plants for each accession was used. Weed control was maintained by hand hoeing. Lime was applied to the *Atriplex canescens* at a rate of 4,000 lbs. per acre; lime was not applied to the southern row of this species. Plants were not fertilized at the time of planting and water was applied only at the time of planting.

Perennial grasses: The most successful were 'Berber' orchard grass, 'Palestine' orchard grass, and 'Largo' tall wheatgrass. Overall, none of the perennial grasses showed the necessary success at this site. This may have been caused by the severe competition with annual species. The perennials have not spread appreciably since planting.

Shrubs: The best shrubs were *Atriplex canescens*, *Eriogonum fasciculatum*, and *Cistus villosus*. All shrubs were killed by grasshoppers in 1983.

The FEP at Pardee will be terminated with this report.

HERBACEOUS PERENNIALS FOR CRITICAL AREA

Name	Accession No.
Agropyron dasystachyum	'Critana'
Agropyron elongatiforme	T6245
Agropyron elongatum	'Largo'
Agropyron intermedium	'Greenar'; 'Oahe'; 'Tegmar'; T6247
Agrophyron intermedium var. trichophorum	'Luna'; 'Topar'; 'Mandan'; PL-120-68
Agropyron pectiniforme	PI-315359; TI8097; PL-287-70
Agropyron riparium	'Sodar'
Agropyron sibericum	PI-108434
Agropyron smithii	'Arriba'; 'Barton'; 'Rosana'; PI-432399; PI-432400
Agropyron varnense	PI-281863
Brachypodium sylvaticum	PI-206546
Dactylis glomerata	'Berber'; 'Palestine'; 'Potomac'; 'Currie'; P-325295; PI-325301
Festuca arundinacea	'Soliman'; PI-283283; PI-316245
Festuca longifolia	'Durar'; 'Scaldis'
Festuca ovina	'Covar'
Festuca rubra	'Clatsop'; PI-303002
Lathyrus latifolius	T5017
Lathyrus sylvestris	'Lathco'
Onobrychis viciaefolia	'Remont'
Oryzopsis miliacea	Smilograss
Phalaris tuberosa hirtiglumis	'Perla' koleagrass

Name	Accession No.
Poa ampla	'Sherman'
Poa canadensis	'Reubens'
Saponaria officinalis	PI-443425
Sitanion hystrix	LK-178
Sporobolus usitatus	T6481

Name	Accession No.
Briza maxima	PL-129-71
Bromus mollis	'Blando'
Bromus rubens	T-6336
Lamarkia aurea	LK-482
Poa annua	LK-474
Vulpia myuros	'Zorro'

SHRUB ADAPTATION TRIAL

Species	Accession No.
Atriplex canescens	'Marana'
Baccharis pilularis var consanguinea	LK-912
Ceanothus hearstiorum	LK-1418
Ceanothus hybrid	LK-449
Ceanothus impressus	T-18128
Ceanothus megacarpus	LK-1053
Ceanothus ramulosus	LK-1063
Ceanothus velutinus	LK-1747
Cistus villosus	T-6545
Celmatis ligusticifolia	LK-1744
Eriogonum fasciculatum	'Duro'
Eriogonum fasciculatum	LK-1444
Eriogonum fasciculatum	LK-1446
Eriogonum fasciculatum	LK-1447
Lonicera japonica	T-6403
Purshia tridentata	LK-1752
Quercus garryana	LK-1539
Rhamnus crocea	LK-1739
Rhus trilobata	LK-1753
Rhus trilobata	LK-1754
Robinia noemexicana	NM-1167
Romneya coulteri	LK-1738

Name	Accession No.
Salvia clevelandii	T-18235
Salvia greggii	T-18237
Spiraea douglasii	LK-1745

CRITICAL AREA PLANTING

Dunlap, CA

This Field Evaluation Planting was started in 1974 for the purpose of evaluating existing plant materials, grasses and shrubs, for their adaptability to some typical soils and environments within MLRA 18. The need for this plant material is for the protection of land disturbed by development of subdivision and roads in the Sierra Nevada foothills. The plants are being evaluated for aesthetic, fire retardant and erosion control qualities to protect these critically exposed soils.

This is the final report on this project.

This Field Evaluation Planting is located in the Dunlap area, approximately 40 miles east of Fresno, California. Sites were selected at elevations ranging from 2,000 to 3,500 feet. Sites include cut and fill slopes, disturbed building sites, and barrow pits. Most sites are on north and south exposures. The precipitation for this area is approximately 20 to 30 inches annually.

The principal soils are Ahwahnee, Auberry, Sierra and Vista sandy loams. These soils comprise over 1 million acres of the Sierra Nevada foothills in eastern Fresno county and are representative of the highly erosive soils encountered in many foothill housing developments.

Plant materials, grasses and shrubs, were selected from plants that have undergone extensive screening at SCS Plant Materials Centers, Universities, and private nurseries.

Materials and Methods

In November 1977, the first plantings were established. Shrubs were planted in rod rows 10 feet long with a spacing of 6 feet. The grass species were planted in plots 10 feet by 17 feet at a seeding rate of 40 lbs. per acre.

The grasses were broadcast by hand and a straw mulch was applied at a rate of 2 tons per acre. A wood fiber was applied at a rate of 750 per acre over the straw as a binder. Fertilizer (16-20-0) was applied at 500 lbs. per acre.

The shrubs were planted from 1-gallon containers or book binders. Fertilizer (Mag Amp Fertilizer) was applied at 4 oz. per container at the time of planting. Weed control, hand hoeing, was done as necessary during the first year.

Results

Under dryland conditions the best looking shrubs are buckbrush, *Ceanothus cuneatus*, LK-176 and PL 117-72; CA buckwheat *Eriogonum fasciculatum*, and quailbush *Atriplex lentiformis*.

Under irrigation, the accessions that looked best were: *Ceanothus griseus,* T-33016; *Salvia clevelandii,* T-18236 and *Eriogonum fasciculatum*, T-19947.

Under nonirrigation, none of the perennial grasses were performing in a manner which warrants considering them for this use. Although most of the perennial grasses are surviving, they have not spread beyond the original rod rows or plots.

The planted annual grasses could not be identified at any of the test sites. This may have been caused by the similarity of the test species to the naturally occurring species. The species originally planted are:

Grasses and Legumes for 1977-78

'Luna' pubescent wheatgrass

'Tegmar' intermediate wheatgrass

'Barton' western wheatgrass

'Arriba' western wheatgrass

'Greenar' intermediate wheatgrass

'Oahe' intermediate wheatgrass

PL-303-69 intermediate wheatgrass (source - Los Lunas PMC)

'Critana' thickspike wheatgrass

'Palestine' orchardgrass

'Berber' orchardgrass

'Potomac' orchardgrass

'Wilton' rose clover

'Mt. Barker' sub clover

'Lutana' milkvetch

'Remont' sainfoin

'Blando' brome

Red brome

'Wimmera 62' ryegrass

'Zorro' annual fescue

'Largo' tall wheatgrass

'Lana' woollypod vetch

Siberian wheatgrass

'Sodar' streambank wheatgrass

Burnet

Crimson clover

Lupine

'Lathco' flatpea

Quaking grass

'Durar' hard fescue

Australian saltbush

Shrubs for 1977-78

Wildlife Cover, Windbreaks, Critical Area

and General Landscaping

Arctostaphylos patula	Greenleaf manzanita
Atriplex canescens	Fourwing saltbush
Atriplex lentiformis	Quailbush
Ceanothus cuneatus	Buckbrush
Isomeris arborea	Bladderpod

Low Volume, Slow-Burning Shrubs

Atriplex semibaccata	Australian saltbush
Atriplex cuneata	
Baccharis pilularis	Dwarf coyotebush
Ceanothus prostratus	Squaw carpet
Eriogonum umbellatum	Sulfur-flowered buckwheat
Penstemon laetus	
Rosmarinus officinalis	Rosemary
Salvia sonomensis	Creeping sage

Shrubs for 1978-79

Low Volume, Slow Burning, General Landscape

Arctostaphylos Hookeri	Monterey manzanita
Arctostaphylos muelleri	
Arctostaphylos uva-ursi	Bearberry
Artemisia ludoviciana	Louisiana sage
Atriplex canescens (short and intermediate strains)	
Ceanothus fresnensis	Fresno mat
Ceanothus martinii	Martins ceanothus
Penstemon strictus	Rocky Mountain penstemon

Wildlife Cover, Environmental Enhancement

Windbreaks or General Landscape

Ceanothus integerrimus	Deerbush
Ceanothus lemmoni	Lemon ceanothus
Ceanothus pappillosus	Wartleaf ceanothus
Cercis occidentalis	Redbud
Cistus sp.	Rockrose
Keckellia corymbosa	
Purshia tridentata	Bitterbrush
Rhamnus californica	California coffeeberry
Saponaria officinalis	Bouncing Bet
Zauchinera californica	California fuchsia

Ceanothus griseus	Carmel ceanothus	T-33016
Salvia clevelandii	Fragrant sage	T-18236
Eriogonum fasciculatum	California buckwheat	T-19947

RANGE IMPROVEMENT

TRIFOLIUM AND *MEDICAGO* SPECIES

Introduction

The legume species being tested are annual cool season varieties indigenous to southern Europe and North Africa. They are *Medicago* and *Trifolium* accessions which were selected from various Initial Evaluation Plantings (IEPs).

Materials and Methods

Seven selected accessions: *Trifolium subterraneum,* 9041173, 9041172; *Trifolium hirtum,* 9041171, 9049362, 9049364; *Medicago hispida,* 9041018; and *scutellata,* 9041078 and their associated control standards were planted at five sites: Sierra field station, San Joaquin field station, Mariposa, Ukiah and Paso Robles. The *Medicagos* and southern CA subclover 9041172 were only planted at the Paso Robles and the San Joaquin field station sites. The rose clovers and control CA subclover, 9041175, were only planted at Sierra field station, Mariposa and Ukiah.

Plot design was a 4' by 4' checkerboard randomized complete block design with four replications.

Each site was evaluated during April or May of 1989 and 1990. Evaluation items consisted of percent stand establishment, flowering, foliage size, abundance, and uniformity, plant type, habitat and root system, seed amount and fill, winter injury, vigor, and resistance to disease, insects, cold and heat.

Results

All accessions planted at San Joaquin field station, Mariposa and Paso Robles were severely affected by the persistent drought. The MLRA 15 site at Ukiah was only evaluated for rose clover because of subclover contamination from previous plantings.

At the Sierra field station, 600' elevation site: Central CA subclover 9041173 performed as well as but not better than standards; rose clover standard 'Hykon' performed the best and all rose clovers had good performance; however, rose clover 9041171 and the two Texas rose clovers were better than 'Wilton'.

At the Sierra field station, 1,600' elevation site: Central CA subclover 9041173 performed better than standard subclover 'Nungarin', 'Mt. Barker', and 'Woogenellup'; rose clover 9041171 performed better than standards 'Wilton' and 'Hykon' and the two Texas rose clovers.

At the Mariposa site, central CA subclover, *Trifolium subterraneum* 9041173 showed the most vigor and drought tolerance.

At the San Joaquin field station site, southern CA subclover, *Trifolium subterraneum,* 9041172 had superior stand establishment, size, drought tolerance and vigor. Bur medic, *Medicago hispida,* 9041018 and the standard, 'Serena' did not establish a stand. Snail medic, *Medicago scutellata,* 9041078 did not establish a stand; however, the standard, 'Sava' did.

At the Paso Robles site snail medic, *Medicago scutellata,* 9041078 had outstanding performance with 25 to 40 percent stand establishment, very abundant foliage, good seed fill, excellent vigor and excellent drought tolerance. The standard, 'Sava' had 5 to 15 percent stand

establishment and good vigor. Bur medic, *Medicago hispida,* 9041018 had a 5 to 25 percent stand establishment and good vigor. The standard, 'Serena', had a 2-10 percent stand establishment with fair vigor. Southern CA subclover, *Trifolium subterraneum,* 9041172, was as good as any of the standards, ('Nungarin', 'Geraldton', 'Seaton Park', and 'Dalkeith') all of which had very poor stands and vigor.

At the Ukiah (MLRA 15) site 'Monte Frio' rose clover, *Trifolium hirtum* 9041171 performed as well as the Texas rose clover 9049362. The standards, 'Wilton' and 'Hykon' had poorer performance.

The superior accessions mentioned are being increased so seed will be available for field plantings and foundation seed for commercial seed production; however, the hard freeze during the winter of 1990-91 severely set back this effort.

INTER-CENTER TRAIN TRIAL

Meyers Landfill

Tahoe Basin, CA

1980

Introduction

The purpose of this planting was to evaluate the adaptability of perennial grasses and legumes to the Tahoe Basin. Test species are being evaluated for use in MLRA 22 (6,000 to 7,500 feet elevation). Twenty-four of the accessions being evaluated are cultivars while four are test species from other PMCs. The planting was made in 1980.

The soil found at the Meyers Landfill is of granitic origin. The sight had been severely cut and eroded, although there was much loose material on the surface at the time of planting.

Materials and Methods

Plot size was 10' x 20' and the plots were not replicated. The seed was broadcast and raked into the soil. The plots were fertilized with 16-20-0 at a rate of 500 lbs. per acre. The plots were covered with straw at a rate of 4,000 lbs per acre. U.S. Forest Service employees, using a straw crimper, rolled each plot.

Results

After 11 years, it was very evident which species are superior at this site and well-adapted to these droughty soils. The following plants had superior initial establishment and maintenance of stands:

'Covar' sheep fescue

'Durar' hard fescue

'Scaldis' hard fescue

'Sherman' big bluegrass

Because this was such a sterile site, the sheep and hard fescues had little competition and become pure, solid stands. The standards, 'Tegmar' and 'Oahe' intermediate wheatgrasses; 'Luna' pubescent wheatgrass; and 'Potomac' orchardgrass, produced fair to good stands that have been reduced by drought and low fertility. 281863 Rush wheatgrass was equal to the standard wheatgrasses and deserves further testing. The western wheatgrasses were very slow to establish, but maintain an almost solid stand. None of the legumes were evident initially and only scattered plants of 'Lathco' flatpea were identified several years ago.

It is quite evident that the sheep and hard fescues have a place in erosion control in the Tahoe Basin on disturbed sites having little or no competition. They, also, seem to be as long-lived as the standard perennial grasses and provide a low maintenance, erosion control cover.

TAHOE FIELD EVALUATION PLANTING

U.S.F.S.

Meyers Landfill

Plots Established May 28-29, 1980

Agropyron intermedium	A-12496
Agropyron intermedium	'Greenar'
Agropyron intermedium	'Tegmar'
Agropyron intermedium	'Oahe'
Agropyron smithii	'Barton'
Agropyron smithii	T-905
Agropyron smithii	T-662
Agropyron smithii	'Arriba'
Agropyron smithii	'Rosana'
Agropyron varnense	PI-281863
Agropyron trichophorum	'Luna'
Agropyron trichophorum	'Topar'
Agropyron elongatum	'Largo'
Agropyron dasystachyum	'Critana'
Agropyron sibiricum	
Dactylis glomerata	'Berber'
Dactylis glomerata	'Potomac'
Festuca ovina	'Covar'
Festuca longifolia	'Durar'
Festuca longifolia	'Scaldis'

Festuca arundinacea	'Goar'
Festuca arundinacea	'Soliman'
Poa ampla	'Sherman'
Onobrychis viciafolia	'Remont'
Astragalus cicer	'Lutana'
Lathyrus sylvestrus	'Lathco'
Lathyrus latifolius	Perennial pea
Saponaria officinalis	

INTER-CENTER STRAIN TRIAL

Meyers Landfill

Tahoe Basin, CA

1989

Introduction

An Inter-center strain trial (ICST) was planted during the fall of 1989. The ICST is five miles south of South Lake Tahoe on landfill which consists of decomposed granitic soils. The ICST was developed because of a need to screen fifty-eight newly developed grass and legume cultivars from the western U.S.

Materials and Methods

A randomized complete block design with four replications was developed on a checkerboard 4' x 4' layout for thirty of the species. Twenty foot long nonreplicated rod rows were laid out for twenty-seven species. Nine species were planted in nonreplicated rod rows on a 2:1 road fill slope. Plots were evaluated for seedling vigor during April 1990 and evaluated for percent stand establishment, foliage size and abundance and vigor during August 1990. The plots will be evaluated in August 1991 and 1992 and result in a final report.

Results

Due to a severe California drought, the overall performance of all species was very poor. The decomposed granitic soils with a low A.W.C. together with the drought pushed species to their adaptability range limits.

The April 1990 evaluation demonstrated that: The replicated plots of 9017596 mountain rye, ARS Hycrest 2 crested wheatgrass, ARS SL hybrid wheatgrass, ARS SL hybrid wheatgrass, and ARS Nephi siberian wheatgrass showed good to excellent germination and seedling vigor with one to two inches of growth. The un-replicated rod row plots of Rush wheatgrass and ARS AE Hybrid had excellent germination and seedling vigor with one to two inches of growth. The 2:1 road bank rod row plots of Corvallis, Stewart 5,000 and Anderson blue wildryes and Indian ricegrass had good to excellent germination and seedling vigor with one to two inches of growth.

The August 1990 evaluation demonstrated that all of the species in the rod row plots showed poor performance. In the replicated plots, Mountain rye 9017596 showed outstanding performance as compared to the other species. It ranged from 20-50 percent stand; good to excellent foliage size, abundance and uniformity; excellent vigor; and 15" to 18" of growth. Others with fair performance were: Thickspike wheatgrass 9021076, ARS L3 Hybrid wildrye 9041327, and 'Pennlawn' red fescue.

It is hoped that all species will improve their performance with the increased moisture received during the spring of 1991. The shrub plots will be installed at a later date due to lack of an irrigation system.

LAKE TAHOE INTER-CENTER STRAIN TRIAL

Replicated plots - grasses, forbs, and legumes 4 x Reps

Cultivar	Common Name	Scientific Name	Accn. #
Secar	Bluebunch wheatgrass	Ayropyron spicatum	9002951
Whitmar	Bluebunch wheatgrass	Agropyron spicatum	421022
	Bluebunch wheatgrass	Agropyron spicatum	232127
	Bluebunch wheatgrass	Agropyron spicatum	232128
Goldar	Bluebunch wheatgrass	Agropyron spicatum	9002950
*Revenue	Slender wheatgrass	Apropyron trachycaulum	358309
Pryor	Slender wheatgrass	Apropyron trachycaulum	432403
San Luis	Slender wheatgrass	Apropyron trachycaulum	483079
	Mountain rye	Secale montanum	9017596
Bozoisky	Russian wildrye	Elymus juncea	T27398
Prairieland	Altai wildrye	Elymus angustus	9016800
Magnar	Wildrye	Elymus cinereus	469229
*Swift	Wildrye		
*Tetracan	Wildrye		
ARS L3	Hybrid wildrye	Leymus racemosus x angustus x cinereus	9041327
	Wildrye	Elymus cinereus	478831
Nordan	Crested wheatgrass	Agropyron desertorum	469225
*Fairway	Crested wheatgrass		
P-27	Siberian wheatgrass	Agropyron sibiricum	108434
Parkway	Crested wheatgrass	Agrophyron cristatum	415799

Cultivar	Common Name	Scientific Name	Accn. #
ARS Hycrest 2	Crested wheatgrass	Agropyron cristatum x desertorum	9041328
ARS 6x	Broadleaf wheatgrass	Agropyron cristatum	9041329
ARS Nephi	Siberian wheatgrass	Agropyron fragile	9041330
*Kirk	Crested wheatgrass		
Critana	Thickspike wheatgrass	Agrophyron dasystachyum	469235
Sodar	Thickspike wheatgrass	Agrophyron dasystachyum	421021
	Thickspike wheatgrass	Agrophyron dasystachyum	9021076
ARS SL	Hybrid wheatgrass	Elymus x Pseudoroegneria lanceolatus x spicata	9041331
Pennlawn	Red fescue	Festuca rubra	9016057
Shadow	Chewings fescue	Festuca rubra	9040815
	Western fescue	Festuca occidentalis	9028822
Climax	Timothy	Phleum pratense	9038502
Hederma	Sickle keeled lupine	Lupinus albicaulis	452129
Lathco	Flat pea	Lathyrus sylvestris	434088
Appar	Lewis flax	Linum lewisii	445972

Replicated plots - shrubs, 4x reps, irrigated

Lassen	Bitterbrush	Purshia tridentata	9033486
	Bitterbrush	Purshia tridentata	9024373
	Bitterbrush	Purshia tridentata	
Cedar	Palmer penstemon	Penstemon palmeri	9003885
Hobble Creek	Big sagebrush	Artemisia tridentata	9024374

Cultivar	Common Name	Scientific Name	Accn. #
Delar	Small burnet	Sanguisorba minor	464584
Esmerelda	Greenleaf manzanita	Arctostaphlos patula	
Altura	Greenleaf manzanita	Arctostaphlos patula	9041129
Maleza	Whitethorne ceanothus	Ceanothus cordulatus	9006521
Summit	Louisiana sage	Artemisia ludoviciana	9021474
Rod Row Plots			
	Columbia needlegrass	Stipa columbiana	9040137
	Mountain brome	Bromus marginatus	9005308
Bromar	Mountain brome	Bromus marginatus	421024
*Bridger 1	Squirreltail	Sitanion hystrix	
*Bridger 2	Squirreltail	Sitanion hystrix	
LK	Blue wildrye	Elymus glaucus	9032907
LK	Blue wildrye	Elymus glaucus	9032970
LK	Blue wildrye	Elymus glaucus	9032895
LK	Blue wildrye	Elymus glaucus	9033078
Corvallis	Blue wildrye	Elymus glaucus	9019633
Stewart 5000	Blue wildrye	Elymus glaucus	9041225
Anderson	Blue wildrye	Elymus glaucus	9041226
Berkeley	Blue wildrye	Elymus glaucus	9041227
	Meadow barley	Hordeum brachyantherum	9041216
*ARS	Rhizome Slender		
Utah	Northern Sweetvetch	Hedysarum boreale	9024808

Cultivar	Common Name	Scientific Name	Accn. #
ARS	ELX Hybrid	Elymus Lanceolatus x L. wawawaiensis	9041322
ARS	LEKA RC Hybrid	Leymus Karelinii	9041323
Nezpar	Indian ricegrass	Oryzopsis hymenoides	469230
Paloma	Indian ricegrass	Oryzopsis hymenoides	476997
	Indian ricegrass	Oryzopsis hymenoides	478833
NMSU	Indian ricegrass	Oryzopsis hymenoides	9035287
CSU	Indian ricegrass	Oryzopsis hymenoides	9052861
ARS	RST Hybrid	Elymus x Pseudoroegneria repens x stipiafolia	9041325
ARS	RS Hybrid	Elytrigia x Pseudoroegneria repens x spicata	9035396
	Rush wheatgrass	Agropyron varnense	281863
*Pullman	Snow buckwheat		
Corvallis	Tufted hairgrass	Deschampsia cespitosa	9019737
ARS	AI Hybrid	Thinopyrum intermedium	9041326
Rhizo	Kura clover	Trifolium ambigum	325489
Peru	tufted hairgrass	Deschampsia cespitosa	9024403
*	Squirreltail		
	Columbia needlegrass	Stipa columbiana	9024804

* Seed was not planted because seed was not received

Shrub plots have not been planted as of 4-9-90

WINDBREAK PLANTING

Lockeford PMC - Field 4

and

Five Points, CA

Casuarina glauca

Introduction

Two Initial Evaluation Plantings (IEPs) were started in 1989 at Lockeford Plant Materials Center (PMC) and Red Rock Ranch, Five Points, CA for the purpose of evaluating *Casuarina glauca.* These IEPs were established with the cooperation of International Tree Crops Institute, USA, Inc.; California Department of Forestry and Fire Control, University of California, Davis, and Lockeford PMC, SCS USDA.

Casuarina glauca, swamp oak, extends along the coast of Australia from southern New South Wales to northern Queensland. Swamp oak is an evergreen tree which grows naturally in saline and waterlogged soils. *Casuarina* is widely grown outside Australia because of their fast growth, ability to fix atmospheric nitrogen, and tolerance of drought. *Casuarina* is used for windbreaks, fuelwood, and as an ornamental.

The purpose of these IEP's is to identify an outstanding accession for use on soils with high saline watertables. This commercially available accession would be used for farm woodlots, windbreaks, and agroforestry.

Materials and Methods

A collection of swamp oak seed was made in Australia during 1988. The collection was conducted in collaboration with CSIRO National Tree Seed Centre in Canberra. A team from California collected seed from 10 widely-spaced trees at each of 10 distinct provenances (total 100 families) along the coast of New South Wales.

The seed was taken to the California Department of Forestry (CDF) Nursery, Davis for propagation. The seed was germinated in flats and then seedlings were transferred to Leach "super cell" containers.

Each IEP is approximately 1.5 acres and includes 15 randomized replicated complete blocks (single tree/accession) with a perimeter buffer row. The trees are 6 feet apart and row spacing will be 6 feet.

Monitoring of survival and growth (height and diameter) will be conducted annually. Data will be collected and analyzed in cooperation with CDF Tree Improvement Program and the USDA Forest Service. Evaluation will continue until 1994.

Results

The first year evaluations have been completed. The data is insufficient to draw any conclusions. The effects of the below zero temperature for 2-3 weeks during December 1990 are not known at Five Points, but there was a significant effect at the Lockeford PMC. All accessions suffered severe frost damage with only 1-10 showing signs of life in March 1991. This situation may change as the growing season proceeds.

MEAN HEIGHT (cm) OF *Casuarina glauca*

PROVENANCES AT YEAR 1

(Provenances ranked at each site)

Lockeford		Five Points	
Narooma	205.6	St. Georges	193.1
St. Georges	197.3	Grafton	192.6
Grafton	197.2	Narooma	191.2
Pt. Macquarie	197.2	Pt. Macquarie	189.9
Ballina	197.0	Buladelah	188.6
SIngleton	191.6	Ballina	186.4
Buladelah	187.3	Bundeena	182.9
Bundeena	184.7	Singleton	180.6
Penrith	184.0	Penrith	179.6
Ipswich	180.8	Ipswich	167.1

CONTRACTS

AND

REIMBURSABLES

REVEGETATION PROJECT

FOR

YOSEMITE NATIONAL PARK

Introduction

In 1987 the Lockeford Plant Materials Center entered into a contract with Yosemite National Park to produce plants for the subalpine meadow project and the roadside revegetation project. As of 1989 the 2 projects became 2 independent contracts. This became necessary because of the source of funding for the Federal Highway Projects. Although the original contract was separated into 2 independent contracts, the criteria established for the single contract remains valid.

The Tuolumne Meadows region of Yosemite National Park is a fragile subalpine region which has suffered extensive damage from high levels of human use. A total of 27 subalpine sites have been designated for rehabilitation. Experiments are being conducted with 37 species of subalpine plants, of which 7 are being propagated at the Lockeford PMC. There are 2 sites, Glacier Point Road and Big Flat Road, in the Federal Highway Projects. There are 7 species being considered for these projects and 9 other species may be considered.

Materials and Method

Species supplied to the Lockeford PMC are being propagated by seed, cuttings, and division. Seed increase plantings of *Elymus glaucus* and *Poa nervosa have been established.* It is the responsibility of the Lockeford PMC to determine methods of propagating species provided by the National Park Service (NPS), propagate plants from stock collected and delivered by the

NPS, collect and clean all seed generated by stock plants and propagate offspring, and document all aspects of plant propagation, plant care, seed collection, handling, and storage.

Plant species being propagated for the subalpine meadow rehabilitation project are:

Carex	exserta
Carex	rossi
Juncus	parryi
Calamagrostis	breweri
Oryzopsis	kingii
Deschampsia	caespitosa
Antennaria	spp.

Plant species being propagated for the Federal Highway Project are:

Arctostaphylos	patula
Arctostaphylos	nevadensis
Symphoricarpos	mollis
Lupine	stirksii
Penstemon	newberryi
Elymus	spp.
Poa	spp.

Plant species being considered for the Federal Highway Project are:

Ceanothus	fresnensis
Ceanothus	diversifoluis
Ceanothus	leucodermis

Castanopsis	sempervirens
Ribes	spp.
Prunus	emarginata
Potentilla	glandulosa
Anaphalis	margaritaceae
Chamacbatia	foliolosa

Results

DISCUSSION OF RESULTS FOR 1988

In September 1987 a small quantity of seed was collected from the following species that had seed: Juncus parryl, Carex exserta, Oryzopsis kingii, Calamagrostis breweri, and *Deschampsia sp.* Seed from this collection was tested by planting 50 Jiffy pots with each species. The germination rates are as follows: *Juncus parryi - 0%, Carex exserta - 0%, Oryzopsis kingii - 0%, Calamagrostis breweri - 90%, Deschampsia sp. - 5%.*

In December 1987 NPS supplied 100 seeds of the following species to be tested for germination and the results were: *Calyptridium umbellatum - 10%, Solidago multiradeata - 0%, Phleum alpinum - 2%, Carex straminiformis - 1%, Carex japsonii - 0%, Calamagrostis breweri - 18%, Poa nervosa - 27%, Trisetum spicatum - 12%.*

CONCLUSION AND MANAGEMENT RECOMMENDATIONS FOR 1989

Division Propagation: *Antennaria corymbosa and Sitanion hystrix* performed very poor; it is recommended that *Antennaria* be collected and increased in flats and *Sitanion hystrix* be dropped. Also, *Muhlenbergia richardsonia and Trisetum spicatum* had poor performance and should be dropped. The following did well and should be continued: *Juncus parryi, Carex*

rossi, Deschampsia (seed propagate), *Poa nervosa* (seed propagate), *Carex exserta, Solidago multiradiata and Carex stramidiformis.*

MANAGEMENT RECOMMENDATIONS FOR 1990

Concentrate on collecting viable seed. Larger seed collection on lots will have a TZ test run on them to determine if the seed is viable ($30.00 each). Follow literature search recommendations in regards to taking cuttings and how to handle them. Discard cuttings that have larvae or gall problems.

In the future, 5 different hormone levels will be applied to cuttings to determine proper level. Larger numbers of woody plants should be propagated from seed in both greenhouse and lathhouse.

Based on poorer FY90 results, it is requested that NPS deliver division stock to PMC on September 4. Rather than putting plants in lathhouse and letting them go dormant, they will be placed in greenhouse under grow lights on September 4, split the first part of October, and moved to lathhouse at the end of October.

FY '89 TUOLUMNE MEADOWS

NPS SEED PROPAGATION

Propagation of all NPS Seed Accessions completed on 1-17-89 and 1-23-89

Acc. #	Species	Number of Propagations	Survival	Date Emerged	Vigor
9041186	DECA #1	392 Cones	361	2-05-89 2-14-89	Excellent
9041187	PONE	196 Cones	164	1-30-89	Good
9041188	LULY #1	196 Cones	26	1-23-89	Poor
9041189	LUCO	196 Cones	66	1-24-89	Poor
9041190	ORKI #1	196 Cones	147	2-14-89	Good
9041191	DACA #1	392 Cones	212	2-13-89 2-27-89	Excellent
9041192	STCO #1	392 Cones	23	2-13-89 2-17-89	Poor
9041193	LULY #2	196 Cones	41	1-23-89	Poor
9041194	LUCO #2	196 Cones	19	1-22-89	Poor
9041195	ORKI #2	196 Cones	117	1-25-89	Good
9041196	DECA #2	392 Cones	385	2-06-89	Excellent
9041197	ORKI #3	392 Cones	295	1-30-89 2-17-89	Good
9041198	LULY #3	196 Cones	46	1-24-89	Poor
9041199	DACA #2	196 Cones	54	2-17-89	Good
		Total 3,724	Total 1,956		

An Additional Propagation of 3 Accessions completed on 3-30-89

Soa :d seed in water with temp. of 90° for 5 hours to see if germination is increased.

Acc.	Species	Number of Propagations	Survival	Date Emerged	Vigor
9041 ;	DECA #1	980 Cones	974	4-14-89	Excellent
9041 '	PONE	196 Cones	179	4-10-89	Good
9041)	LUCO	196 Cones	10	4-03-89	Poor
		Total 1,372	Total 1,163		

FY '88 TUOLUMNE MEADOWS

NPS - SCS NATIVE PLANT PRODUCTION

Species	Amt. Rec. on 9-01-87	Amount Survived Winter	Division Dates	Amount Divided	Amount Survived & Shipped
Juncus parryi	1008	612	3-28	1950	1180
Carex exserta	1008	651	4-26	1850	1600
Oryzopsis kingii	288	189	4-21	700	600
Calamagrostis breweri	1014	270	4-28	(2050)	(1230)
1st collection site	-	-	-	550	400
2nd collection site	-	-	-	1050	630
3rd collection site	-	-	-	450	200
Antennaria	400	82	4-28	(1825)	(1400)
2nd collection site	-	-	-	300	200
3rd collection site	-	-	-	550	450
4th collection site	-	-	-	975	750
Carex rossi	900	582	4-13	(1550)	(1390)
1st collection site	-	-	-	1350	1200
4th collection site	-	-	-	200	190
Deschampsia	498	452	3-15 5-02	3800	3800
TOTAL	5,116	2,838	-	13,725	11,200

U.S. NAVY

Lemoore Naval Air Station

Introduction

In 1987 and 1988 an Initial Evaluation Planting (IEP) of legumes and cool and warm season grasses was made at Lemoore Naval Air Station. At present, the banks of irrigation canals are kept clean by using herbicides. This practice causes erosion, increased sediment and herbicide levels in the irrigation water. The purpose of this IEP was to determine the effectiveness of vegetation to reduce erosion and improve water quality. Accessions are being evaluated for use in Major Land Resource Area (MLRA) 17.

The accessions are being evaluated for their ability to survive: low precipitation, extreme temperature, steep slopes, and saline/alkali conditions.

Materials and Methods

The IEP was made along the slope of the irrigation canal, which has a side slope of 2:1. Each accession was planted in a 20 x 12 foot plot and was replicated 4 times. The replications are divided equally according to aspect. The IEP was cultivated and planted by hand whether seed or plugs. Straw mulch was applied to each plot at the rate of 2 tons per acre.

Results

After 2 years of evaluation, a recommendation was made to the Navy which should meet the needs of revegetating irrigation canal slopes. It was recommended that *'Zorro'* annual fescue and *'Panoche'* red brome be used for rapid growth and *'Rio'* beardless wildrye for long-term stabilization of the slopes. *'Rio'* is a new Lockeford PMC release with a limited quantity of seed available at this time.

REVEGETATION OF WARM-WATER RESERVOIRS

FOR

CALIFORNIA DEPARTMENT OF FISH AND GAME

Introduction

This project is being conducted to aid the California Department of Fish and Game (DF&G) in developing grasses, legumes, and shrubs, for the revegetation of drawdown zones of warm-water reservoirs. The purpose of this project was to determine which forms of vegetation were best suited for the revegetation of drawdown zones. The objective of the project was to find vegetation that would provide microcover for juvenile warm-water gamefish. Major benefits include bank stabilization, sediment reduction, and water quality improvement. Because of 5 years of drought, we have not been able to fully evaluate the test species.

From 1987 to 1990, the only test site to be inundated was at Folsom Lake and this was in 1989. Although the data collected does provide information about drought tolerance of the test species, we have no conclusive data in regards to test species and their intended use.

The contract for this project ended with fiscal year '90.

Materials and Methods

The first plantings were at Lake Camanche during the fall of 1987. Plantings were made at Folsom Lake in the fall of 1988 and at New Hogan Lake during the fall of 1989. There are a total of 6 sites at Lake Camanche, 1 site at Folsom Lake and 1 site at New Hogan Lake. Each lake has its own project number. The shrubs, grasses and legumes were planted at the lakes in rows which descend down the slope. When possible, sites were roto-tilled and raked. At

New Hogan, the site was roto-tilled and furrows were installed perpendicular to the slope. This was done to increase water-catching ability of the site.

Results

There was a total of 28 accessions tested at the 3 lakes. During the 3 years that evaluations were conducted, only the test site at Folsom Lake was inundated for 66 days. Because of the lack of data, we are unable to give a definite conclusion as to the inundation tolerance of test species. As the drought in California has progressed for 4 years, we have gained valuable data on drought tolerance of test species.

In descending order, the best performing herbaceous species are: *'Perla' Koleagrass, reed canarygrass, baltic rush, 'Rio' beardless wildrye, and saltgrass.* In descending order, the best performing woody species are: *'Streamco' willow, buttonbush, black willow, and 'Jacometti'* poplar. It should be noted that *baltic rush* and *black willow* can be found at most California reservoirs and for this reason should be given further consideration.

Test Species, Varieties, and Accessions planted are:

Black willow (9041204)	Salix nigra
Reed (434204)	Phragmites australis
Giant reed (436727)	Arundo donax
Brunswickgrass	Paspalum nicorae
'Blando' brome	Bromus mollis
'Zorro' fescue	Vulpia myuros hirsuta
'Kanlow' switchgrass	Panicum virgatum
"Coastal' bermudagrass	Cynodon dactylon

'Coast Cross' bermudagrass	Cynodon dactylon
'Callie' bermudagrass	Cynodon dactylon
Saltgrass (9032695)	Distichlis stricta
Saltgrass (9032696)	Distichlis stricta
Saltgrass (9032713)	Distichlis stricta
Baltic rush (9041136	Juncus balticus
Creeping wildrye (490360)	Leymus triticoides
'Perla' koleagrass	Phalaris aquatica
'Trikkala' subclover	Trifolium subterraneum
'Jemalong' medic	Medicago truncatula
Reed canarygrass (906592)	Phalaris arundinacea
White sweet clover (9041135)	Melilotus alba
Buttonbush (9033227)	Cephalanthus occidentalis
Buttonbush (9033236)	Cephalanthus occidentalis
Sandbar willow (9041108)	Salix hindsiana
'Streamco' willow	Salix purpurea
White alder (9041146)	Alnus rhombifolia
River she-oak (9041139)	Casuaraina cunninghamiana
Cottonwood (9041148)	Populus fremontii
'Jacometti' hybrid poplar	Populus euramericana

List of Plants Associated with Drawdown Zones:

Sedge	Carex spp.
Common bermudagrass	Cynodon dactylon
Red rooted-cyperus	Cyperus erythrorhizos

Glinus	Glinus lotoides
White cudweed	Gnaphelium luteo-album
Baltic rush	Juncus balticus
Carpet weed	Mallugo verticillata
Willow smartweed	Polygonum lapathifolium
Rose clover	Trifolium hirtum
Tomcat clover	Trifolium tridentatum
Bur clover	Medicago spp.
Woollypod vetch	Vicia dasycarpa
Lupine	Lupinus spp.
Cottonwood	Populus spp.
Bentgrass	Agrostis scabra
Soft chess	Bromus mollis
Black willow	Salix nigra
Brodiaea	Brodiaea coronaris
Annual fescue	Festuca megalura
Ripgut	Bromus rigidus
Annual rye	Lolium perenne
Wild oats	Avena fatua
Lady's thumb smartweed	Polygonum persicaria
Cockle bur	Xanthium canadense
Dodder	Cuscuta spp.
Lippia	Lippia nodiflora
Coyote brush	Baccharis pilularis

WATER INTERCEPTION PROJECT

FOR

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

Introduction

The Water Interception Project was initiated in 1989. The purpose of this project is to propagate and obtain agroforestry tree species which will be evaluated for their ability to intercept and uptake ground water that moves from the coast range to agricultural areas on the west side of the San Joaquin Valley. This project will determine effects on salinity, crop production, and water quality problems associated with excessively high water tables in the Valley. Moreover, this project will expand on agroforestry projects by identifying species that could be used for agroforestry purposes.

Material and Methods

At various sites, (John Diener, Panoche Gin Co, San Luis Water District, and others), saline seeps and/or high water tables were identified. Tree species were selected as to their adaptability to climate, salinity, selenium, and excessive water. *Eucalyptus* and *Casuarina* collections were made from old homestead trees which were on salt effected soils with water tables at 5 to 10 feet. The PMC propagated and/or purchased up to 5,000 trees. The Westside Resource Conservation District (RCD) planted the trees and worked with the local landowners in establishing and maintaining the site. The PMC and RCD jointly evaluated tree performance at the end of the summer of each year. Propagation goals were then established based on accessions with the most potential.

The best performing accessions are as follows:

Gleditsia triacanthos	Honey Locust	9041324
Eucalyptus globulus	Blue gum	9041274
Eucalyptus globulus	Blue gum	9041263
Eucalyptus globulus	Blue gum	9041268
Eucalyptus camaldulensis	Red gum	9041298
Eucalyptus camaldulensis		9041299
Eucalyptus camaldulensis		9041300
Acacia melanoxylon		9041224
Casuarina cunninghamiana		9041260
Casuarina cunninghamiana		9041261
Casuarina cunninghamiana		9041262

HALOPHYTE PROJECT

FOR

WEST SIDE RESOURCE CONSERVATION DISTRICT

Introduction

In the fall of 1990, a halophyte project was developed which would establish halophyte and/or highly salt tolerant species that can utilize saline waste water to produce livestock feed. Species were selected for disease and insect crop compatibilities, productivity, nutrition, and regrowth ability. This is a contract between Westside Resource Conservation District and Lockeford PMC with assistance from Fresno and Hanford field offices and California Department of Food and Agriculture.

Materials and Methods

At two sites, Westlake farms and Murrietta farms, all species were planted during February and March of 1991 with seed except for the saltgrass which was planted with stolons in June 1991. PMC will evaluate vegetation growth and plant performance twice per year. Salinity will be monitored to determine species adaptation levels.

Results

Since this is a new project, there are no results at this time; however, the accessions are:

Festuca arundinacea	'Goar' tall fescue	283284
Agropyron elongatum	'Jose' tall wheatgrass	150123
Festuca arundinacea	'Olympic' tall fescue	9041437
Distichlis spicata	Saltgrass	9032694
Atriplex nummularia	Oldman saltbush	9041435
Tamarix pentandra	Saltcedar	

ALTERNATIVE CONSERVATION SYSTEMS FOR COTTON ROTATIONS IN THE SOUTHERN SAN JOAQUIN VALLEY

Introduction

Evaluate locally adapted crops for use as vegetative barriers and as vegetative buffer strips for wind erosion control during the critical wind blow period from March through May.

Materials and Methods

Vegetative barriers (mini-windbreaks) shelter downwind areas equal to 10 times their average height and thereby reduce the unsheltered distance factor "L" in the Wind Erosion Equation. Plants must provide protection. Plants suitable for vegetative barriers need to be taller than 3 feet - preferably 5 to 6 feet tall - during the critical period and provide a density between 40 and 60 percent.

Vegetative buffer strips create stable areas and thereby reduce the unsheltered distance factor "L". Buffer strips must be capable of trapping incoming, saltating soil particles during the critical period. Plants or standing plant residues up to 3 feet tall are suitable.

Results

All summer grown species, (sundangrass, sorghum, sunflowers, and corn), showed good growth during summer months as expected; however, as winter progressed, all species deteriorated and provided little wind protection during the winter months. All winter grown species, except *'Merced' cereal rye,* performed poorly. Other plants seeded were *fava beans, berseem clover, triticale and sweetclover.* These plants were all grown dryland which affected their initial establishment and growth. *'Merced' cereal rye* had excellent germination and

competitive ability and reached a height of 4 feet during March. *'Merced' cereal rye*, with a 4 foot height, would protect a 40 foot downwind area, (10 x 4' = 40'). It would provide wind erosion control during the critical wind blow period from March through May. *'Merced'* should be planted in 8" row spacing with a total width of 7-15 feet and at a seeding rate of 22 lbs/acre.

The summer species grown on beds and furrow irrigated provided superior stands to those planted flat and flood irrigated.

NATIVE PLANT PRODUCTION PROJECT

FOR

LAKE COUNTY

Introduction

In 1988 a seed increase was started for 3 native grasses to revegetate serpentine soils. This was a contract agreement between Lake County and the Lockeford Plant Materials Center at the request of East Lake Resource Conservation District. The purpose of the seed increase is to find a seed mix, mostly native grasses, which would be suited for Serpentine soils, without the need for periodic additions of soil amendments. This seed mix would be a longer-lasting vegetative solution. To meet these goals, the Lockeford PMC agreed to increase: *Melica californica, Melica torreyana,* and *Sitanion jubatum.*

Materials and Method

Seed was germinated in the greenhouse in cone-containers and transplanted by hand to the field. There were 8 rows, 200 feet long, of each native grass planted in field 3. The seed was harvested by hand for 3 years. Seed was cleaned using a 47-B clippor seed cleaning machine.

Results

This project demonstrated that 9041142 *Melica californica* seed can be produced using commercial seed production technology. Big squirreltail, *Sitanion jubatum*, was very difficult to harvest, clean and process due to its texture and long awns. The PMC is currently maintaining the *Melica californica* stand for further evaluation.

TAHOE BASIN WETLAND PLANTS PROJECT

FOR

TAHOE RESOURCE CONSERVATION DISTRICT

Introduction

A large need for wetland plants is projected for the Lake Tahoe Basin by the California Tahoe Conservancy, Tahoe Resource Regional Planning Agency, and the Tahoe Resource Conservation District. The purpose of this contract is to provide technical information on how best to propagate large numbers of specific wetland plant species.

The first wetland species were delivered to the Lockeford PMC in March 1990. Species were identified and placed in the greenhouse for growth and preparation for division. Members of the PMC staff made a second collection during October 1990. Samples from the second collection were sent to a specialist in wetland plants for identification.

Materials and Methods

The Lockeford PMC will develop techniques for the production of these wetland plants and document the data for use by the Tahoe Basin agencies. In accordance with the contract, the PMC will deliver 1,500 to 2,000 plants during September to the Tahoe Resource Conservation District.

Plants being considered for propagation testing purposes are:

Cerastium	vulgatum	
Juncus	balticus	
Juncus	encifolius	
Stellaria	longipes	
Gallium	triflorum	
Poa	pratensis	
Poa	palustris	
Deschampsia	caespitosa	
Carex	serratodens	
Cyperus	niger	
Carex	paucicostata	Mkze.
Carex	lanuginosa	Michx.
Juncus	covillei	Piper
Agrostis	tenuis	

Results

Since this contract was begun in 1990, the first plant delivery date is not until September 1991. Plants are being propagated by division with good success. There has been some difficulty in identifying the *Juncus, Carex,* and *Cyperus* species.

SEED PRODUCTION/INCREASE

The purpose of seed and/or plant production is to produce seed and plants in sufficient quantities for Field Evaluation planting and Field Plantings, and to provide Foundation seed of released varieties.

For the past 10 years, Foundation seed has been produced of 10 grass species and 5 shrub species. Other seed increases were made of 7 grass species, 5 legumes, and 2 shrubs.

Grass species:

'Goar' Tall fescue	Festuca	arundinacea	
'Akaroa' Orchardgrass	Dactylis	glomerata	
'Rio' Beardless wildrye	Leymus	triticoides	
'Cucamonga' California brome	Bromus	carinatus	
'Panoche' Red Brome	Bromus	rubens	
'Perla' Koleagrass	Phalaris	aquatimatca	
'Blando' Brome	Bromus	mollis	
'Wimmera 62' Ryegrass	Lolium	rigidum	
'Berber' Orchardgrass	Dactylis	glomerata	
'Zorro' Annual fescue	Vulpia	myuros	
Blue wildrye	Elymus	glaucus	9032907
Blue wildrye	Elymus	glaucus	9032970
Blue wildrye	Elymus	glaucus	9032895
Torrey melic	Melica	torreyana	9041143
Squirreltail	Sitanion	jubatum	9041144

California melic	Melica	californica	9041142
Reed Canarygrass	Phalaris	arundinacea	9006592

Shrub Species:

'Sierra' Sulphur flower buckwheat	Eriogonum	umbellatum	
'Duro' California buckwheat	Eriogonum	fasciculatum	
'Marana' Fourwing Saltbush	Atriplex	canescens	
'Casa' Quailbush	Atriplex	lentiformis	
Desert Saltbush	Atriplex	polycarpa	9006313
Desert Saltbush	Altriplex	polycarpa	9006315
'Dorado' Bladderpod	Isomeris	arborea	

Legume Species:

Legume increase (Walt Graves)

Rose clover	Trifolium	hirtum	9041171
Bur clover	Medicago	hispida	9041018
Snail clover	Medicago	scutellata	9041078
Subclover	Trifolium	subterraneum	9041173
Subclover	Trifolium	subterraneum	9041172

SEED

PRODUCTION/INCREASE

SEED PRODUCTION RECORDS

FOR

1984-90

Seed Increase	'84 lbs.	'85 lbs.	'86 lbs.	'87 lbs.	'88 lbs.	'89 lbs.	'90 lbs.
Grass Species							
'Goar' Tall fescue						295	
'Akaroa' Orchardgrass	16	10	17			42	
'Rio' Beardless wildrye	12	8		8	9	5	3
'Cucamonga' California bromegrass				3	4	27	398
'Panoche' Red bromegrass	87	64	22				
'Perla' Koleagrass	89	114	625		117	110	20
'Blando' Bromegrass	549	1448					
'Wimmera 62' Ryegrass	1708						
'Berber' Orchardgrass	150	299	166	35	185	128	72
'Zorro' Annual fescue	804	632	79				
9032907 Blue wildrye					0.1		
9032970 Blue wildrye					0.3		
9032895 Blue wildrye					0.06		
9041143 Torrey melic					0.4	0.03	
9041144 Squirreltail					0.2	0.8	0.2
9041142 California melic					0.01	5	1.4
9006592 Reed canarygrass							

Seed Increase	'84 lbs.	'85 lbs.	'86 lbs.	'87 lbs.	'88 lbs.	'89 lbs.	'90 lbs.
Shrup Species							
'Sierra' Sulphur flower buckwheat	81	121		111	18	55	
'Duro' California buckwheat			13	37	45	9	13
'Marana' Fourwing Saltbush		276	338		77		
'Casa' Quailbush		7	10		69	56	
9006313 Desert saltbush					6		
9006315 Desert saltbush					0.6		
'Dorado' Bladderpod			27	9	11		7.7
Legume Species							
9041171 Rose clover					14		
9041018 Bur clover					18		
9041078 Snail clover					4		
9041173 Subclover					3		15
9041172 Subclover					1		4
9041174 Sulla					0.2	1	1