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Annual grassland in eastern Tulare County. Dominant species include *Hordeum leporinum*, a barley, *Bromus mollis* (soft chess), and *B. rubens* (red brome), all introduced from Europe. Photograph by the author.

PROPAGATING NATIVE PERENNIAL GRASSES

by Mitchel P. McClaran

In the 1950s researchers from the U.S. Soil Conservation Service and the University of California made a number of attempts to establish native perennial grasses on California's rangelands, with an aim to improving the production of forage for livestock. Work in this area was discontinued for many reasons, including a lack of seed sources, high costs, and a shift towards the use of introduced species, especially annual clovers. The first two problems remain unsolved today for those who are interested in establishing native perennial grasses.

Current interest in propagating native perennial grasses has quite different objectives from the production of forage; rather there is an interest in these species for native plant gardening, large-scale landscaping (e.g. rights-of-way and parks), controlling erosion, and mitigating environmental disturbance. The reasons for choosing native grasses include considerations of "appropriate horticulture," low water use, the re-creation of "Pristine" landscapes for biological study-areas, the conservation of native species, and inherent esthetic qualities of these plants.

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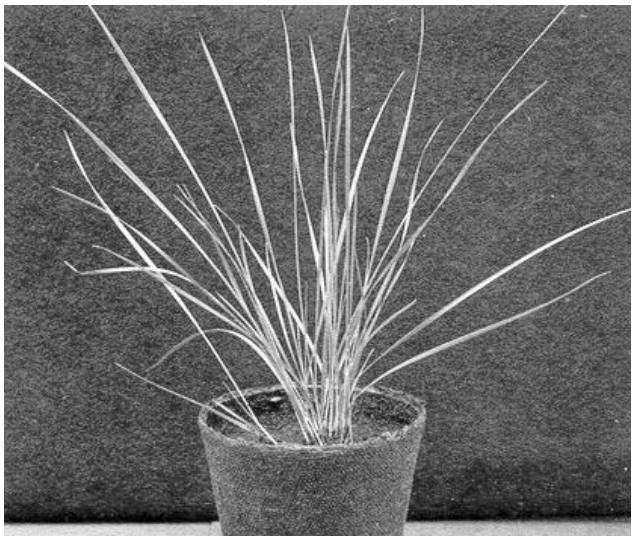
Site Preparation

Because alien annuals and other undesirable species compete so aggressively with native perennial grasses, the successful establishment of native species requires special site preparation directed to the control of weeds. Fire and tillage of the soil are the principal methods. Either method requires precise timing to be effective. If fire or tillage is used before the seeds of the annuals have germinated, it is not effective, because neither method destroys the viability of seeds in the soil. Burning or tilling after germination eliminates the new seedling population of alien annuals, and thus reduces the total reserve of seeds in the soil. The removal of annual seedlings should be done by mid-January, in time to establish the native grasses before the summer drought. Fire tends to stimulate the growth of any low-vigor perennials which may be present, whereas tilling often destroys these relict plants, which often persist undetected in annual grasslands. Tilling on the other hand presents a potential for the loss of soil from erosion and should be used only where fire is inappropriate.

The application of herbicides is a poor method of site preparation because most of the competing annuals are grasses, and chemicals which control them also eliminate perennial grasses. The uncertain availability of many herbicides in the future in another limitation of many herbicides in the future is another limitation of this method.

Propagation

Three methods of propagation can be used immediately following the preparation of a site, 1) broadcast seeding, 2) drilling, and 3) transplanting. Broadcast seeding has the lowest establishment rate of the tree, but it is the cheapest. Drilling requires the use of a rangeland or agricultural drill that plants the seed at a specified interval and depth. It also requires prior processing of the seed (awn removal, etc.) and the purchase or rental of a drill, at a cost which can be economically prohibitive. Although expensive, drilling is a highly efficient method of sowing scarce seed.



One-month-old greenhouse-grown seedling of Stipa pulchra (purple needlegrass) in a three-inch peat pot.

For transplanting, either wild specimens from the field or greenhouse-grown seedlings can be used. Field transplanting of bunchgrass consists of uprooting and dividing the bunches and replanting them in their new sites. This may be the only means of propagating species that produce either scant seed or seedlings with low viability. Growing seedlings in the greenhouse has the disadvantages of requiring space and planting materials, but it is a less destructive transplanting method. Seeds are germinated in the greenhouse and plants are grown in the greenhouse for one and a half to two months; then are transplanted to their permanent site in December or January.

"Success" in propagation is a function of both the techniques used and the objectives. For example, successful conservation of a species may require the establishment of perhaps twenty plants per acre, while the reconstruction of a "pristine" biological study-area requires a much greater plant density. Therefore appropriate propagation methods should be selected to fit the objectives.

Strawberry Canyon Study

Dr. James Bartolome of the University of California, Berkeley, and I are studying methods for propagating native perennial bunchgrasses Our study is being conducted in the Strawberry Canyon Natural Area on the Berkeley campus. It is currently in its third year. In mid-December 1978 separate plots were burned or tilled to reduce weed competition. On the burned plots six thousand pounds per acre of annual grass mulch was burned, resulting in a low-intensity grass fire. On the tilled plots tilling was done with a roto-tiller. Both treatments significantly reduced the total plant material as measured the following June. Previously unnoticed native perennials, *Stipa lepida* (foothill stipa), and *Elymus glaucus* (blue wildrye) showed a flush of growth and an increased amount of seed set in response to burning.

Following the site preparation, seeds of *Stipa pulchra* (purple needlegrass), Festuca rubra (red fescue), and *Melica californica* (California melic) were broadcast at thirty-two, twenty-four, and sixty-four pounds per acre, respectively, on a six-hundred-square-foot plot. In August 1980, forty-seven two-year-old plants of S. pulchra and twenty-seven of F. rubra were found on a five-hundred-square-foot portion of the broadcast-seeded plot, which was either tilled or burned. Seed was produced by seventeen of the S. pulchra plants. More plants of S. pulchra were established on the treated area than plants of F. rubra. There was no difference between the two methods for either species. No M. californica plants were found. No plants of any of the species were found on the one-hundred-square-foot untreated portion of the plot. Seeds of *Melica torreyana* (Torrey's melic), *Koeleria cristata* (prairie Junegrass), and *Danthonia californica* (California oatgrass) were broadcast at much lower rates on a one-hundred-square foot burned plot. No plants of these species were found in September 1980.

In December 1978, five wild specimens each of *S. pulchra* and *S. lepida* were transplanted to a burned plot. Three *S. pulchra* and four *S. lepida* plants were present and producing seed in June 1980.

California Oatgrass
Danthonia californica

Stipa pulchra, *Melica californica*, *M. torreyana*, *Koeleria cristata*, *Danthonia californica*, *Festuca rubra*, *F. californica* (California fescue), and *Poa scabrella* (pine bluegrass) seeds were germinated in the greenhouse in November 1979, for transplanting. The seedlings were transferred from flats to three-inch peat pots when they reached the three-leaf stage. Three to four plants were places in each of seventy-five pots. In early January 1980, after planting in the peat pots, the seedlings were transplanted into plots which had been burned the previous winter. (The sides of the pots were removed before planting because peat tends to act like a wick, depleting soil moisture around the seedling.) All transplants has survived as of June 1980, except seven of ten F. californica, which were undermined by gophers and one of six M. torreyana, which was uprooted by a grazing animal.

Seed used in this study was collected by the author in the San Francisco Bay Area, and was not stored for more than one year.

Summary

Preliminary results from this study show several methods which can be used for site preparation and propagation. The choice of these methods should reflect the particular objective of the project. Site preparation using fire and tilling was necessary for the establishment of broadcast seed. Two-year-old plants of Stipa pulchra and Festuca rubra from broadcast seed were present at a density of 1.5 plants per ten square feet on the treated plots. Plants of other broadcast species were not found. Transplanting wild and greenhouse-grown plants shows great potential as a method for establishing native perennial grasses. The greenhouse-grown seedling method is less destructive and more practical when seed is available, and because transplanting removes competing annuals from around the new perennial, fire and tillage may be unnecessary.

Plans for further study on this site include reburning for weed control, different broadcast-seeding rates with closer monitoring, enlarging the study area, and increasing the number of plants tested. Funding for future research has been mad possible by a grant from the Elvina J. Slosson Research Fellowship in Ornamental Horticulture.

The development of sources of seed adapted to different environments and the refinement of propagation techniques will help to increase the use of native perennial bunchgrasses in California. The present lack of seed sources has limited the evaluation of appropriate species for particular environments. Currently, only species whose seed can be collected by an interested party or on a contract basis with a native plant supplier can be considered for use. Further propagation studies in different parts of the state, on larger sites, and using different species from diverse environments will provide information needed for the selection of appropriate species and the rational application of propagation techniques.

In California the potential is great for using native perennial bunchgrasses in gardens, large scale landscaping for erosion control, and as a mitigation measure. An increase in public awareness and interest, the development of seed sources, and the refinement of propagation techniques will help to achieve this potential.