

## USE OF FIRE TO CONTROL FRENCH BROOM

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Controlling exotic plants is a very difficult and sometimes impossible task. Any technique that effectively treats large populations is valuable. If the control method is also inexpensive its appeal increases dramatically. Prescribed burning can treat large areas inexpensively but unfortunately many exotic species are adapted to fire, possessing strategies which allow them to survive its effects.

French broom, Genista monspessulana, is an important weed species that is fire vulnerable. Pre-treatment is necessary and the physical layout of the sites must be such that burns can be conducted without undue risk or expense. Compared to other methods, however, burning can be very cost effective.

In 1994 a relatively large scale project began at Mt. Tamalpais State Park, Marin County, California, using this technique. In recent years dense stands of French broom had become established on the northeast side of the park downslope of the Panoramic Highway (Panoramic Unit) and in the vicinity of Muir Woods Road (Muir Woods Road Unit). At these locations the park borders a dense residential neighborhood in the City of Mill Valley. The sites are highly visible and traversed by well used hiking trails. Before treatment began approximately 70 acres of the 91 acre project area was occupied by broom. The Panoramic Unit was almost continuous broom while the broom stands in the Muir Woods Road Unit formed a mosaic with surrounding grassland and native shrubland. Significant stands of Scotch broom, Cytisus scoparius, were also present in portions of this unit. An aerial photograph taken in 1943 shows that these were grassland sites prior to the influx of broom.

The goal of this project is the restoration of this grassland plant community. This is being accomplished through a series of manipulations which begin with hand cutting the broom. Subsequent prescribed burning prevents resprouting of cut stems and seedling survival. The project's success to date and its relatively large scale allows new conclusions to be reached regarding the effectiveness of this technique.

## Methods and Materials

All of the broom within the project area has now been treated. Work began first in April, 1994, on the Panoramic Unit. A crew from Sylver Trees of Potter Valley, California used chain saws to cut the broom, taking 800 hours to cut an almost impenetrable 27 acres. The broom was cut to within 6 to 12 inches of the ground. All cut stems were left in place, providing a two to three foot deep bed of fuel.

In December, 1994 an additional 12 acres of broom was cut by the Marin Conservation Corps (MCC) above Muir Woods Road. The Corps used both weed eaters and chain saws. The work proved to be challenging because of the density of the stands and the steep terrain. In December of 1995 and October of 1997 the Sylver Trees crews returned to cut an additional 30 acres, completing the phase of the project which targeted mature stands of broom.

The sites were broadcast burned after the cut material cured. The Panoramic Unit was burned on May 13, 1994. Cut broom in the Muir Woods Road Unit was burned on June 13 and June 20, 1995 and on April 25, 1996.

The broom burned in May, 1994 was very dry and extremely flammable. The weather conditions on the day of the burn were moderate (73° F, 52% RH) but very intense upslope headfires were possible. There was limited surface fuel to carry a backing fire. Due to the abnormally wet winter in 1995 a period for burning was not available until June of that year. Significant stem sprouting had occurred by that time and the fires were less intense but still resulted in complete consumption of all the cut material. The April, 1996 burn was conducted during relatively cool conditions due to rainfall the previous day, but again produced complete consumption.

Rainfall occurred soon after the May 13, 1994 Panoramic Unit burn and seedlings appeared and survived the summer. None of the cut broom stems sprouted. Native coyote brush, Baccharis pilularis, was scattered throughout the site and these plants, in contrast to broom, vigorously sprouted after cutting and burning. The burns on the Muir Woods Road Unit produced about the same results with complete cut broom plant mortality and vigorous coyote brush stem sprouting.

Because of the long term viability and abundance of the French broom seed bank, re-establishment of the broom stands must be prevented. A cost effective and efficient method is necessary to kill seedling plants before they reproduce, eliminating the seed bank over time. This is being achieved through the establishment of a cover of annual grass designed to provide a fuel source for the subsequent burns needed to kill broom seedlings.

In November 1994, the California Conservation Corps (CCC) seeded 90 pounds/acre of UC603 barley, Hordeum vulgare, to the Panoramic Unit. By the last week in November of that year it did

not appear that the barley was becoming established at an adequate density to provide the necessary fuel load. At that time the CCC applied a mixture of blando brome, Bromus hordeaceus, at 18 pounds/acre and zorro fescue, Vulpia myuros, at 6 pounds/acre to the site in an effort to provide a more even and dense fuel load. This blando brome/zorro fescue seed mix was later applied to the Muir Woods Road Unit in November and December of 1995 and December of 1996 and 1997.

In early summer 1995, after the annual grasses planted on the Panoramic Unit had cured, it became obvious that there were patches of densely spaced broom seedlings which would survive fire if left untreated. To ensure a good fire kill in these areas, 40 hours of CCC crew person time was spent cutting the plants with weed eaters equipped with tri-blades. A similar area of dense broom seedlings without adequate grass fuel to produce mortality was cut by the CCC in the summer of 1997 in the Muir Woods Road Unit.

The grass fuel on the Panoramic Unit was burned on July 26, 1995 and again on July 19, 1996. On October 15, 1996 a large portion of the Muir Woods Road Unit was burned and on September 4, 1997 the entire area under treatment was burned. These burns consumed a large percentage of the available grass fuel, killing most broom seedlings.

## Results

None of the broom plants cut in the Panoramic Unit or the Muir Woods Road Unit sprouted after the cut material was broadcast burned. The fires effectively killed the cut stems. The height that the broom stems had been cut above ground varied between three inches and two feet.

The results of seeding grass to provide fuel was less uniform. In general, the density of agricultural barley used on the Panoramic Unit was not adequate to provide an ideal fuel load. The plants were too widely spaced even in the best locations. In addition, throughout the 27 acres seeded with barley, there were areas where only scattered plants became established. The blando brome/zorro fescue mix, however, filled in to improve the fuel load.

There have also been small areas which were entirely missed during seeding operations. Steep slopes and adverse weather conditions can be blamed for these un-seeded locations.

The fires that burned this grass fuel on both units killed almost all of the broom seedlings, even though many stems were not consumed. Fire did not carry through some small areas where grass seeding was inadequate but there has been an very high percentage of seedlings killed overall by each burn. Seedling size appears to influence vulnerability to fire with minimum heat needed to kill small plants. Limited basal sprouting of larger seedlings after burning has occurred but the sprouts have been

very small in comparison to vigorous coyote brush and roadside fennel, Foeniculum vulgare, sprouting.

### Discussion

The control of plants such as French broom which produce very long lived seeds is especially difficult. A technique is necessary to deal with the large seed bank as well as the mature plants. What this project has demonstrated is that large numbers of mature plants can be removed economically using prescribed fire. This is the same initial result that would have been achieved if these mature plants had been pulled one by one with weed wrenches or sprayed with herbicide. The direct cost of cutting stands of mature broom in preparation for burning is relatively low. The cost of labor is variable, but it is reasonable to expect that this work can be done for approximately \$500 per acre.

What is yet to be determined is the magnitude of the long term effort needed to eliminate the seed bank. This project did not include seed bank measurements, however, so it is still unclear how quickly the seed bank is being depleted. Permanent transects were established on the Panoramic Unit in 1994 but current data is not available to evaluate the level of seed bank depletion. On both units a dense carpet of broom seedlings became established after the first burns removed the cut broom. This level of germination certainly appears to be fire induced. The number of seedlings that became established after the second grassland burns were greatly diminished so it can be presumed that significant seed bank reduction has occurred. The Panoramic Unit has been burned three times including the first burn which consumed cut broom. It was not burned in summer, 1997 because of the relatively few broom seedlings present. It is felt that a summer, 1998 burn will remove a high percentage of these seedlings. If some are too large to be vulnerable to a grass fire a low cost herbicide spot treatment may be necessary.

The two exotic grass species that were used when the barley proved to be inadequate are found throughout many grassland sites in this. As a result, their addition to this site was considered to be a reasonable price to pay for the removal of the broom. It would have been preferable to use native species but this was not possible. Even if genetic integrity concerns had not dictated the use of site specific seed, costs would have been prohibitive. Also, perennial bunch grass species could not have been established at an adequate density to meet fuel production objectives.

The future methods used to assure that broom does not re-occupy the site will be determined after considering various options. This project has taken an integrated approach, using mechanical treatments, prescribed burning and limited herbicide use outside of the burned area. Burning is not without its

liabilities. The neighboring community has been very supportive of the project, primarily because of fire hazard reduction benefits. Even with this support, smoke management has been difficult. This is primarily because of the particular location of the site. The treatment areas extend up to a ridgeline which is the park boundary. Unless very specific burning conditions are met smoke travels at low elevation over this ridge and into residential neighborhoods. Annual or biennial burning must take place initially but as the number of broom seedlings which become established after burning become greatly diminished, smoke impacts must be balanced against the difficulty of using other more labor intensive control methods. Regardless of the method chosen, a continuing long term control program will be needed to sustain the gains that have been made.

Finally it should be remembered that burning has benefits that go beyond the control of exotic plants. Native grassland plant communities are very well-adapted to fire. A long term prescribed burn program, coupled perhaps with direct seeding, can result in the restoration of a grassland with a high representation of native species. Already there has been a definite increase in the number of native bunch grass species in the treatment areas. Trail side populations have expanded into areas previously occupied by dense stands of broom.

	Cut	Burned	Seeded	Grass burned
Panoramic Unit (27 ac broom)	4/94	5/94	10-12/94	7/95, 7/96
Upper Muir Woods Rd. Unit (12 ac broom)	12/94 to 3/95	6/95	11-12/95	10/96, 9/97
Lower Muir Woods Rd. Unit (20 ac broom)	11/95	4/96	12/96	9/97
Remaining Lower Muir Woods Rd. Unit (10 ac broom)	10/97			

## CALIFORNIA NOXIOUS WEED CONTROL PROJECT INVENTORY

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In 1995 through 1997 a Memorandum of Understanding was signed by sixteen State and federal agencies to create the California Interagency Noxious Weed Coordinating Committee(CINWCC). The CINWCC also includes many stakeholder groups such as the Cattelmens Association, CalEPPC, California Native Plant Society, Nature Conservancy and the Nuserymen's Association. The CINWCC holds quarterly meetings, and has formed six subcommittees: 1) Weed Project Database; 2) Education; 3) Research & Monitoring; 4) Funding & Grants; 5) Regulatory Streamlining; and 6) Regional Working Groups.

The CINWCC Weed Project Database Subcommittee has designed the California Noxious Weed Control Project Inventory (CNWCPI). The Committee is led by California Department of Food & Agriculture staff, and has been additionally funded by the California office of the United States Bureau of Land Management. The project inventory is an Internet-based searchable database. The technical coding of the database and its housing is contracted to the Information Center for the Environment at the University of California at Davis. Information about a noxious weed control projects is entered into the database by having a person affiliated with the project fill out a three page dataform and submit the form. Once in the database, projects can be viewed with an Internet browser. One can search the project database for projects selected on many criteria such as; county, weed species, treatment, agency, etc. The database will also contain an on-line encyclopedia of noxious weed biologies and control methods, as well as links to other weed control related Internet sites. The Internet address of the database is <http://endeavor.des.ucdavis.edu/weeds/>.