

Use of Fire to Control French Broom

David Boyd

California Department of Parks and Recreation
1455-A East Francisco Blvd., San Rafael, CA 94901

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. There is potential, however, to achieve control of some species using fire if specific parameters are met.

One of these fire vulnerable species appears to be French broom, *Genista monspessulana*. The Marin Municipal Water District, Marin County, California, has made some use of fire to control French broom for a number of years. Dr. Carla Bossard is currently conducting studies which include the use of fire to control this species at Jackson State Forest, Mendocino County, California. 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 from 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, the net area occupied by broom totaled over 60 acres. 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. An aerial photograph taken in 1943 shows that these were grassland sites prior to the influx of French 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 allow new conclusions to be reached regarding the effectiveness of this technique.

Methods and Materials

To date approximately 37 net acres of broom have been treated. Work began in April 1994 on the Panoramic Unit.

A contracted forestry crew used chain saws to cut the broom. In December 1994 an additional 12 acres of broom were 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. The forestry crew took 800 hours to cut an almost impenetrable 25 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.

The sites were broadcast-burned after the cut material cured. The Panoramic Unit was burned on May 13, 1994. By this date the material was very dry and extremely flammable. The weather conditions on the day of the burn were moderate (73°F, 52% Relative Humidity (RH)) but very intense upslope headfires were possible. There was limited surface fuel to carry a backing fire.

MCC cutting began in December 1994 but was not completed until early March 1995. Due to the abnormally wet winter, a dry period for burning was not available until June 1995. A portion of the site was burned on June 13, 1995 and the remainder was burned on June 20, 1995. Significant stem sprouting had occurred by that time and the fires were less intense.

Rainfall occurred soon after the May 13, 1994 Panoramic Unit burn; seedlings appeared and survived the summer. Permanent transects were established in late September 1994 to measure the abundance of these seedlings (Table 1). Very few other plants were present and 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.

Because of the long term viability and abundance of the French broom seed bank, the project's most difficult task will be to prevent re-establishment of broom stands. A cost effective and efficient method must be developed to kill seedlings 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 mid-October 1994, (the California Conservation Corps (CCC) applied 16-20-0 fertilizer at a rate of 365 pounds/acre to the Panoramic Unit that had burned the previous spring. In early November 1994, 90 pounds/acre of UC603 barley, *Hordeum vulgare*, was sown by the CCC. By the last week in November it appeared that the barley was not becoming established at an adequate

density to provide the necessary fuel load. At this 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. The results of this seeding are reflected in Table 1.

Table 1.
Mt. Tamalpais French Broom Control
Transects Summaries

Fall transect: September 26, 1994

Spring transect: May 19, 1995

Note: 25 meter transects with 100 CM² (20cm X 50cm) quadrat placed on alternate sides of the tape every 2.5 meters (i.e., 2.5, 5, 7.5, 10, . . . etc.). Only main species of concern included in this summary.

Transect 1a and 1b	# of Broom Plants per Quadrat	Height (cm)		Veg. Cover (%)	
		Fall	Spring	Fall	Spring
<i>Genista monspessulana</i>	25.6	19.1	104.6	11.0	54.0
<i>Hordeum vulgare</i>					17.3
<i>Vulpia myuros</i>					15.2
<i>Bromus hordeaceus</i>					4.0
Bare Ground				76.2	0

Transect 2a and 2b	# of Broom Plants per Quadrat	Height (cm)		Veg. Cover (%)	
		Fall	Spring	Fall	Spring
<i>Genista monspessulana</i>	19.9	22.4	95.3	12.5	25.8
<i>Hordeum vulgare</i>					51.6
<i>Vulpia myuros</i>					11.3
<i>Bromus hordeaceus</i>					5.1
Bare Ground				77.0	0

Transect 1a and 1b	# of Broom Plants per Quadrat	Height (cm)		Veg. Cover (%)	
		Fall	Spring	Fall	Spring
<i>Genista monspessulana</i>	7.0	14.4	99.0	--	6.7
<i>Hordeum vulgare</i>					10.5
<i>Vulpia myuros</i>					50.6
<i>Bromus hordeaceus</i>					8.6
Bare Ground				88.2	3.5

In early summer 1995, after the annual grasses planted on the site had cured, it became obvious, that there were patches of densely spaced broom seedlings which would survive fire if left untreated. The total area occupied by these patches was only about two acres but four of the permanent transects fell in these dense seedling patches.

These transects were re-read on May 19, 1995 and show a particularly high percent cover of broom. 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.

On July 26, 1995 the Panoramic Unit was burned again. The fuel and weather conditions were dry enough to consume a large percentage of the grass fuel.

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 broom stems had been cut from three inches to two feet above the ground.

The results of seeding grass to provide fuel was less uniform. In general, the density of agricultural barley was not adequate to provide an ideal fuel load. The plants were too widely spaced even in the best locations. In addition, throughout the 25 acres, there were areas where only scattered plants became established. The blando brome and zorro fescue, however, filled in and improved the fuel load.

The fire that burned this grass fuel in late July 1995 killed the tops of almost all the broom seedlings on the site, although the stems were not consumed. The fire did not carry through some small areas but well over 99% of the plants were impacted. Many seedlings were quite large at the time of the burn. Some plants were over five feet high, with one inch stem diameters at ground level. These largest plants had become established soon after the site was burned in May 1994.

The final level of seedling kill has not yet been determined. Some basal sprouting is taking place but only on a very limited number of seedlings. The permanent transects were again read on September 9, 1995, seven weeks after the burn, and only one seedling, (0.4% of the total 240 seedling sample), had sprouted. All of the coyote brush and roadside fennel (*Foeniculum vulgare*) was sprouting, and these sprouts were much more vigorous than the small basal broom sprouts.

Discussion

The control of plants such as French broom which produce long-lived seeds is especially difficult. Techniques to deal with the large seed bank as well as the mature plants are needed. Thus far, this project has demonstrated that large numbers of mature French broom 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. Burning should promote seed germination. This project did not include seed bank measurements, however, so it is still unclear how quickly the seed bank is being depleted. The number of seedlings which emerge during fall 1995 on the Panoramic Unit will give an indication of the progress being made.

Some aspects of the technique used to kill seedlings with fire are also not fully developed. A few seedlings were not killed by burning the available cured grass fuel. The application of fertilizer may have resulted in rapid seedling growth and subsequent fire resistance. In addition, this survival may be at least partially the result of the early establishment of some of the seedlings in spring 1994, which allowed them to reach a fire resistant size by the time the burn took place. This could have been prevented by not burning the mature cut broom until fall, thus delaying all germination. This was not done on this project for two reasons. The window for burning is much shorter in the fall due to air quality considerations. Also, there is more hazard associated with fall burning of the highly flammable cut material because of the low fuel moisture of surrounding live native vegetation.

Better grass fuel production is also needed. Barley was chosen because it does not produce viable seed and so will not persist. Establishment was poor in many locations however, probably due to its large seed size. The seeds needed to be raked in to ensure germination, but this was impossible on a site this large and rugged. As a result, the stems that emerged were rather widely spaced and did not produce intense heat where it was most needed when burned.

The two exotic grass species that were used when the barley proved to be inadequate are found throughout many grassland sites in this area. It was felt that their addition to this site would not be significant. 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 bunchgrass species could not have been established at an adequate density to meet fuel production objectives.

The methods used to assure that broom does not re-occupy the site in the future will be determined after considering various options. This project has taken an integrated approach, using mechanical treatments, prescribed burning and limited herbicide use outside 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 location of the site. The treatment areas extend up to a ridgeline which is the park boundary. Unless 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 diminishes, 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 with direct seeding, can result in the restoration of a grassland with a high representation of native species. This project will include restoration work of this nature.