

Appendix Seven: Broom Removal Methods

The most effective invasive weed removal techniques consider the species involved, climate, terrain, size and age of infestation, previous efforts at removal (which often make future attempts at removal more time-consuming and costly), and the available financial and personnel resources.

The removal methods that we present here constitute a diverse tool kit for use in a broad range of site-specific conditions. We will work with landowners to develop the best set of removal tools based on landowner goals of containment, reduction, or eradication.

Manual Pulling

Manual methods use hand labor and hand-operated tools to remove the entire broom plant. Removal of the entire plant is extremely labor intensive, and thus costly. It is, however, the most successful method. Manual methods are highly selective one can remove broom plants with little to no damage to surrounding desired vegetation.



Weed wrenches provide gripping and leverage to remove above-ground plant and roots. <http://www.weedwrench.com/images/Tom%20&%20Weed%20Wrench-shadow.jpg>

It is possible to pull up new shoots of young Scotch broom by hand, a method that is easiest in winter or early spring when the ground is damp and soils are pliable. However, Scotch broom grows quickly and the root systems soon become deep and well established, which make manual removal impossible without the use of tools. In addition, the chances of re-sprouting are increased in the case of especially moist soil, and when involving young (1-3 years old) plants.

Plants should be pulled as soon as they are large enough to grab, but before they produce seeds. Single-stem plants up to three feet tall are easily hand-pulled. Weed wrenches, pulaskis, and shovels are useful tools for pulling larger broom plants. Tools such as chainsaws, and loppers can be used to cut the vegetative portion of Scotch Broom so that the remaining stem and roots can more easily be removed. This is particularly useful with multi-stemmed individuals.

Manual removal is the primary strategy for containing the growth of large stands, and for subsequent re-treatment of already-treated stands. In addition, manual pulling can be the preferred method for eradication of stands < 1 acre, as well as stands that are ecologically sensitive.

Truck & Chain Pulling

Truck-and-chain pulling consists of using a 4x4 vehicle and approx. 25 feet of chain secured at the base of mature, multi-branched, broom plants along roadsides. Once the branches are sawn off, it takes approximately two minutes to pull each plant. This method works only for those mature plants that are not only vehicle-accessible but also in a safe location.

Sawing

Sawing of the above-ground portion of the plant is less labor-intensive than manual removal, though not 100% successful. About half of cut plants will re-sprout in typical conditions, but well-timed cutting can nearly eliminate re-sprouting, especially on older stands. Young vigorous plants in moist soil re-sprout the most. Incorrect cutting in moist soil can result in 50% of the plants re-sprouting. Old plants in dry soil re-sprout the least, with re-growth rates near zero if cutting is done carefully.

One researcher (Bravo, 1985) suggests cutting plants before the seeds are set; this prevents seed production and dispersal for that plant. However, if the stand is well established, one additional year of seed production is probably not significant. It is most effective to cut plants below the basal node (i.e. near or below ground level, where the stem is more yellow than green) during the dry season (July - October in the Petrolia). Cutting large, mature plants at chest height during the dry season, and cutting off side branches will generally eliminate re-sprouting.

The key to long-term control is to prevent seed set after the initial clearing takes place. Sites with an established broom seed bank require follow-up treatment for many years.

Excavator

Excavators have been used successfully on flat or gently sloping land. According to local rancher Tim Cook, it is possible to sit in one place and grab several “mouthfuls” with the machine before “spinning around to pile the plant material”. This method provides a burnable pile, relatively free of soil, while recovering most roots. As with all mechanical treatments, there are drawbacks to using an excavator. Soil compaction and disturbance are high, making future hand removal difficult because so many new plants establish on disturbed soil. It is possible that this treatment requires grazing or mowing as a re-

treatment. Excavators should not be used in areas of high ecological importance, as much of the surrounding vegetation would be destroyed in the process.

Brush Hog

Scotch broom can be cut by tractor-mounted mowers (often called bush or brush hogs) on even ground. In addition to the limitations that hillslope impose on this method, mowers can only be used on plants that are a certain size. Mowing can, however, be used as a re-treatment for re-sprouts following sawing. This method will require several cuttings before individual plants die. If only a single cutting per year can be made, the optimum time to cut is as the broom begins to flower. At this stage, root reserves of nutrients are at their lowest and you lower the risk re-seeding the sight.



Bush hogs work well on level ground, and when landowners are committed to several years of follow-up mowing. www.opico.co.uk/agmac/bush-hog/specs_01.htm

Follow-up treatment after mowing is either continued mowing or grazing, as the cut broom plants will re-sprout from ground level. In addition, mowing or grazing to retreat such areas is necessary because tractors tend to compact the soil, making most other methods exceedingly difficult. (Soil compaction greatly hinders manual removal, especially for multi-stemmed plants, which occur because of mowing.) Another problem with mowing is that it affects all vegetation in the area, not just the broom.

For these reasons mowing should only be considered as a method if a land-owner is committed to long-term mowing or grazing, and eventual reseedling of native plants.

Heat / Prescribed Burning

Because broom produces volatile oils, the plants are highly flammable and thus large infestations may be burned in order to remove standing mature plants. Prescribed burning logistics include the time and cost of coordinating a burn, administrative and legal issues related to burning, and the amount of turned-up, or disturbed soil resulting from firebreak construction and fire mop-up efforts. This latter condition promotes broom seedling establishment. In addition, although burning effectively removes the shoot portions of broom plants, it also stimulates broom seed germination. Such germination is desirable *if and only if* the landowner is committed to long-term follow-up using aggressive re-treatment strategies until the seed bank has been exhausted.

So, we must emphasize:

Improper use of broadcast burning however, especially without aggressive follow-up may contribute to a re-invasion of broom or other weeds by creating more bare soil and a flush of available nitrogen.

Burning should be followed by scorching those seedlings that are fewer than 2 inches tall by using a propane torch, by manual removal of seedlings greater than 2 inches as they mature, and eventual re-vegetation with fast growing native species where appropriate.



A Mattole resident volunteers in a prescribed burn to keep grazing lands open and broom and other invasives at bay. Photo by Andy Chittick.

Fire can be applied at very small scales to aid in keeping invasives at bay. http://www.flameengineering.com/Assets/torch_images/Flaming-in-Rock-Garden.jpg

Most of all, burning Scotch broom stands should not be done without proper permits, planning, safety personnel, and under the right weather conditions. This is accomplished by coordinating with CDF. CDF generally pays for 90% of the cost to burn, leaving the other 10% as a cost share for the landowner to produce. According to CDF this cost share is in the form of equipment provided or used by the landowner to cut fire line, provide water, etc.

Grazing

Livestock grazing as a control measure may be effective, although Scotch broom is slightly toxic and unpalatable to most livestock (Mobley 1954, Long 1938). In many areas of California the use of Angora and Spanish goats is showing promise as an effective control for Scotch broom (Daar 1983), both types of which have co-evolved with broom in its native habitat. Goats are able to negotiate steep slopes, and can be used to retreat seedlings between 4 inches, and 2 feet. Drawbacks to goats include their consumption of desirable vegetation (riparian areas should not be grazed), and the labor involved in the pasture rotations necessary.



Goats can be an effective tool for treating invasive plants. <http://www.fibergoat.com/Images/brush%20goats.jpg>

In the Mattole, ranchers have had some success controlling broom using large numbers of grazers in 2-5-acre pastures for short periods of time. Once grazed down, the pasture should not be re-visited for forty days. Since most ranchers have much larger areas fenced, movable electric fence is often used, making parcels “on the grid”, more successful in this endeavor, and parcels which are flat (fewer posts per linear distance), cheaper to use grazing. In addition local experience has it that scotch broom can cause pregnant does to abort while eating large

amounts of broom. A remedy to this problem would be to use se predominantly wethers and bucks, and less frequently, does with kids on the ground.

Cultural Control

Research by Williams (1983) suggests that broom stands are early successional plants (that is, they establish first after a soil-exposing disturbance) and can be replaced by plants that establish some years later, like forest vegetation, if left undisturbed. Planting of tall-growing and desirable shrubs or trees in or near broom stands may aid in reducing photosynthesis in broom plants and *possibly* lead to their demise. This method should be treated carefully, as it is highly site-specific in its success.

Local broom infestations that the Mattole Restoration Council has treated for the past three years have shown this pattern not only in the growth rate of existing plants, but also in rate of germination. Those stands in partial to full shade have few to no re-sprouts after removal of mature plants, whereas stands in full sun have multiple cohorts of seedlings surrounding mature plants, and the seed bank re-sprouts readily in years following

removal. Thick native bunch grasses have also been noted to have this effect of suppressing germination around solitary mature plants. This phenomenon was noted on the “Strawberry Rock grazing allotment”, near Windy Point on four different sites. (See Figure 9.)

Integrated Pest Management

Integrated Pest Management (IPM) incorporates an ecosystem-based control strategy with a long-term goal of *preventing* invasive exotics. IPM uses biological control, habitat manipulation, manual control, mechanical removal, chemical control and cultural practices to ensure long-term prevention of brooms and other invasive plant species in site-specific situations (LeBlanc 2001).

Biological Control

Introducing natural predators (usually insects) is often a successful control method and has been effective with many species. But FDA testing and approval is necessary, and it is not recommended for all species. Like most control techniques, biological control is most successful when combined with other techniques, such as habitat manipulation.

The insects listed below are used specifically for Scotch Broom, and do not colonize or affect French or Spanish Broom. These insects are currently the only broom bio-control mechanism under consideration in the U.S.

Insects

- *Leucoptera spartifoliella* (Scotch broom twig miner)
- *Apion fuscirostre* (Scotch broom seed weevil)
- *Agonopterix nervosa* (Gorse or broom tip moth)

Despite their use as bio-control agents, none of these insects have proven extremely successful at controlling broom.

As of yet, the Mattole Restoration Council does not advocate the use of bio-control agents for the removal of any invasive species, including broom.

Chemical Control

The use of herbicides, though not recommended for use in the Mattole watershed, is a commonly used technique for controlling invasive exotics. However, this technique is most successfully used when combined with other methods and not used as the primary control method.

Figure 3: Broom Brush Eradication Methods and Treatment Phases

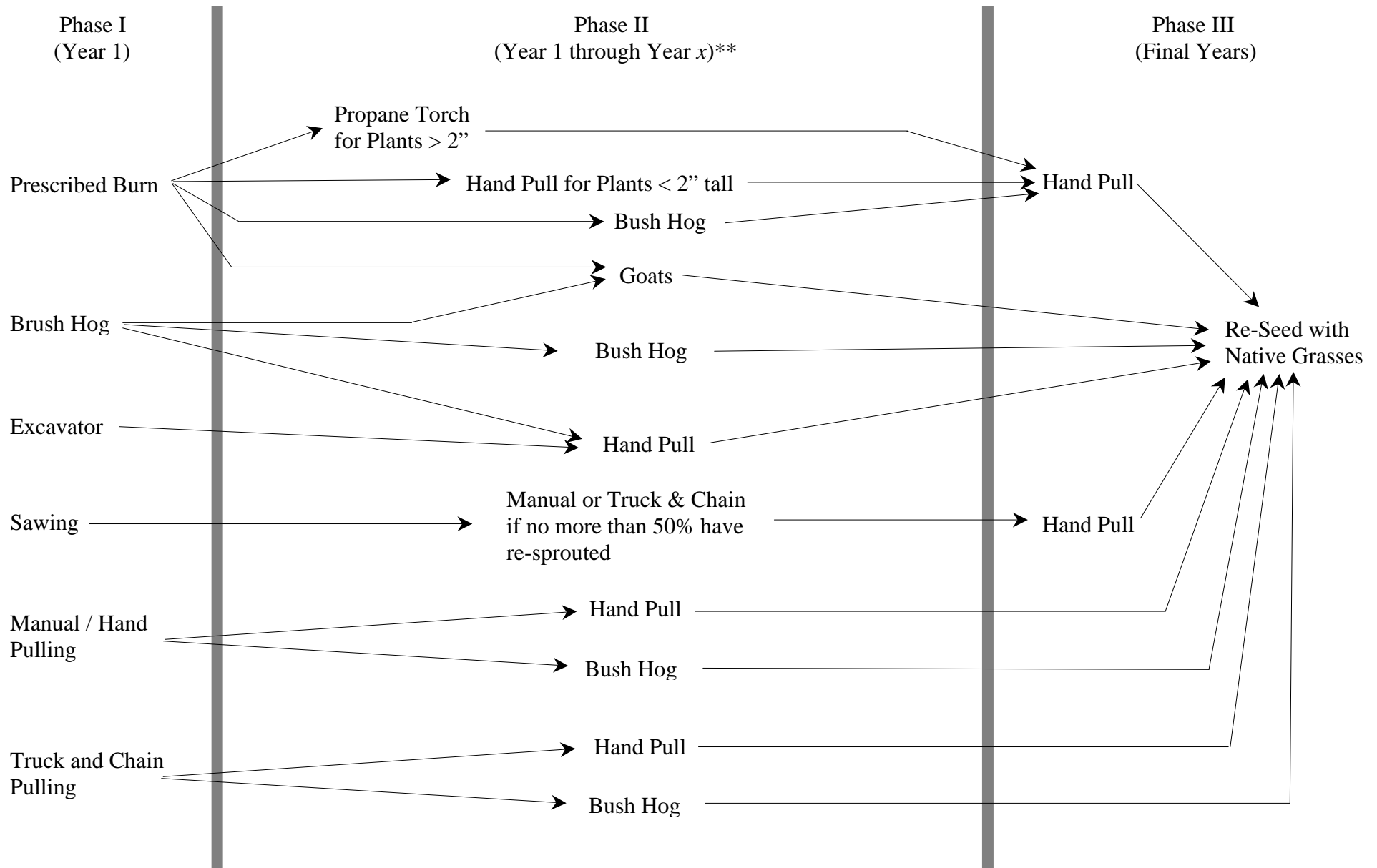


Figure 1. ****NOTE:** Year "x" refers to site-specific variations in when treatment can move from Phase II to Phase III



	PROXIMITY TO ROAD		TOPOGRAPHY			SOIL COMPACTION		AGE				SIZE OF INFESTATION			BRANCHING @ BASE			RATE OF SPREAD OVER 5 YEARS				PLANT COMMUNITY AROUND BROOM				LANDOWNER RESOURCES AVAILABLE			
	Roadside	Non Roadside	Steep	Moderate Slope	Flat	Light-Moderate	Severe	Seedling (0-2")	Immature (Never Seeded)	Young Mature (Flowers/Seeds)	Old Mature (Diameter. >2.5" w/ Flowers/Seeds)	<1 Acre	1-5 Acres	>5 Acres	None-Light (0-3 Branches)	Moderate (4-10 Branches)	Severe (>10 Branches)	<5' From Edge	5-20' From Edge	21-60' From Edge	>61'	Riparian	Shrubs/Young Trees	Grassland	Forest	Dozer	Brush Hog	Excavator	Labor For Follow-Up
Manual Pulling	0	0	0	0	0	1	2	1	2		1	2		1	2			1	2	3		0	0	0	0				1
Truck & Chain Pulling	1		0	0	0	1	2		2	1		1			2	1		0	0	0	0	0	0	0	0				1
Excavator	0	0		2	1	2	1		2	1		1	2		0	0	0	0	0	0	0			1				1	2
Sawing	1	2	1	2	3	2	1		1		1	2			2	1		0	0	0	0	0	0	0	0	0	0	0	1
Prescribed Burns	1	2	1	2	3	2	1		2	1			1		2	1		0	0	0	0			1		1	3	2	
Propane Torch	0	0	0	0	0	2	1	1				2	1	3	0	0	0		3	2	1			1					
Brush Hog	0	0		1		2	1	3	1	2		2	3		3	2	1	0	0	0	0			1		1		2	
Goat Grazing	2	1	1	2	3	2	1	2	1			1			0	0	0		3	2	1			1				1	

1 = Best choice 2 = Good choice 3 = OK choice 0 = Any option with a zero is acceptable Blank = Don't do it!

Broom Brush Calendar of Optimal Times for Treatments

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Prescribed Burning ¹	Optimum	Optimum	Good	OK						Good	Optimum	Optimum
Excavator ²						Optimum	Optimum					
Brush Hog ³				OK	OK	Good	Optimum	Optimum	Optimum	Good		
Sawing ⁴				Good	Optimum	Optimum	Optimum	Good	Good			
Truck and Chain ⁵			Good	Optimum	Optimum	Optimum	Good					
Manual ⁶			Good	Optimum	Optimum	Optimum	Good					
Goat Grazing ⁷	Good	Good	Optimum	Optimum	Optimum	Optimum	Optimum	Optimum	Optimum	Good	Good	Good
Re-Seeding ⁸	Optimum	Optimum	Good							Good	Optimum	Optimum
Re-Planting ⁹	Optimum	Optimum	Good								Good	Optimum

= Optimum time
 = Good Time
 = OK if weather or site conditions are right

¹Burning is a function of when CDF is available and weather conditions immediately before desired burn date

²Done during the dry season when soil is firm enough to minimize rutting and erosion; best time is prior to seed maturing

³Done during the dry season when soil is firm enough to minimize rutting and erosion; do at regular intervals to avoid re-growth and flowering

⁴Start of flowering season until mature seeds have formed and plant resources are at a seasonal low

⁵Following the bulk of the rainy season until prior to seed maturity

⁶Following the bulk of the rainy season until prior to seed maturity

⁷Intensive grazing, which should be followed by five to six weeks of rest before re-grazing

⁸Immediately prior to the start of the rainy season, or during a predicted lengthy rainy spell

⁹Start of the rainy season until two months prior to its end

