Plant Control–Some Possibilities and Limitations[1]
I. The Challenge to Management

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Recent successes in plant control on many fronts have been so notable that the idea of examining the possibilities and limitations of plant control on the vast expanse of American wild lands may seem superfluous. Since World War II impressive acreages of culturally established reseeding have been accomplished in the Northern Great Plains and Intermountain regions of the United States. New techniques of large scale operation in brush chaining, cabling, root plowing, and mowing have cleared major woody pest species from significant areas in the Southern Plains. Selective spray developments have given sufficient success to raise the hope, if not the confidence, that such sprays can be developed for specific application to almost any undesired plant or association. Imported insect enemies of goatweed *(Hypericum perforatum)* are bringing the Pacific Northwest's far-ranging infestation of that plant under control.

The total effect of these many accomplishments in plant control naturally is one of optimism. Yet there are major limitations, both physical and economic. There are, also, limitations arising out of conflict of interest as to what use should be made of our wild lands. While it is not the purpose of this paper to dispel the optimism now prevailing, various practical problems which will require increased attention in future large scale plant control programs are discussed.

Terms Need Definition

As background for this discussion, the following review of definitions will be helpful:

Control is a word of many degrees. It may mean anything from mere direction, at the one extreme, to complete eradication at the other. In between lie such ideas as replace, restrain, limit, balance, manage, utilize, and tolerate. As range managers we would like to *eradicate* certain death-dealing poisonous plants. We work toward *replacing* low value invaders with more useful plants. We are content to *restrain* northern blackbrush *(Coleogyne ramosissima)* and big sage *(Artemisia tridentata)*, each of which has important values in its own right. We might settle for *limiting* medusa rye *(Elymus caput-medusae)* to its present territory, if we could. We seek to strike a *balance* between plants and associations most profitable for livestock production and others necessary for wildlife. We aim to *manage* our way around the seasonal dangers of lupine *(Lupinus* spp.) and larkspur *(Delphinium* spp.) in the north, and bitterweed *(Hymenoxys odorata)* further south, meantime using the total feed resource in such a way as to discourage increase of these species. We try to *utilize* cheatgrass *(Bromus tectorum)* so as to take advantage of its late spring production peak without at the same time destroying the perennials which we hope gradually will regain their old dominance. And we simply *tolerate* a great many plants that have little apparent importance for us, just as we tolerate various people—we are willing to let them alone as long as they let us alone.

So when we talk of controlling undesirable range plants we are talking, not of a single aim or operation, but of many different possible approaches in the broad field of range management.

Undesirable likewise is a word of many meanings. We cannot stop with merely saying *what* plant or association is undesirable. Good range management requires us to act on the basis of why, where, when, how, and to whom that undesirability exists. The larkspur that is deadly in spring is harmless in summer and fall. The mesquite *(Prosopis* spp.) that was friend in need while it kept to the gulches and the badlands, is mortal enemy where it occupies what once were rich grasslands. The chaparral *(Adenostoma fasciculatum* and associates) that clothes the California Sierras is undesirable chiefly because there is far more of it than the desired balance between wildlife and livestock requires. The big sage of the Intermountain region that is useless to the summering cow is needful cover for the nesting sagehen, the range dropped spring lamb, and the antelope and deer fawn. It is a vital protein source to the wintering sheep and antelope.

Range, too, requires delimitation for purposes of this discussion. Essentially we speak here of wild grazing land, low productivity land, arid or semi-arid land, land not used for cultivated crops. While we include areas reseedable by cultural means, we exclude those areas which fall in the category of seeded pastures. While we include areas improved by water spreading projects, and the shoestring seasonal meadows that sleeve our

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[1] *Paper presented at the 11th Annual Meeting of the American Society of Range Management, Phoenix Arizona, January 30, 1958.*

mountain streams, we exclude permanent meadows capable of producing hay, and all managed-irrigation areas. In marking these limits we largely eliminate from consideration those pest plants whose chief importance is on crop lands — the noxious weeds named in our pure seed laws.

Finally, when we talk of controlling *plants* we are usually thinking of one or a few selected species. Only occasionally, as in the chapparal and Texas thornbrush areas, are we interested in controlling a major association. And even there we wish to rid ouselves only of the dominant woody plants. We would like to keep most of the interspersed grasses and forbs, and the micro-vegetation which inhabits the underlying litter and the humus layer of the soil. These distinctions raise some pertinent questions: Can we control a species without controlling an association? Can we profitably impose a type of plant community in an environment where it cannot survive by its own strength? Can we control selected plants without controlling wildlife, including rodents, game animals, predators — in short, whole biological groups?

Factors in Control

Without attempting to answer these questions here, let us consider some further background aspects of our general subject. This material may be conveniently considered under five major headings, namely: (1) physical factors, (2) cost factors, (3) management factors, (4) livestock adaptations, and (5) conflicts in interest.

Early work in plant control dealt largely with physical problems. Much might be said here, but suffice it to say that the basic work in this field has been pretty well accomplished, and although there is much yet to learn we have in hand sufficient knowledge to permit us to proceed with large scale plant removal and reseeding projects with reasonable confidence that needed new knowledge will be gained before we exhaust the possibilities of what we already know. The remaining questions are not so much in the realm of how, physically, to accomplish our ends, as in the realm of how to gain them at costs we can afford.

What total capital investment are we facing when we contemplate a comprehensive range rehabilitation program? Can range revegetation really pay its own way as a private endeavor, or must it be subsidized by government benefit payments, by taking advantage of tax write-offs, or by applying windfall income from other sources? How many acres of range are occupied by undesirable plants, and what would it cost to clear them?

Size and Cost of Job

In order to get some approximate figures on the size and cost of the overall plant control job, each of 36 range authorities in the western United States and Canada were asked for listings of ten most undesirable range plants in their respective regions. The 33 replies received provided some rather startling statistics.

The inquiry covered the entire western range province in the United States and the Plains grazing region of Canada. Of the more than 70 species reported, 36 were reported as occupying 1,000,000 or more acres each. An additional 16 species were reported as infesting from 100,000 to 780,000 acres each. The total area reported for all these undesirables was an astounding 863,382,750 acres (Table 1). Even this figure does not include large areas of many undesirable plants listed but upon which acreage estimates were not ventured.

The total just quoted does not represent a net area. First, it represents area adversely affected by the plants listed, rather than area solidly occupied by them. Second, many of the same acres are counted more than once, because they are occupied by interspersed stands of two or more undesirables. What we are concerned with, however, is not the net acreage but the acreage requiring treatment in order to control the undesirable plants. Since many undesirables on the same area require separate treatment, the overlap of acreage among interspersed species represents only a partial inflation.

An illustration of this point is noted by E. H. McIlvain[2] reporting on the Southern Great Plains Region: "The total brush acreage is 80 million acres, but this is because 2, 3, or sometimes even 4 species occupy the same acreage. This is a real problem on some ranches, because clearing only one species allows the others to become dominant—and no range improvement results." Similar relationships doubtless occur in other regions.

As regards costs of control for a current estimate the total acreage may be cut to less than half before we start figuring. If we accept the position of Professor G. W. Tomanek of Kansas State College that the undesirable plants in the Central Great Plains Region, except sand sage, are not serious enough to warrant present control, we may happily omit the 126 million acres of undesirables reported from that region. Let us omit also for the moment those species for which no satisfactory control measures are yet known, notably the oaks (*Quercus* spp.), creosote bush (*Larrea* spp.), the locos and poison vetches (*Astragalus* spp.), the cactuses (*Opuntia* spp.), snakeweed (*Gutierrezia* spp.), and yucca (*Yucca glauca*). These species and a few lesser ones to-

[2] *Director, U. S. Southern Great Plains Field Station, Agricultural Research Service, U. S. Department of Agriculture, Woodward, Oklahoma; information to the author.*

Table 1. Occurrence, recommended control and estimated control costs of major undesirable range plants

Plant Species	Total Acreage Reported	Recommended Control	Est. Cost Per Acre Control
A. *HERBACEOUS*			
1. Burroweed *(Aplopappus tenuisectus)*	1,000,000	No satisfactory control	———
2. Loco *(Astragalus* spp.)	44,000,000	Chemical	$ 2.00 - $ 4.00
3. Cheatgrass *(Bromus tectorum)*	25,050,000	Management & cultural	3.50 - 10.00
4. Canadian thistle *(Cirsium arvense)*	1,586,200	Chemical	10.00 - 20.00
5. Larkspur *(Delphinium* spp.)	4,149,000	Chemical	2.50 - 10.00
		Chemical & biological	5.00
6. Halogeton *(Halogeton glomeratus)*	10,088,000	Cultural	8.00 - 10.00
7. Bitterweed *(Hymenoxys odorata)*	15,000,000	Chemical	2.50 - 4.50
8. Goatweed *(Hypericum perforatum)*	1,623,000	Biological & management	5.00
9. Lupine *(Lupine* spp.)	30,900,000	Chemical	3.00 - 3.50
10. Crazyweed *(Oxytropis* spp.)	1,758,000	Chemical	2.00 - 3.00
11. Russian thistle *(Salsola* spp.)	102,000,000	No satisfactory control	———
12. Cocklebur *(Xahthium* spp.)	5,205,000	Chemical	4.00 - 6.00
13. Death camas *(Zigadenus* spp.)	7,030,050	Chemical	4.00
		Management & Chemical	3.50
14. Other (20 reported)	14,627,500	Various	2.50 - 10.00
Total Herbaceous Plants	264,016,750		
B. *WOODY*			
1. Chamise *(Adenostoma fasciculatum)*	8,500,000	Chemical, burning and cultural	9.00 - 30.00
2. Manzanita *(Arctostaphylos* spp.)	4,000,000	Burning	1.00
		Chemical	9.00
3. Sagebrush *(Artemisia* spp.)	87,370,000	Burning	.50 - 1.00
		Chemical	2.50 - 10.00
		Cultural	4.00 - 6.00
4. Rabbitbrush *(Chryothamnus* spp.)	4,925,000	Chemical	3.00 - 6.00
		Cultural	12.00
5. Southern blackbrush *(Flourensia cernua)*	13,250,000	Chaining	.90 - 1.50
		Mowing	3.00 - 10.00
6. Snakeweed or broomweed *(Gutierrezia* spp.)	142,125,000	Chemical	2.50 - 4.50
7. Juniper *(Juniperus* spp.)	63,883,000	Cabling, chaining or dozing	1.00 - 15.00
8. Creosote bush *(Larrea* spp.)	46,500,000	Cabling or chaining	.75 - 1.50
9. Cactus *(Opuntia* spp.)	78,600,000	Burning	.50 - 3.00
		Cabling & grubbing	1.00
		Chemical	2.00 - 5.00
10. Yellow pine *(Pinus ponderosa)*	4,000,000	Burning	1.00 - 3.00
11. Aspen *(Populus tremuloides)*	2,000,000	Removal & cultural	20.00 - 50.00
		Removal & chemical	7.50
12. Mesquite *(Prosopis* spp.)	93,000,000	Chaining	1.50 - 4.50
		Chemical	.65 - 7.50
		Cultural or root plowing	10.00
13. Scrub oak *(Quercus* spp.)	40,250,000	Chemical	6.00 - 11.00
14. Wild rose *(Rosa* spp.)	1,000,000	Cultural	7.50
15. Willow *(Salix* spp.)	2,010,000	Removal & chemical	7.50
16. Snowberry *(Symphoricarpos* spp.)	3,000,000	Chemical	5.00
		Chemical & cultural	4.00 - 8.00
17. Yucca *(Yucca glauca)*	2,000,000	No satisfactory control	———
18. Other (14 reported)	2,961,500	Various	———
Total woody plants	599,374,500		
GRAND TOTAL	863,391,250		

tal some 375 million acres. Subtracting this and the Central Plains acreage less its overlap in these species, we have a remainder of roughly 370 million acres of undesirable plants in some 30 to 40 species against which sufficient control work has been done to establish approximate cost figures.

At present costs of these controls, complete treatment of the affected area would cost in the neighborhood of $2,000,000,000. Should we add back now the acreage we earlier subtracted and allow a slightly higher per acre cost in view of the greater difficulty of controlling the oaks, cactuses, and other species, a total cost above $5,000,000,000

would be reached. Should we expand our goal to include all undesirables to their full extent, this cost might easily be doubled. And it must be borne in mind that none of these figures take into account the cost of repeating treatments which fail on the first try, costs of deferred use while seedings become established, and interest on investment.

The foregoing figures on area and control cost of undesirable plants effectively demonstrate the scope of the economic problem we face. From even these partial figures two conclusions appear obvious: (1) The total costs greatly exceed the economic capacity of the range industry to undertake, except on a gradual basis; (2) we must continue to live with most or all of our undesirables over most of their respective areas for a long time to come.

Management Implications

What are the management implications of these findings?

The ability of depleted ranges to pay back restoration costs varies widely, according to inherent soil capacities, climate, price of livestock, and other factors. Certain areas of high productive ability, such as the Rio Grande Plains of Texas described by Carter in the January 1958 issue of the *Journal Of Range Management,* can pay back costs of brush clearing and reseeding in two or three years. Such areas approach croplands and seeded pastures in the economics of their management. They can be operated as self-sufficient management units. Much more commonly, economic success requires that a range restoration project be used in such a manner as to permit natural forage improvement on large areas of associated untreated lands through their relief from grazing while the treated area is being used. Bracketed between these outside limits are many degrees of economic potential, calling for corresponding adjustments of management.

At all levels of forage production capacity, experience has well demonstrated that success in range restoration demands a positive management follow-through. Nature abhors a biological vacuum and will fill the one which often follows an unreseeded brush clearing with whatever she has at hand. On a badly depleted range she usually has numerous secondary undesirables waiting to step in. Unless management provides for both early and vigorous establishment of desired plants, and for their protection from a repeat cycle of depletion, the clearing job soon requires redoing.

The development of sprays and other chemical treatments capable of controlling undesired plants on unreseedable areas has vastly expanded the horizons of artificial range betterment. Many areas where burning cannot be successfully applied or cannot be tolerated are within reach of such treatments. The limits of aerial control applications are almost entirely economic rather than physical. However, this does not remove, but only emphasizes, the necessity for sound use of treated areas. Automatically, the aerial method reaches out into areas of lower potential than is found in areas capable of cultural reseeding. In many places the site potential is so low and the remnant of useful plants so sparse and weak that years of careful management are required to re-establish them in vigor and abundance.

No matter what plant control technique is applied to start with, the same problem is faced in the end: How to use the area without bringing about re-establishment of the former pest plants or take-over by other undesirables.

The manner in which a treated area can be used has a direct connection with the pocketbook. Only where the site productivity is so high and economic success so sure that the treatment cost can be recovered almost immediately can the user afford to use the treated area in such a way as to deplete the new or restored forage cover. In circumstances where the gains accomplished in the treatment must be held for a maximum period in order to be profitable, the user will find that he must follow about the same use pattern that would be required to maintain good condition on an untreated native range in the same area. This is simply because nature imposes essentially the same seasonal growth responses, rest periods, food storage requirements, and other physiological limitations upon introduced species as apply to the native species of the area. The same unseasonal use, overuse, or other abuse which depleted the original cover, just as surely will deplete the new cover.

Readjustment of Use

An essential part of any program for lasting control of undesirable plants, then, is readjustment of use to the pattern dictated by nature for the area concerned. Unfortunately, this fact frequently has been overlooked in plant control projects. Its neglect has been the chief cause of early failure of many initially successful reseedings and brush burnings in the Great Basin and Northern Intermountain Regions, where big sage and rabbitbrush are vigorous contenders for every opening in the plant cover. Carter, in the article already mentioned, notes that "lack of desirable follow-up range management favored the regrowth or re-establishment of undesirable brush species following control work" done over the past 10 years on some 3,000,000 acres of private range in the Rio Grande Plains, and that "the necessity of redoing control work on most of the acreages now

faces the ranchers." Abundant similar examples can be found in other regions.

Where the use readjustments required are merely seasonal shifts or reductions in stocking, they may be relatively easy to make, provided economic obstacles can be overcome. A much more difficult problem lies in the relationship of water distribution to proper range utilization. To illustrate, the long distances to water traveled by cattle in much of our Southwest are common knowledge. But behind the scenes are these facts: First, such travel is forced, and has resulted only because feed resources within easy travel distance from water have been exhausted. Second, this pattern of use is seriously destructive of both forage and soil close to water.

In these circumstances the increasing popularity of Brahman and related cattle is not altogether due to the remarkable heat tolerance of these animals. They also are remarkable travelers, far outdoing our dominant beef breeds in this respect.

The need for better-traveling cattle is by no means confined to the Southwest. Throughout the Intermountain states today there are millions of acres of range close to water being overgrazed as the price of forcing cattle to reach out to other millions of acres of under-utilized range lying farther from water than these cattle willingly travel. Much of this range can never be watered at much closer intervals than it is today, unless by hauling. Any attempts to heal the sore spots on these underwatered ranges by plant control treatments alone are doomed to failure.

Wildlife Problem

There exists in the United States today a very strong pressure for reduction of livestock use of public range and forest lands in favor of game animals. This conflict of interest in the use of the range poses a critical problem for range users, game managers, and public land administrators, for it tends to degenerate to name calling and to obscure the real needs of the range. Many wildlife enthusiasts do not understand, and steadfastly refuse to believe, that game animals themselves can be responsible for overgrazing. Their well organized and highly vocal opposition to attempted game control programs generate formidable political hazards.

We recognize, of course, the legitimate needs of game animals and other wildlife for feed and cover often provided by plants not particularly useful to livestock. Many areas exist where rough topography, distance from water, or other factors prevent livestock use, and these areas are wholly available to wildlife. With the almost total removal of predators in recent years, however, game numbers have multiplied tremendously. Areas of conspicuous range depletion and watershed damage by game animals now are numerous, particularly in the snow zone states where seasonal concentrations occur. In addition, these animals now compete with livestock on a very broad scale.

Control of undesirable plants takes on added complications in these areas of crowed game populations. Even where reseedings and other range vegetation improvements have been done for the sole benefit of game, these gains have been almost impossible to protect. From the plant control standpoint, game use is an essentially unregulated pressure upon the desirable species, and at the same time often requires retention of much undesirable vegetation for cover purposes.

Work Unlimited

A great deal more could be said on each aspect of plant control touched upon here. I have purposely dealt in broad strokes, intending only to set a background for appraisal of the many action programs now in progress, and for consideration in planning future plant control programs.

It is clear that the quantity of needed plant control work is unlimited in this generation. Tremendous range betterment may be realized by this means. But to make the most of our efforts, both in our planning and in our doing, we must be guided by the sign posts of sound economic and management practice.

The signs are up and the words clear at most of the caution points. Let us not drive so fast we fail to read them.

Colorado Host for Summer Society Meeting!

The Colorado Section has invited members and friends of the American Society of Range Management to its summer field meeting at Gunnison, Colorado, July 31-August 1, 1959. Details of the program and accommodations will be given in the May issue of the Journal. The Board of Directors of the Society meet at Gunnison on July 30, 1959.