

Evaluation of the Wildlife Results from Fuel Breaks, Browseways, and Type Conversions

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Deer Habitat Improvement Evaluation Committee

THERE HAS been need in California for an evaluation of the results of deer habitat improvement projects. A significant acreage of land has been and is being treated. While most of this work has been considered beneficial, there has been no prior systematic statewide effort to determine if this assumption is true.

In 1965, representatives of the California Department of Fish and Game met with those from other concerned agencies to discuss the need for deer habitat improvement evaluation. As a result, a Committee made up of representatives of the Bureau of Land Management, the Forest Service, and the Department was organized to carry out an evaluation survey.

The first step taken by the Committee was to develop a simple standardized report form with which to gather information from

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the field. This in itself was a fair accomplishment when two different Federal and one state agency agreed to use the same form. Field units of the three agencies used these forms to report on deer range habitat improvement projects. It was found upon review of these reports that evaluations in regard to both the vegetation and the animals were largely subjective. In some cases, however, supporting field measurements had been made and were reported. In addition to evaluations made by field personnel, the Committee had the benefit of the findings of several intensive research projects. These included the work of Biswell, Taber and Dasmann with nonmigratory black-tailed deer in north-coastal chaparral types, the studies of Biswell, Shultz, Gibbens and Jordan of the effect of brush rejuvenation treatments on a migratory California mule deer winter range in the southern Sierra Nevada, and the bitterbrush restoration studies of the Pacific Southwest Forest and Range Experiment Station.

The Committee divided the state into five broad regions in which climate and vegetation were roughly homogenous. These regions are the North Coast, South Coast, Western Sierra, Great Basin, and Southern California. The Montane-Timber Zones within these regions were considered separately.

CLASSES OF HABITAT IMPROVEMENT

It was recognized by the Committee that direct deer habitat improvement work fell into five broad classes. These are listed as browseways, browse rejuvenation treatments, browse plantations, herbaceous seedings, and weed tree control. In addition it was recognized that several classes of treatment made for other purposes often indirectly improved the quality of deer habitat, especially in cases where such work is planned to provide side benefits for wildlife. Those classes are listed as brush type conversions, fuel breaks, and wildfire rehabilitation. A brief description of each class of deer habitat improvement follows:

Browseways:—Browseways are lanes built through dense brush fields, usually of tractor blade width but sometimes wider. Ordinarily brush is crushed with a bulldozer blade, but sometimes these lanes

FUEL BREAKS, BROWSEWAYS, AND TYPE CONVERSIONS

are hand-chopped. The browseway concept was originated in California by Cyril Robinson, Forest Officer, as a result of his observations of use by deer of vegetation on fire breaks. The browseway facilitates access both by deer and man and the rejuvenating crushed shrubs offer a supply of forage higher in both succulence and nutrients than the surrounding brush. This form of brush manipulation to favor game has been popular on National Forests in Southern California because (1) the tractor lanes do not disturb either vegetation cover or soil to a degree that will cause significant accelerated soil erosion and (2) the browseway offers a means of extensive treatment of chaparral brush lands in this fire hazardous region without a high buildup of dry fuel or need for burning. Some of the considerations used in planning browseways are:

Brush composition contains more than 20% desirable forage species for deer.

Brush density exceeds 70% ground coverage.

Average height of shrubs is more than five feet.

Brush stand is mature with little or no sprout or seedling production.

At least seasonal water is accessible to deer within reasonable travel distance.

Acreage of treatment is geared to density of deer.

Browseways are broken down into extensive (usually one or two lanes along ridge-tops where adjacent slopes are steep and soil is unstable), checkerboard (crisscrossing of lanes on less erodable soils with width between lanes varied to intensity of treatment desired) and parallel contour (used on moderate slopes where soil erosion is a problem).

A total of 2,863 acres of browseways were reported. The cost varied between \$15 and \$38 per acre. Costs of recent projects indicate the average cost to be around \$30 per acre of actual browseway.

No detailed quantitative evaluations have been made on the increase in deer populations associated with browseways; however, in most cases they were subjectively reported as receiving from medium to high deer use.

On the Cleveland Forest in Southern California deer use as deter-



FIG. 1. Browseways on Angeles National Forest.

mined from pellet-group counts ranged from 5 to 83 deer days per acre. The average use in this area was 34 deer days per acre. On untreated areas pellet groups ranged from 0 to 5 deer days per acre.

It appears that browseways provide improved habitat for deer over long periods of time. Browseways constructed 14 years ago are still open and providing good deer browse. I understand that recently in Orange County a browseway also served as a spot to get in men and equipment where one front of the Paseo Grande fire was confined.

Browse Rejuvenation:—Browse rejuvenation projects are categorized as areas where shrubs have been crushed, burned, sprayed, mowed, rolled, chopped or otherwise treated to encourage new growth in the form of sprouting or seedlings. Such areas may or may not be seeded to herbaceous species in order to provide soil stabilization and to add variety to the deer diet. Again, low value browse species may or may not be discouraged through chemical spray treatments. Browse rejuvenation areas differ from type conversions in that the aim is to encourage production of a plentiful supply of palatable browse, an aim shared by browseways. Browse rejuvenation areas differ from browseways primarily in their size and shape.

FUEL BREAKS, BROWSEWAYS, AND TYPE CONVERSIONS

The objectives of browse rejuvenation may be listed as:

- (1) To set back mature brush and establish sprouting or seedlings. The new growth and young plants are generally higher in palatability and nutritional value than is growth on older plants.
- (2) To open up the brush stand to permit movement of animals and people.
- (3) To create conditions favoring the natural establishment and growth of grasses and forbs interspersed with the browse plants.

The trend back to the original condition of the brush stand starts as soon as the treatment is concluded. Ordinarily it is desirable to delay this progress as long as possible. Moderate browsing of the sprouts and seedlings by deer and livestock helps to achieve this objective. Where livestock use is light, the openings should be kept small enough to permit deer browsing alone to hold the development in check. In order for deer to accomplish this, acreage treated must be kept in balance with the number of deer. Since the deer population can be expected to increase as a result of improvement of their habitat, the total treated acreage should also increase with time. Thus, the acreage treated in the first year may be a small proportion of that treated some years later. One recommendation is that areas be limited in size so that no point is more than 100 yards from protective cover. At maximum about two thirds of the south slopes and one third of the north slopes should be treated. An effective program requires long-range management planning. Once embarked upon, the program should be continued indefinitely with repeated treatments as an integral part of the program.

Standing brush can, of course, be burned. Crushing the brush prior to burning permits burning under less hazardous conditions and usually results in a cleaner burn. Where standing brush is burned, many charred stubs usually remain. Several observers have reported that the presence of many old burned brush stems discourages deer from any but light use of manipulated areas. This stub problem is also tied in with straight herbicidal treatment, but does not exist where brush is mowed, rolled, or chopped.

There were 22,084 acres reported as being treated for browse rejuvenation. Of this total 14,988 acres were in the North Coast Region.

Most of this work has consisted of control burning or mechanical manipulation of chaparral based on the studies made by Biswell, Taber and Dasmann. These studies showed that on a managed shrubland there was a mid-summer population two to three times higher than on unburned chaparral. Subjective evaluations made of similar projects have been in general agreement with these findings.

The Department of Fish and Game carried on an extensive browse rejuvenation program on the Cow Mountain area of Lake and Mendocino Counties. This program involved crushing, discing, and burning 1,494 acres, control burning an additional 6,105 acres, spraying 52 acres and seeding to grass 5,765 acres as well as constructing access roads and trails and spring development. Due largely to the improvement of access the buck kill in this area doubled but no further increases occurred or were attributable to the habitat improvement work. The average cost per acre of control burning without crushing has been about \$5 per acre but on projects which involved crushing, burning and seeding the costs have been about \$30 per acre.

The best information on browse rejuvenation in the Western Sierra region is provided by a study carried out by Gibbens, Shultz, Jordan and Biswell on the San Joaquin winter deer range. Tall decadent chaparral was mashed, burned, and seeded.

In general brush manipulation in this area resulted in a large increase in production of browse per acre and an increase in deer days use from 100 deer days per acre to 172 deer days per acre after treatment. However, continued heavy use by deer and domestic livestock is causing a shortage of preferred browse species.

Two crush and burn projects in Tehama County gave inconclusive results. On one, deer days use decreased 5% 6 years after treatment as compared to the check area; on the other, there was a 45% increase 5 years after treatment.

The cutting of brush species, particularly mahogany and bitterbrush, has been carried out to stimulate new growth. In general, this has resulted in an increase in forage production but little quantitative evidence is available that it has had any effect on deer populations or use.

Browse Plantations:—Browse plantations may consist of direct seeding or of transplants. This category includes all projects where

TABLE I
Reported Acres of Direct Habitat Improvements by Classes and Regions

<i>Region</i>	<i>Acres Treated</i>		<i>Browse Planting</i>	<i>Brush Type- Conversions</i>	<i>Herbaceous Seeding</i>	<i>Weed Tree Control</i>
	<i>Browseways</i>	<i>Browse Rejuvenation</i>				
North Coast	121	14,988	20	6,771	2	—
South Coast	909	—	—	4,644	—	—
Western Sierra	85	4,108	—	7,575	35	—
Great Basin, North	24	675	2,126	94,530	1,400	1,042
Great Basin, South	—	35	162	17,674	—	20
Southern California	2,493	2,038	10	9,291	—	—
Montane-Timber Zone	96	40	—	—	—	—
Totals	3,728	21,884	2,318	140,485	1,437	1,062

the objective is to establish or restore browse species on a range by planting methods.

Most of the browse planting effort so far has been aimed at re-establishing bitterbrush—either in pure stands or interspersed with grass. Excluding experimental plantings, there has been something over 2,126 acres of bitterbrush seeded in northeastern California. Exact figures are not available because some evaluation reports did not separate areas seeded to bitterbrush alone from combined grass-browse seedings. Costs for planting bitterbrush have averaged about \$20 per acre.

Many of the browse seeding efforts to date have been failures. At least some of these failures have been due to efforts to plant on too dry sites or during drought years. Bitterbrush planting—at best—carries a high risk. Where the site has an average precipitation of less than 12 to 14 inches, or where the soil is light-textured and loses moisture rapidly in the spring, one should expect success in only one year out of every 5 or 10.

Herbaceous Seedings:—The category, herbaceous seedings, includes all projects where the direct objective is to establish stands of grasses or forbs either as a temporary or permanent cover, and either as pure stands or stands intermixed with browse plants. Herbaceous seeding may be a complete treatment in itself. If it was done as part of a type conversion, browse rejuvenation, fuel break, or even a browse plantation project, it has been classed as such rather than reported as a herbaceous seeding.

Only two projects were reported in this category with no real evaluation made of the effects of this project on wildlife.

Brush Type Conversions:—Brush type conversions are categorized as treatments made with the objective of converting a brush stand to a permanent herbaceous type. Ordinarily this class of project is confined to fertile soils of a nature suitable to support a permanent grass cover. Such projects usually involve repeated brush control treatments to eliminate brush from the project area, although sometimes a scattered stand of the better browse species is retained by selective control treatments. Where this is done, the project was classified as the type conversion if it displayed a predominantly herbaceous aspect. If the aspect was predominantly that of a shrub



FIG. 2. Brush to grass type conversions on Mendocino National Forest.

cover it was classed as browse rejuvenation. The principal steps taken in brush type conversion are (1) crushing and/or burning of the existing stand of brush, (2) planting of grass or other herbaceous seed, (3) spraying with herbicides as often as needed (or other adequate treatment) to eliminate regenerating brush sprouts and seedlings. Where the third step is not carried out, and chaparral brush species are present, the regenerating brush will soon dominate the area and the project should more properly be labeled as a browse rejuvenation treatment.

With some Great Basin shrub types, such as sagebrush, often the treatment may consist only of burning and seeding. Where an adequate stand of grasses already exists as an understory under sagebrush, the control of brush and release of grass may be done by spraying alone.

Because of the multipurpose nature of many brush type conversions, only those projects in which at least some wildlife benefits were planned have been reported. Forest Service reports, for instance,

include only those projects which were partially financed with wildlife management funds. As a result, only a fraction of the total acreage covered by this class of treatment is given in this report. As an example, the total acreage of National Forest land treated for permanent chaparral brush-to-grass conversion up to 1965 was 130,000, but evaluations were submitted on only 10,266 acres. The Forest Service total of sagebrush-to-grass conversions was around 135,000 acres up through 1966, but no evaluations on this class of treatment (which is called "revegetation" by the Forest Service) were reported.

The costs of this work have averaged from \$35 to \$55 per acre for chaparral in the North Coast area. Subjective evaluations indicate that many of these are beneficial to wildlife. However, there is no quantitative data available on their effects on wildlife. In some cases the area would have been more beneficial for deer if there had been more escape cover left nearby. This could be done by leaving brush islands and corridors within large converted areas or not completely eliminating all brush plants during the follow-up sprayings.

Fuel Breaks:—In developing both the fuel break and the regular brush-to-grass type conversion, the objective is to convert the brush type to a grass type on a permanent basis through clearing, seeding and spraying. The difference between the two treatments lies in their respective purposes. The fuel break is designed to provide a break in woody fuel types to assist in control of wildfire. Such treatments are usually about 300 feet wide and are located along principal ridges or valleys suitable for stopping fire. Fuel breaks may be widened at strategic places along their length, but ordinarily the objective is to achieve length rather than width.

On the other hand, a principal purpose of the brush type conversion is to provide forage for livestock, or deer, or both. But because such grass openings also serve as fuel breaks and may also stabilize the soil and increase water yield, ordinarily they are considered as multipurpose in nature. Type conversions are confined to areas of fertile soils suitable for support of a permanent herbaceous cover. The fuel break is located in suitable terrain without regard to soil type. Fuel breaks are beneficial to wildlife in that they provide interspersions of herbaceous vegetation and increase edge in brush types. But because these are primarily a fire control rather than a wildlife

habitat improvement measure, their benefits for wildlife were only incidentally evaluated in this survey. The total existing acreage of fuel breaks was not determined.

Wildfire Rehabilitation:—Large burns resulting from wildfires often receive some treatment in order to stabilize the soils. Usually this consists of aerial seeding with fast growing grass species. Sometimes regenerating brush is sprayed with herbicides to reduce the density of woody vegetation and create shrub land. Occasionally wildfire burns in whole or in part are used as the first step in converting the brush to grass. In such instances, type conversion treatments are confined to suitable soils and fuel breaks are confined to suitable locations.

There can be no doubt that the regenerating brush sprouts and seedlings on wildfire burns offer deer a palatable and nutritious diet. Ordinarily on larger burns (and particularly on clean burns) the food supply greatly exceeds the demand. As a result, portions of such burns that are distant from suitable cover are often left entirely unused by deer, and browsing over the remainder of the area is of such light intensity that the brush rapidly grows back into dense tall stands. Where the large wildfire burn is treated to maintain a pattern of grass openings, browseways, and fuel breaks, economies in costs are achieved and the value of the area is enhanced for wildlife as well as other uses.

Weed Tree Control:—The most common kinds of weed tree control involve pinyon or juniper. But this class also includes projects where commercial timber species or other overstory tree species are reduced or eliminated in order to release and encourage either shrubby or herbaceous vegetation. Only two projects of this type were reported. One involved cutting of juniper and another cutting of pinyon pine. Evaluations were subjective and have indicated low benefits to wildlife to date. This type of work should be conducted only on those areas where browse plants still show vigor and are capable of responding to the release from tree competition.

Montane—Timber Zones:—The summer range for migratory deer (and for nonmigratory deer in some regions) consists largely of commercial timber type areas interspersed with meadows, brush fields and other openings. Because of the assumption that winter

range is the limiting factor for deer on most herd units, very little habitat investigation or direct habitat improvement has taken place within these zones. Recently more thought has been directed to the importance of summer range in the overall wildlife picture. It has been determined that the total acreage of true summer wildlife habitat within some units is actually more limited than that on the winter range.

The accelerated conversion of brush fields to commercial tree plantations on both the National Forests and public domain land has sharpened the interest in summer deer range. While it was formerly accepted that timber cutting and wildfires created better wildlife habitat on deer summer range, modern silvicultural practices resulting in hardwood removals, as well as early tree planting of cutover and burned over areas followed by treatments to discourage competing vegetation, has raised some doubt as to the value for wildlife of some present day silviculture treatments. There is need for investigations to determine the current status of modern forestry practices as they relate to wildlife benefits. It is possible there may be room for minor practical modifications in both cutting practices and reforestation methods that will result in increased benefits to wildlife without adversely affecting forest outputs. The development of methods to establish stands of palatable and nutritious forbs on plantation areas offers a possible partial solution. The actual signing of wildlife den trees and distinctive marking of individual or stands of hardwoods left for wildlife to prevent accidental removal may also solve problems in this field.

As pointed out above very little direct wildlife habitat improvement has been done to date in the Montane-Timber Zones of any of the regions. On the Plumas National Forest a total of 96 acres of browseways have been constructed in summer range brush fields with high to moderate benefits to deer. Also the Mendocino National Forest has reported a 40-acre browse rejuvenation project involving crushing and handcutting of tall bittercherry on deer summer range. This has resulted in a considerable increase in deer use. Once cultural methods are proven, there is room for a greatly accelerated program of habitat improvement in the Montane-Timber Zones.

In summation the following conclusions seem to be warranted:

FUEL BREAKS, BROWSEWAYS, AND TYPE CONVERSIONS

Deer appear attracted to regenerating forage on areas where chaparral browse species have been crushed or burned. Both browseways and browse rejuvenation projects are beneficial, especially in the chaparral brush fields of the north and south coast and in Southern California. Certainly, the intensive studies made in the Cow Mountain area in the North Coast Region show that actual fawn production and total population increase markedly on treated areas. It appears that browseways may be more productive if incorporated with small brush-type conversions and browse rejuvenation areas to create a series of connected islands. Care must be taken, however, to keep acres of browse rejuvenation treatment in balance with actual need.

On the winter ranges in the Sierra foothills, the studies of the effect browse rejuvenation treatments on the San Joaquin deer herd show they produce a greatly increased volume of available forage and result in an increased use by deer of treated areas. But this enhanced forage supply apparently did not result in a significant increase in fawn production or in yield to the hunter. Also, the heavy use by deer and livestock on the treated areas caused damage to both vegetation and soil. It appears that plans for improvement of winter deer range in the Sierra foothills must be carefully made and that priority should be given those areas on which either-sex harvest makes possible some regulation of deer numbers and where control of livestock is assured.

Weed tree control projects that aim at release of established browse should be centered in areas where browse plants still show vigor. Experience in other states indicates that additional benefits may be derived from chaining or cabling projects if browse is planted in disturbed soils resulting from tree removal. Care must be taken to avoid large clearings. An interspersion of cover and clearings is essential for best results. Projects planned for improvement of wildlife habitat in arid areas should aim at minimal disturbance of existing ground cover until such time that establishment of replacement vegetation is more assured.

Multipurpose type conversions can be beneficial to wildlife where they create interspersions of herbaceous types within stands of brush, provided the clearings are not too large. Irregular shaped clearings

with occasional woody wildlife corridors across them and with adequate patches of cover (40 acres or more) will yield better wildlife habitat than will continuous brush cover.

Where fuel breaks are constructed in areas where wildlife populations are encouraged, the use of habitat improvement funds to treat browse species along edges and to develop occasional browse rejuvenation areas on flat ridges and swales appears worthwhile and economical and should be encouraged.

Opportunities to take advantage of wildfire burns as a first step toward development of scattered brush-type conversions and fuel breaks will yield savings and should not be overlooked.

There is need for early initiations of studies to determine methods to improve summer migratory deer range, which occurs primarily in the commercial timber zone. It has been assumed that present day logging methods actually improve the habitat for many species of wildlife. On the other hand, the reforestation methods in use today, and especially the conversion of brush-to-trees, may be lowering the wildlife carrying capacity. Studies are needed to determine the current status of forestry treatments in relation to wildlife and to determine if there are any practical modifications of both cutting and reforestation practices that can be made to yield higher benefits to deer and upland game. In view of the importance of succulent forbs in the summer diet of deer, the test planting of various palatable forbs (dry land alfalfas, other legumes) appears especially desirable as offering a possible means to improve habitat on summer range without significant adverse effects on trees. The development and trial of treatments on summer range for rejuvenation or regeneration of decadent brush stands is also desirable. The importance of creation and/or maintenance of wildlife openings within solid timber stands, of wildlife corridors, and of islands of cover in brush-to-tree conversions, and the reservation of an adequate stand of hardwoods in both numbers and placement during cutting and reforestation, appears paramount.

Prior to initiating a habitat improvement program for an area the land manager should know what changes in the habitat he hopes to accomplish.

An inventory of the species and distribution of the vegetation in

FUEL BREAKS, BROWSEWAYS, AND TYPE CONVERSIONS

the area and the wildlife population in the area prior to manipulation will help in producing plans for good management as well as a basis for evaluating the results of the treatment on both vegetation and wildlife.

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