

DEER REFUGES UNDER THE BUCK LAW¹

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Throughout the west, a system of refuges has been considered an essential part of big-game management. The first two decades of the twentieth century found big-game numbers far below those the environment could support. It was generally thought that recovery of the herds from the days of unrestricted hunting was not sufficiently rapid, and that other measures were needed in addition to the closed seasons, bag limits, and sex restrictions that had been placed in effect. This view was strengthened by the feeling that the law-enforcement organizations were insufficient to make the existing regulations fully effective.

During this period an extensive system of big-game refuges was started, on the underlying theory that the animals would increase within them and that they would serve as reservoirs to restock adjoining territory. The theory evidently presupposed—

1. That hunting would keep numbers down in the territory open to shooting.
2. That game would increase within the refuges.
3. That the lack of balance and the resulting population pressure would cause an overflow of animals from the refuges.

Typical of the western states, California has set aside a large number of sizeable big-game refuges during the last 25 years. These are principally for deer, since these animals form over 95 per cent of the State's big-game population. The writer had an important part in recommending many of these areas.

Within the State are 45,000,000 acres of woodland and forest, the bulk of which is big-game range. Over 2,500,000 acres are closed to hunting by established big-game refuges and other protective measures. In addition, there are over 1,700,000 acres within the national parks which are closed to hunting.

Numerous questions have arisen concerning these 4,200,000 acres of refuges and their effect on the deer herds and hunting in the surrounding territory. The marked general increase in the deer population during the period the refuges have been in operation, and the tenacity of the herds in areas subjected to extremely heavy hunting, have led many to believe that the refuge system has been an effective tool in deer management.

State legislation in California permits the taking of male deer with branched antlers only. It is unlawful "to possess . . . female deer, spotted fawn, spike buck, . . . and in District 1 $\frac{1}{2}$, forked-horn deer."²

Each year for the seven years 1935 to 1941 inclusive, each national forest in the State has kept quite accurate records on individual deer killed. These included antler measurements, actual weights, and location of kill. Antler measurements were taken of over 75,000 animals, actual weights of over 10,000, and the location of each kill was entered on a map as kills were reported. The measurements have served as an

indication of the condition of the crop of animals harvested. The spot maps of the deer kill have served many purposes, an important one being to aid in interpreting the effect of the refuge system.

It was apparently assumed that refuges would maintain deer populations and perhaps increase them within their immediate vicinity. When functioning at their best the deer-kill spot maps would appear

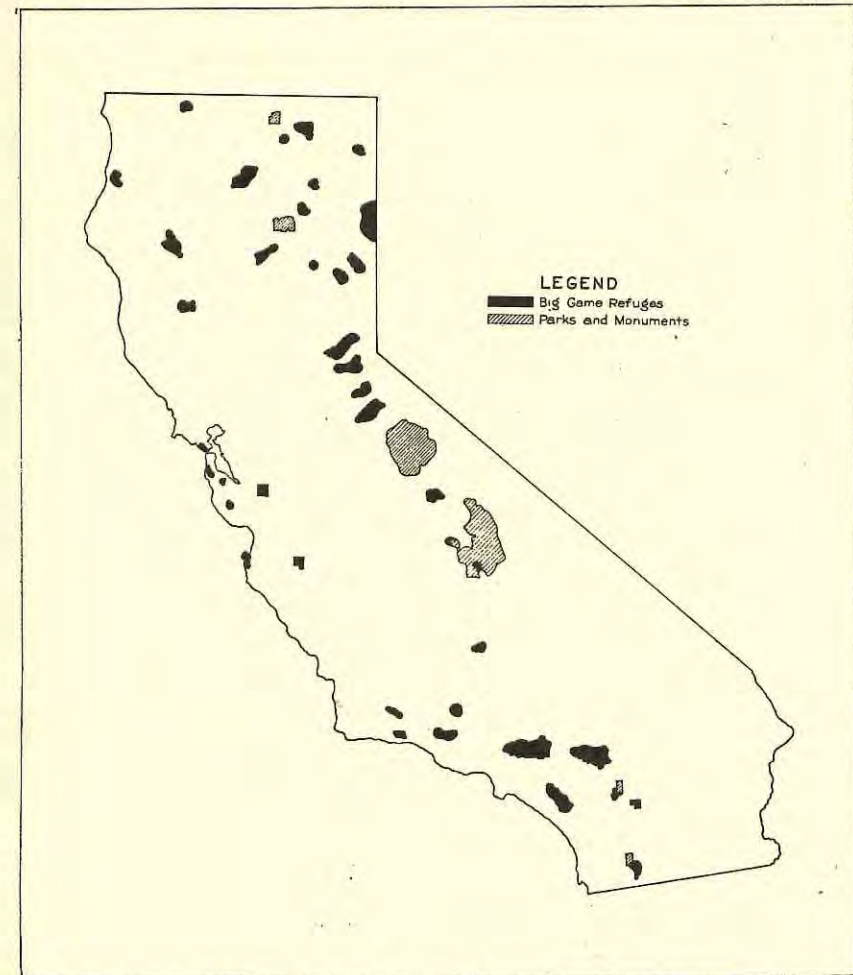


FIG. 61. Map of California, showing refuges, national parks, national monuments.

like that of the eastern part of the Plumas National Forest. In Figure 62, the heavier kill in the vicinity of State Fish and Game Refuges 1-P (established in 1927) and 1-V (established in 1935) could be interpreted as showing their successful operation. A study of these areas on the ground, however, shows that the concentrated kill adjacent to the refuges, which reflects heavier deer populations, is due in part at least to other factors such as quantity of preferred forage species and proximity

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² In portions of District 1 $\frac{1}{2}$ Rocky Mountain mule deer predominate.

or accessibility to desirable winter ranges. In some places the high population or kill within a short air-line distance from the refuge has no relation to it, since the herds are separated by a topographic barrier.

Many refuges were established without much thought as to the food supply available. Game Refuge 2-A in Mendocino and Lake counties, established in 1917, was one of these. It was placed in a timbered area where there was a minimum of suitable forage and a low deer population. After 25 years there is no evidence that the number in the vicinity has increased. As seen in Figure 63, the kill is very low in nearly all of the

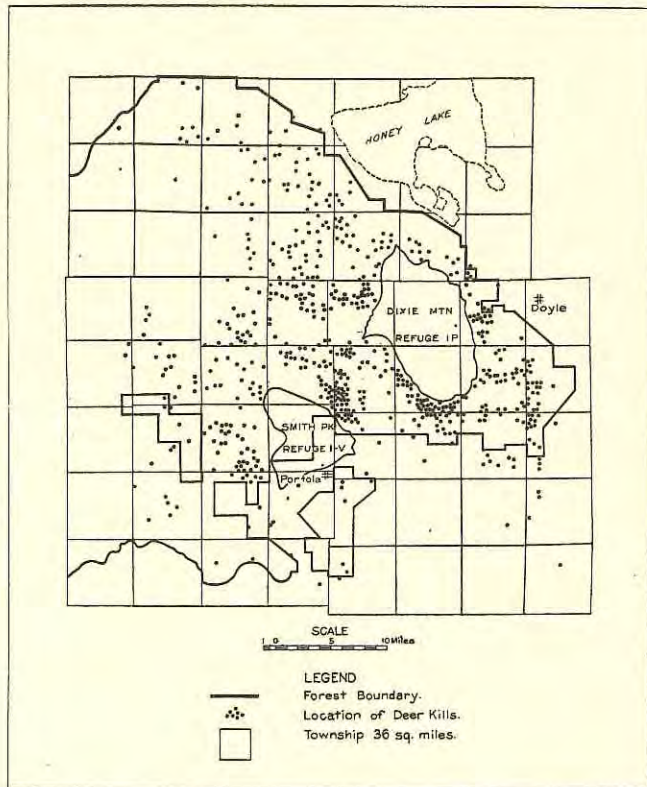


FIG. 62. Spot map of deer kill, Plumas National Forest, 1938.

contiguous area. The areas of heavy kill coincide with the areas of more abundant forage.

Where refuges are established on migration routes, needed protection may be given deer from overshooting or from the deadly methods of the ambush. On the other hand, large refuges on summer ranges at the head of migration routes may result in the only territory open to shooting being on these routes. Migrations in the Sierra and Cascades in California start near the close of the hunting season (October 15). If fall storms are early, the downward movement will be within the open season; if late, it will not occur until afterwards. If the early storms are

heavy, the movement will be abrupt and a heavy kill will result in the open territory. As a result, such refuges function differently in different seasons.

Topographic barriers in many cases have partially defeated the purposes of refuges. Boundaries have been made along deep canyons, high, almost uncrossable ridges, large bodies of water, etc. The Huntington Lake Refuge, created in 1931, is an example. Its boundaries include the deep canyons of the San Joaquin River and Big Creek, the high cirque of Kaiser Crest at 9,000 to 10,000 feet elevation, powerhouse penstocks, and Huntington Lake. This refuge was created partly to promote park-like conditions in the highly developed recreational area to the north of Huntington Lake, where vacationists could see and photo-

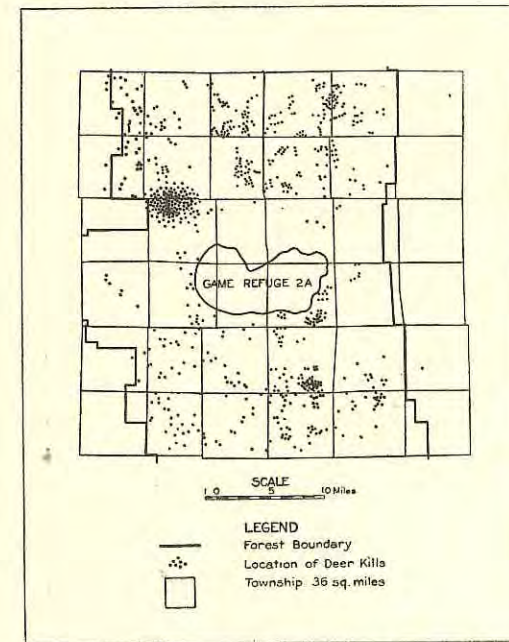


FIG. 63. Spot map of deer kill, Mendocino National Forest, 1938.

graph deer and also be free from the stray bullets of the hunters. Still, had the herds overflowed in accord with the refuge theory, the deer population would have increased in parts of the contiguous area. That this did not occur is indicated by the spot map of the deer kill for the Sierra forest, which is shown in Figure 64.

Refuge 1-K (created in 1917) is similarly bounded; on the south by the deep canyon of Kings River and on the north by the escarpment of Spanish Mountain, 9,000 to 10,000 feet in elevation. The area of heavy kill to the north, indicated in Figure 64, is a separate biotic unit, and these herds bear little relationship to those in Refuge 1-K. Refuge 1-K was abandoned in 1941, and the kill that year in the accessible area, which is the upper or northerly part of the refuge, was much less per unit of area than in the territory to the north, long open to shooting.

The herds of Yosemite National Park have contributed little to sport hunting on the Sierra Forest. The southerly and westerly boundary of Yosemite is to a large extent on legal land subdivisions cutting across natural wildlife units, yet the spot map (Fig. 64) does not indicate that a higher population has been developed in its vicinity by this long-established sanctuary.

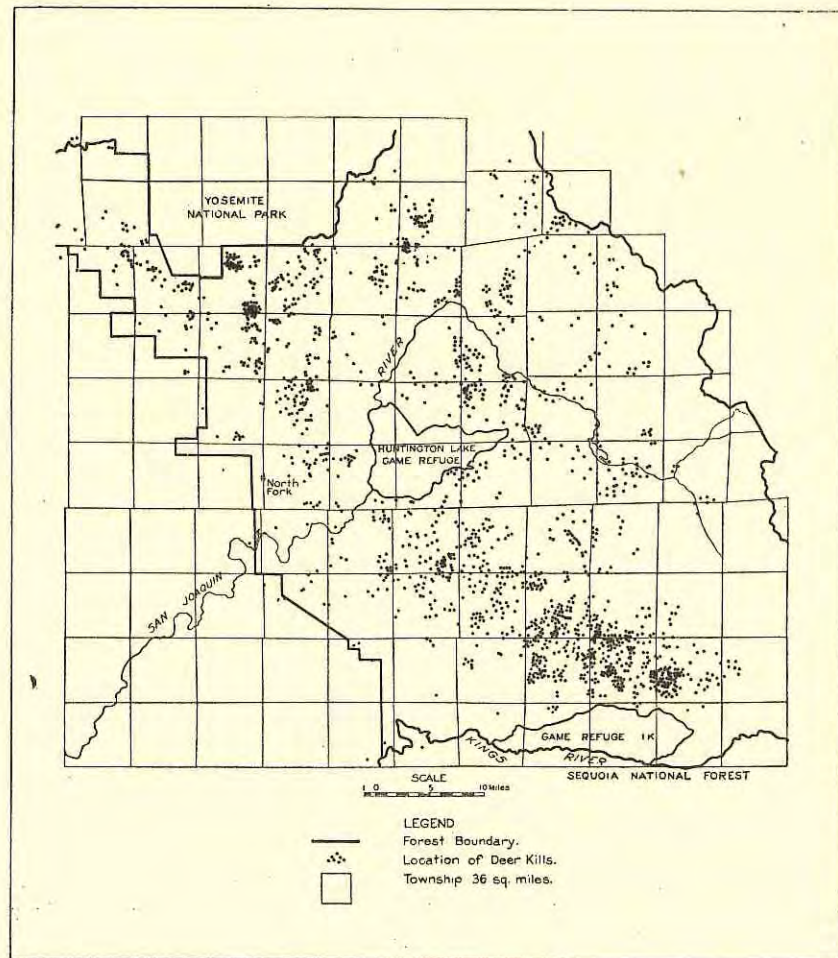


FIG. 64. Spot map of deer kill, Sierra National Forest, 1938.

An inspection of the spot map of deer kill for the Sequoia Forest does not indicate that the large area included in the Sequoia National Park has been of value as the refuge theory would have it. In Figure 65 the circumscribed areas marked "A" are in the better deer range and all within four miles of the north and south boundaries of the park. It would be assumed that within these areas there should be a definite indication of refuge influence if such existed. They contained 185 square miles, and there was recorded a kill of 0.76 deer per square mile in 1940. In an area

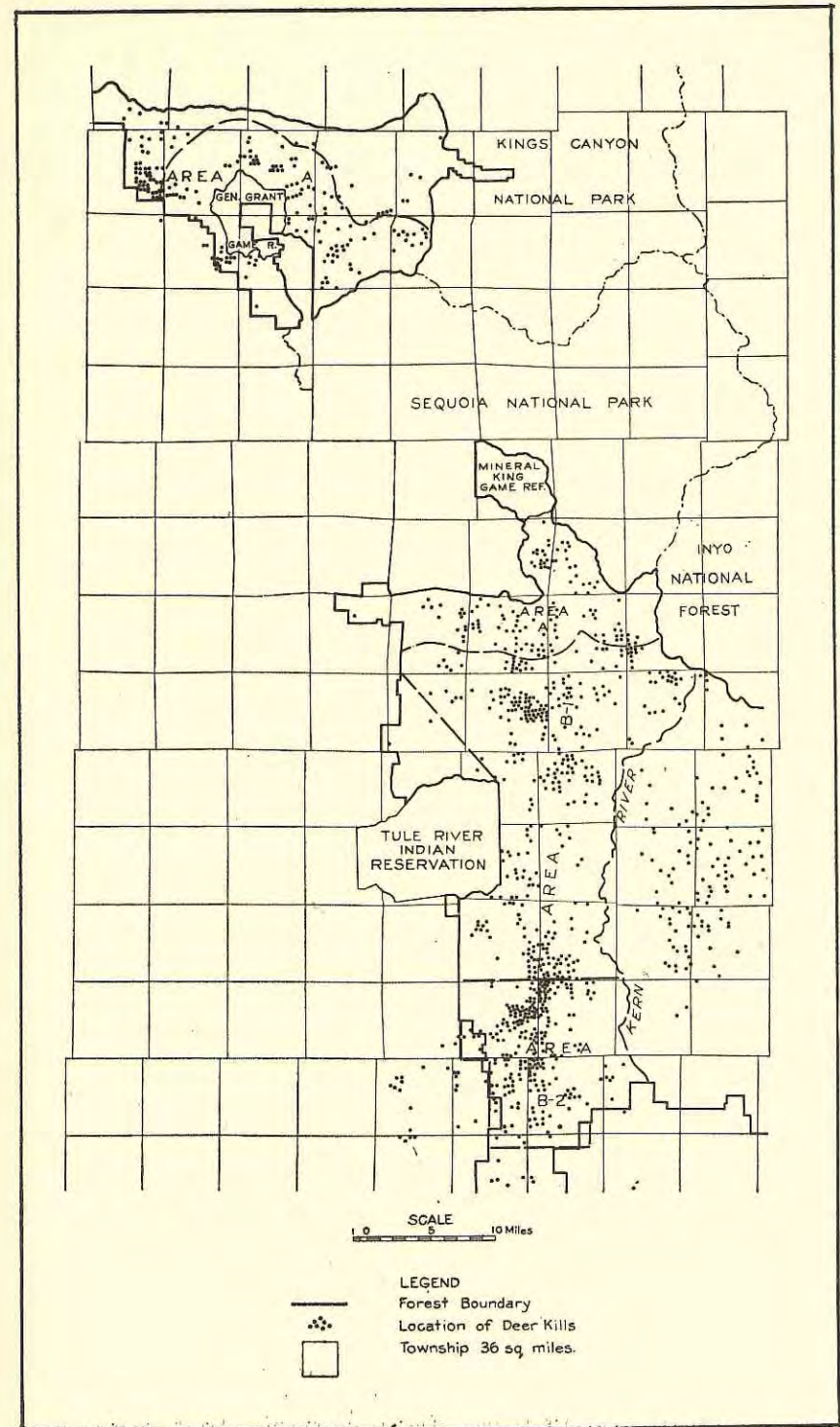


FIG. 65. Spot map of deer kill, Sequoia National Forest, 1940.

more remote from the park (Area B-1), with similar environmental conditions, containing 328 square miles, the kill was 1.03 per square mile. If Area B-2, still more remote, is added, the kill was 1.18. The area to the west of the park is late fall and winter range and not occupied by deer in any great number until the close of the hunting season.

The value of big-game hunting in California normally is recreational rather than as a supplemental food supply. Management therefore considers the "trophy" quality of animals taken. A heavy take of buck deer over a period of years results in fewer of the older age classes being available. The crop then consists mostly of juveniles two or three years of age, small in size, and of insufficient antler development to be termed a

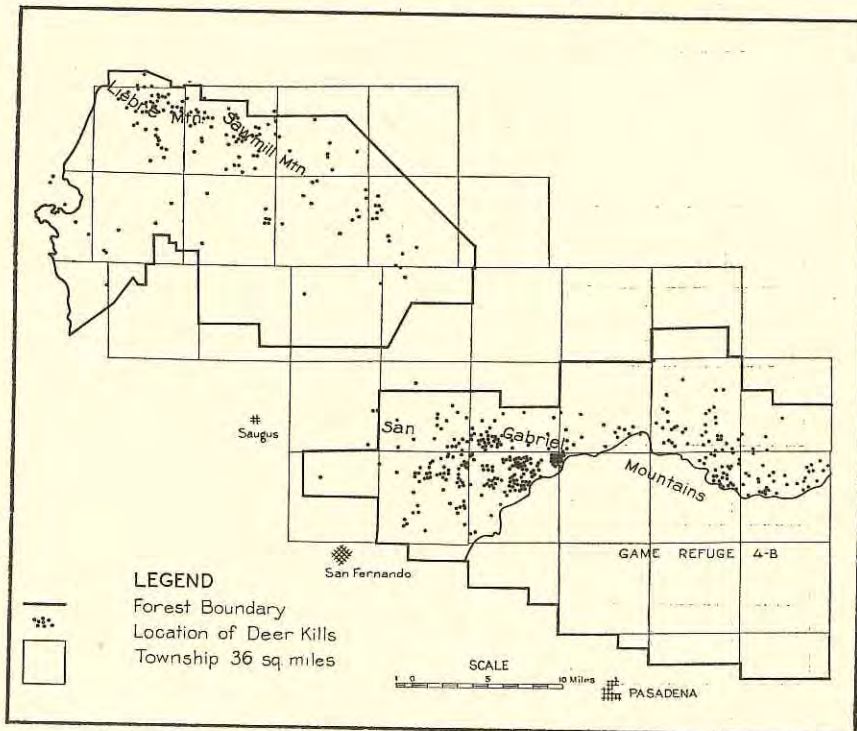


FIG. 66. Spot map of deer kill, Angeles National Forest, 1935.

trophy. An analysis of limited data indicates that the trophy quality may increase in the vicinity of refuges. In Area A on the Sequoia Forest the bucks taken averaged nearly 10 pounds heavier than in Area B and had correspondingly greater antler development.

Area B-2 on this spot map, and others, repeatedly show that high populations are developed and maintained under the buck law away from the influence of a refuge. This is clearly illustrated by comparing two separate units on the Angeles Forest (Fig. 66). The Liebre-Sawmill Mountain area is a mountain range separated from the San Gabriel Mountains by the fairly broad Santa Clara River drainage into which the Mojave Desert intrudes, forming a definite barrier to deer movements. Over one-half of the San Gabriel Mountain portion of this forest is within Game Refuge 4-B. This was created in 1929, partly for the purpose of

reducing human use and thereby increasing the protection of important watersheds from fire. For many years the deer kill was very high in Los Angeles County.³ Some credited the large refuge as being the management tool that permitted the deer kill to be maintained. Such "off-hand" conclusions were no doubt reached without consideration of the barriers of desert and urban areas between the different hunting areas in the county or without knowledge of the kill from year to year in the vicinity of the refuge.

Studies in this area indicate the herds do not have the mobility of the migrating herds of the north. The few does that have been under more or less continuous observation for periods of several years have a year-long radius of movement little more than one-fourth mile. Known bucks have confined their lifetime movements to a few hundred acres. These movements have been exceeded only by those deer that summer at the highest elevations where deep snows force the animals to somewhat lower elevations for winter. Individual deer definitely have a "home base," and the spread of these deer under minor population differentials is probably negligible.

It can be safely stated that because of the desert barrier the kill on Sawmill and Liebre mountains was not appreciably influenced by Refuge 4-B in the San Gabriels. The territory open to shooting is similar in character on both mountain ranges, yet the San Gabriels contain somewhat better quality deer forage due to the fact that a larger proportion is at a higher elevation. The more succulent forage plants occur above the 4,000-foot contour; in the Liebre-Sawmill mountains only about 10 per cent of the hunting area is above this limit, whereas in the San Gabriels this figure is near 20 per cent.

From 1935 to 1941 inclusive, a total kill of 1,742 deer has been recorded for the Sawmill-Liebre area and 1,145 for the San Gabriel. The average annual kill per square mile was 0.97 and 1.05 respectively. The highest average kill on the Sawmill-Liebre area was 1.43 per square mile (1938) and the lowest 0.68 (1935 and 1941). In the San Gabriel area the highest was 2.17 (1935) and the lowest 0.22 (1941).

The change in deer kill in the two areas over the 7-year period in which records were taken (Table 1) raises another vital question.

TABLE 1

Deer Kill for the Sawmill-Liebre and San Gabriel Areas, 1935 to 1941, Inclusive

Year	Sawmill-Liebre	San Gabriel
1935	175	337
1936	258	304
1937	325	209
1938	366	145
1939	279	84
1940	165	32
1941	174	34

In the fall of 1937, rangers reported that in excess of 200 deer had died in the Pacoima, Tujunga, and Arroyo Seco drainages in the San Gabriel Mountains. The area in which losses were noted was bisected by

³ The Angeles National Forest is almost wholly within Los Angeles County.

the refuge boundary, and the focal point seemed to be within the refuge. Posting carcasses in the field indicated an intestinal disturbance which at the time was assumed to result from a poison. The quick onset of the losses and the rapid spread to areas that had supported a large deer population for many years and were remote from orchard sprays and other poisons indicated an epidemic disease was causing the loss. This was borne out by the fact that the losses continued over a three-year period, as reflected in the kill recorded.

The analysis of the maps and records leads to the conclusion that the large refuge area has not maintained the deer population, and has given rise to the question as to whether or not the refuge has been a major factor in causing the catastrophe that has overtaken the herd.

Refuge 4-B is an example of a sanctuary created partly for reasons other than game conservation. The protection of a series of watersheds from fire was a factor in determining its placing and its size, and perhaps crystallized the decision to establish it. Similar action has been taken in other areas of high fire hazard, and still other refuges and parts of refuges have been created in the interest of protecting power installations, highly-developed scientific observatories, and the particular interest of individual landowners. On the other hand, areas within the national forests closed to public use for fire protection under regulations of the Secretary of Agriculture have been effective refuges, where the hunting season does not extend beyond the fire season.

Under the California State Fish and Game Code, areas may be closed to hunting where required for the special protection of game animals. Such action has been taken where extensive brush fires have removed needed protective cover. Deer are often attracted to these areas by the temporary increase in desirable food consisting of succulent sprouts and herbs. The escape cover is eliminated by fire, and a very heavy kill may result unless a closure is effected. After a period of three to five years, cover is partially reestablished, the forage loses its attractiveness, and the concentration is dispersed. The area is then reopened to hunting. Such temporary refuges are effective in limiting the take of the legal males.

In opening refuges, the hunting effort for the first year or two is far above normal. Hunters assume these newly-opened areas offer a better opportunity to secure a deer, and they flock to such areas in large numbers. The result is usually a heavy take but only average success per individual hunter. There is increased hazard to the hunter from stray bullets, and an immediate reduction of the number of legal males to that of the surrounding open territory. For this reason the periodic opening or shifting of refuges does not appear to be an effective tool in deer management, except in the case above cited where the change in the forage results in a dispersal of the animals before the area is opened to shooting.

Discussion

In order to explain why deer refuges have demonstrated so little positive evidence of their effectiveness and have shown much that is negative, their theory must be explored and the inherent characteristics of the animals examined.

1. The breeding potential of deer is high—if realized, it is sufficient to double the size of the herds at least every two years. With herds

averaging over 40 per cent breeding does, and with a doe-fawn ratio of 1:1.5 at birth, the 500,000 deer in the State could produce 300,000 fawns a year. Yet only 40,000 animals are removed annually by legal hunting. Over 200,000, then, must succumb to disease, weather, starvation, predators, and other causes.

2. Deer are polygamous and promiscuous in their breeding habits. The taking of a portion of the legal males does not interfere with the breeding potential. A study of 2,681 bucks taken on the Angeles Forest during the seven-year period 1935-1941 showed that hunting removed less than 40 per cent of the legal males each year. This is believed to be the heaviest kill in the State. Those who have studied deer herds during the breeding season could not possibly assume that the so-called "barren" doe could be the result of a scarcity of bucks, when the ratio of breeding males to mature females is no lower than 1 to 3 or 4.

3. In only a few instances is there evidence that marked population differentials exist between the refuges studied and adjoining open areas. However, should they exist, there is strong evidence that such conditions do not result in any considerable dispersal from the more concentrated areas. Deer have a definite "home base." This is particularly true under the natural conditions of a refuge. It consists of selected places for cover, feeding areas, watering places, and avenues of escape. Populations may expand until there is a shortage of food, a lower level of nutrition, and less resistance to disease and severe weather. Then there is a natural reduction in the herd to the capacity of the habitat. Such vicious circles are also known to take place in areas open to shooting under the buck law. Should major differences in population exist between adjacent areas similar in character, it can not be denied that some movement may result. The point is that these differentials generally do not exist to a marked degree.

Refuges to a certain extent serve as sanctuaries for the legal males during the hunting season, but not in all cases. After the Cleremont Refuge in the Plumas Forest was abandoned in 1935, the kill within that area was no higher than that in the surrounding territory that had been open for many years. No concentration was noted in the area that had been included in Refuge 1-K, when it was opened in 1941. On the other hand, on two different areas on the Modoc Forest that were opened after a number of years of closure, a concentration of legal males was found. The number of other deer, however, was low.

4. Refuges with flexible control are usable for protecting particularly vulnerable herds, such as those whose escape cover has been destroyed by fire, herds concentrated on migration routes, or plantings in underpopulated areas. There are possibilities in the use of refuges to improve the trophy quality in local areas where the existing season and bag limit is insufficient to allow the herds to produce animals of desirable size. In addition, they can be used when other uses of land preclude hunting.

Conclusions

As a result of the study it is concluded:

1. That deer refuges under the California buck law are of value where visual recreation is of greater importance than hunting.

2. That they are of value in areas of concentrated human use requiring the removal of the hazard of stray bullets.

3. That they are of value to furnish needed protection on well-defined migration routes, and in such localities to promote better sport.

4. That they are of value to furnish needed protection to deer on certain burned-over areas where escape cover is removed and concentrations are heavier because of a temporary increase in the amount of succulent feed.

5. That the establishment of a refuge as a means of reducing human use of an area, such as for the purpose of protecting a watershed from fire, is not meeting an issue squarely. Obviously the answer in this case is to establish an open season when human use will not be a threat to the major values and at a time when the animals are in a satisfactory condition for taking.

6. That under a buck law, refuges temporary in character may be of value in special problem areas, to prevent a heavy take of bucks and particularly to maintain the sporting values of trophy hunting.

7. That the use of a refuge as a game-management tool presupposes improper management of the areas open to shooting—this to the extent that hunting reduces the herds excessively or interferes with the breeding potential.

8. That refuges have not increased hunting opportunities but have resulted in a reduction in the take approximately equivalent to their proportionate area.

9. That retention by the Legislature of authority to establish, adjust, and abolish refuges precludes effective management and lends permanency to errors inherent in a system of fixed refuges and to the problems that develop within them.

10. That deer refuges under the buck law should be re-examined in the light of present-day knowledge and given a general overhaul.