



Fig. 5
Remains of an illegally-killed doe
and fawn. Only the hams and back-
straps of the doe were taken.



Fig. 6
Remains of an illegally-killed doe
and fawn (Fig. 5) were hidden in
this burned out stump.

area in Douglas county. This information is shown in graphic form in Tables 5 and 6.

Data summarized in Table 5 clearly indicate that the time of greatest poaching or illegal hunting, as measured by the number of arrests made for this cause, begins just prior to the legal hunting season and reaches a peak during that season. During this time many more hunters are in the field and more chances are taken to violate the laws. Table 6 shows that this situation was also true on the resident study area. Due to the fact that other duties called the observer from the area during most of the months of September and October 1941, there was little opportunity to obtain information during those months.

In comparing legal and illegal kills made during the 15-month period on the 4-township area, it was found that insufficient evidence could be obtained for the entire area on which to base an accurate comparison. On one unit of this area, however, considerable more facts were known than for the other units. This unit, known as the Reston Area, served as a key area during the entire study. Due to the fact that residence was established there, it was possible to become more intimately acquainted with the local people and thereby learn more of their hunting activities. The natural reluctance of local residents to disclose their illegal hunting activities, even after their confidence was

Table 5. Number of arrests, deer cases only, by month for seventeen western Oregon counties (Clatsop, Columbia, Tillamook, Washington, Clackamas, Marion, Yamhill, Polk, Lincoln, Benton, Linn, Lane, Douglas, Coos, Curry, Josephine, and Jackson) for the period between Aug.1,1940 and Nov.1,1941 as compared with arrests made in Coos and Douglas counties for the same period.

—Number of arrests, by month, for 17 western counties.
 ---Number of arrests, by month, for Coos and Douglas.

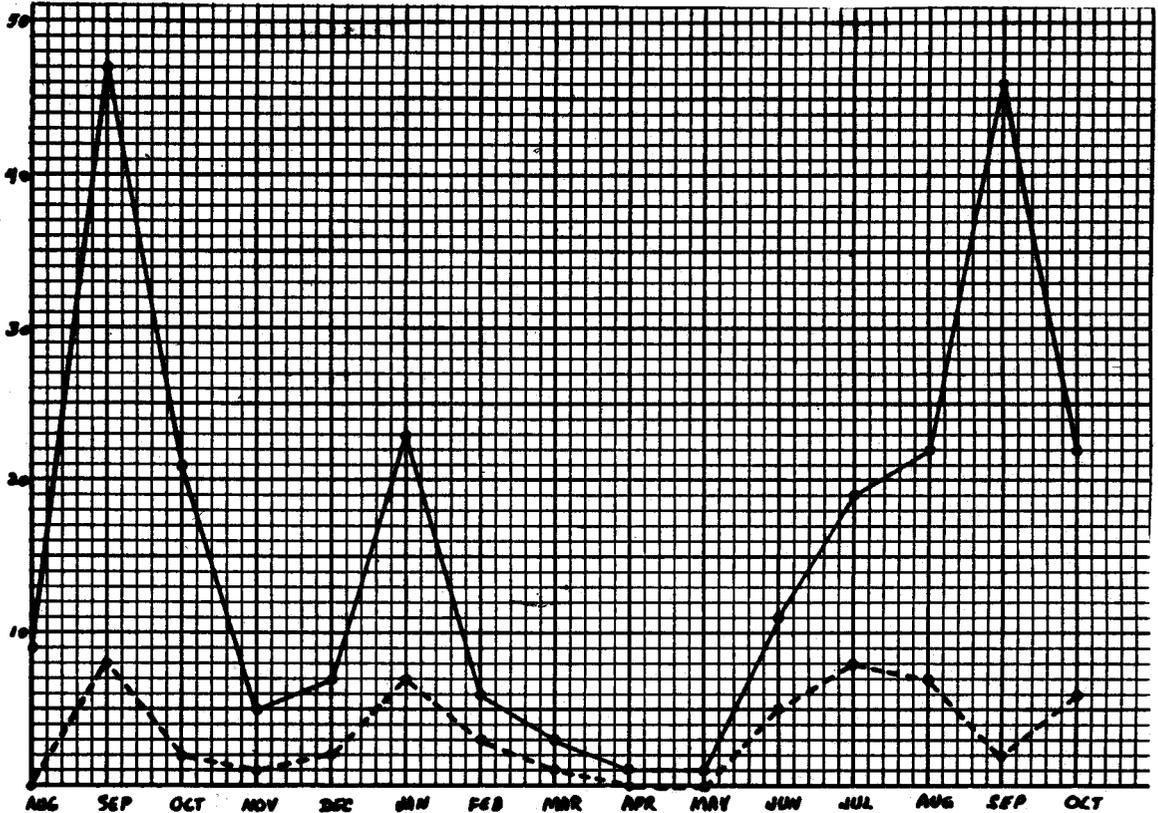
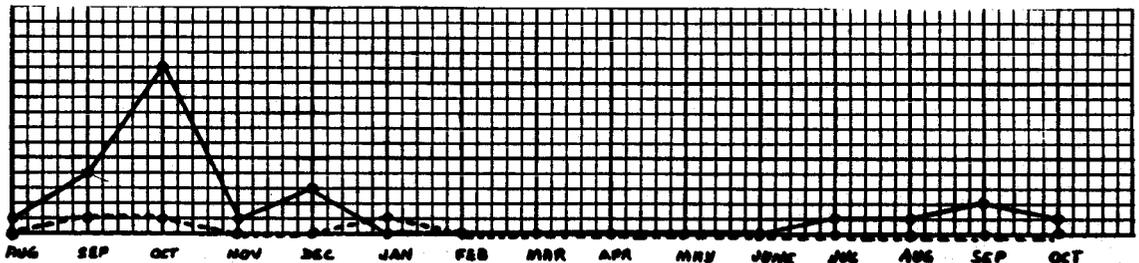


Table 6. Number of known game law violations on resident study area of four townships, Coos and Douglas counties, as compared with the number of violators arrested.

—Known game law violations on resident study area.
 ---Number of violators arrested on this same area.



won, made the collection of information on this subject difficult. The illegal hunting activities of non-residents were equally hard to measure and for these reasons it is believed that the figures of illegal deer killed on the area are extremely low. Conversely, it was relatively easy by everyday contact to learn of any legal deer killed on the area during the open hunting season. During the period of study, 11 deer were known to have been illegally killed on this one township, Figure 7. Six of these were killed by non-residents, 3 by residents, and 2 by unknown persons. During the same period only 2 deer were known to have been killed legally.

Another similar community of about the same population located in western Lincoln county, was used as a check area. Through personal contact it was possible to obtain detailed information concerning the illegal hunting activities of the residents of this second community. During the past two years, an average of one deer per month has been killed. These deer are shared by the entire village of twelve people. Thus during the two-year period each resident has averaged one deer per year.

This study would seem to indicate that the chief reason for such a serious drain on the blacktail population, due to illegal hunting, lies with inefficient law enforcement. This is not believed to be true. In all fairness it



Fig. 7
Skeletal remains of an illegally-killed
doe and fawn. Only the hind quarters
and backstraps were taken.

must be stated that in almost every case, officers in this entire region were not only efficient and hard working but spent far more time and effort in doing their jobs well than they received compensation for. The fact that only two men were assigned to patrol an area as large as Douglas County, 5062 square miles, would seem in itself sufficient explanation for an apparent laxity in game law enforcement. A summary of convictions obtained from cases of game law violations tried during the past six years is a record of constant improvement and proof of the excellent job done by these men in collecting sufficient evidence to convict "the poacher," Table 7.

Table 7. Convictions as compared to cases tried for all game law violations for the entire state of Oregon.

Year	Arrests	Convictions	%
July 1, 1934 to June 30, 1935	1,046	890	85.1
July 1, 1935 to June 30, 1936	783	685	87.5
July 1, 1936 to June 30, 1937	1,039	940	90.5
July 1, 1937 to June 30, 1938	1,368	1,264	92.4
July 1, 1938 to June 30, 1939	1,380	1,286	93.2
July 1, 1939 to June 30, 1940	1,495	1,417	94.8

(Biennial Reports of the Game Commission of the State of Oregon, 1937-1940)

What then is the solution to the very serious problem of illegal deer hunting? The answer is well summed up by the rancher from southwestern Oregon who was previously quoted from the Oregonian of November 10, 1942:

"When a man openly boasts of killing 97 deer in one year, and his statement is accepted without surprise or resentment by a group of hunters, one can readily see to what low levels law enforcement as well as sportsmanship has descended."

DISEASES--PARASITES

Because moist humid regions are known to be favorable to the development of many species of internal parasites, it was expected that a parasite problem might be significantly present in the deer herds of western Oregon. Shaw (21-280) states, "Certain parasites of sheep in Oregon continue to be the chief cause of losses, especially in Willamette Valley sheep....." The fact that sheep and deer are subject to infestation by many of the same species of parasites, Table 10, and that livestock losses had been rather serious in parts of the area due to heavy infestations of parasites, were added reasons for suspecting a similar condition might exist in black-tailed deer herds.

Throughout the fall and early winter, many people were asked whether they had ever noticed such a condition in the deer of that area. Few people could recall ever having seen a deer that they considered sick or diseased though some

mentioned finding "grubs"* in the nose and throat region of some bucks killed during the open hunting season, Figure 8. Others remembered that they had occasionally found a deer carcass in the woods, but reported that they had thought little about it at the time, assuming that the deer had probably been shot or killed by some predatory animal. A government predatory animal hunter in a letter to the Oregon Game Commission, stated:

"I have seen one deer, in my 40 years of hunting in this country, that was sick and that one was covered with warts and we shot it....."

During the latter part of the winter and early spring months of this study period, reports were received in gradually increasing numbers of diseased and dead deer. The great majority of these reports came from the southern half of the coastal region, Douglas and Coos counties, though one report was received from the extreme southern part of Lincoln county. Most of the animals from Douglas county were reported from the North Umpqua river drainage and slightly beyond the established boundary of the study area as previously described. However, due to the serious nature of this phase of the study, evidence was collected wherever available from the entire region west of the summit of the Cascade Mountains, the natural boundary of the blacktail

*Larvae of the bot fly, Cephenomyia sp.



Fig. 8
"Grubs," the larval form of nose bot flies,
Cephenomyia sp. Commonly found in the
sinus and throat regions of deer.



Fig. 9
A typical scoured fawn showing messy
appearance of tail and hind quarters
and extremely poor physical condition.

range.

In late December, 1940, a government hunter in Lincoln county reported that he had seen seven deer, so poor and weak that they were unable to run when he approached to within a few yards of them. He noted that they were suffering from scours and that their tails and hind quarters were "well-plastered" with manure. Efforts were then directed toward discovering the prevalence of this condition among the black-tailed deer, the importance of this condition in the general welfare of the deer and if possible the causes and cures.

Cooperation was sought from the Department of Veterinary Medicine, Oregon State College, on this phase of the study. Such aid was readily given by Dr. J. N. Shaw, head of that department. Permission was kindly granted for the use of a laboratory for post-mortem examinations of several deer that were later brought or sent in. Dr. M. P. Chapman, staff member of the department, performed all such examinations and together with Dr. Shaw identified the parasites found.

Between December 1940 and April 1942, many reports were received about sick and dead deer that were seen or found from time to time. Careful examination showed that several of the "diseased" animals reported had actually died of other causes. Some had been struck by automobiles. While

such injuries were not always apparent until the animal was skinned, they were sufficient to cause the death of the animal. One, a large buck, died as the result of a ruptured spleen, gained possibly in a fight with another buck or from some unknown cause. The most frequent "other cause" was illegal hunting. Many a sick deer that was reported had actually died because of gunshot wounds rather than disease.

Throughout this study it was noted that almost invariably sick or diseased deer were suffering from severe diarrhea, more commonly called scours, Figure 9. Actually, scours should be described as a "condition" and not a "disease." Such a condition can result from a variety of causes and, as pointed out by Shaw (12-3) should be treated only as a symptom. In the early spring, when the first tender green shoots of grass and browse become available, both deer and livestock will eagerly seek them for food. Such succulence, after several months diet of coarser, drier forage, may produce "washy" manure. It is reported that when animals eat forage that has been frozen the condition sometimes develops. Almost any nutritional disorder or deficiency may sometimes cause bowel irregularities which result in loose watery dung, lacking the characteristic pellet formation. Heavy infestations of internal parasites, especially certain species inhabiting the digestive tract, frequently cause functional disorders that develop into

scours.

"Every serious outbreak of scours in sheep and goats which has been observed by the department of Veterinary Medicine of the Oregon Agricultural Experiment Station has been caused by parasites of some type." (12-3)

Since many of the same species of parasites that cause scours in sheep and goats in western Oregon have been commonly found in black-tailed deer, it is to be expected that they may be the cause of similar outbreaks in deer.

Such a diseased condition usually develops during the so-called critical season--the late winter and early spring months. At this time most of the better browse and forage plants are not available or are greatly reduced in palatability and nutritional value. While the deer will eat large quantities of these less-nutritious species, in order to survive, it is evident that they gradually lose weight and condition during this period. This lowered vitality seems to favor the development of internal parasites and such parasites have a far greater toxic effect on the deer at this time. Many animals, and especially the fawns of the year, are unable to withstand this constant and severe drain at this time and succumb.

Many observers fail to recognize this situation and report deer dying in areas containing "abundant food." Actually, this is not the case and careful observations show that many of the food plants still available at this late

winter season are seldom, if ever, chosen by deer at any other season. Dr. J. R. Haag, Chemist, Agricultural Experiment Station, has made chemical analyses of several species of typical browse plants collected during the late fall and winter season. As yet this work is incomplete though his findings indicate that the same plants may vary considerably in nutritional value from season to season.

Hellmers (13-324) carried on experiments in Pennsylvania in which he collected, at monthly intervals, samples of eight species of woody plants browsed by white-tailed deer, Odocoileus virginianus, and analyzed them chemically to detect variations in their composition. He reports,

"Marked differences were found, especially in protein, nitrogen-free extract, and crude fiber, all of which exhibited trends indicating reduction in nutritive value through the winter."

Some reports stated that animals were found that had not been secured at the time of death though throughout most of the study period, specimens of such animals could not be found. In February, 1942, one such fawn was captured in the Umpqua National Forest, about 50 miles east of Roseburg, Oregon, Figure 10. This animal was a male about nine months old. Because of his extremely weakened condition, this animal was unable to overcome the fright and shock of being captured and died within a few hours. This fawn was weighed and measured then taken to the Veterinary Department at Corvallis for post-mortem examination. Such examination did



Fig. 10
A typical diseased fawn that showed an
extremely emaciated condition but
was not scoured.



Fig. 11
A typical diseased fawn that showed an
extremely emaciated condition and
heavy scouring.

not, however, show that this animal had been infested with other than the usual species of internal parasites though it was heavily loaded with these, especially the stomach worm, Ostertagia sp. This fawn was considered a typical case, even though not scoured at the time of death. Dr. Shaw expressed the opinion that this animal had probably been scoured previously but had somewhat recovered at the time of capture.

In February, 1941, a very typical case of a "scoured" animal was found near Sitkum in Coos county. This little buck, judged to be about nine months old, was in extremely poor physical condition, with backbone and ribs sharply visible and hooks, rump, and tail stained and matted with manure, Figure 11. This deer had suffered with severe diarrhea for a considerable length of time. When found it was still alive, though too weak to get up or move away. Though handled very gently, the excitement of being carried to a nearby CCC camp, added to the natural fear all wild animals possess for humans, was too much to overcome, and the fawn died within a half hour after being found. Blood smears were made and the carcass carefully weighed and measured, after which a post-mortem examination was made.

To emphasize the severely emaciated condition of these typical cases, the weights and measurements are compared with those of a normal fawn, killed by a dog two months

later, Table 8.

30 (5-52)
Table 8. A comparison of weights and measurements of two diseased and one normal fawn.

Measurements Taken	Diseased Secured	Diseased Not Secured	Normal
Approximate age in months	9	9	11
Total length in inches	47	48	48
Height at shoulder	27	27	29½
Hind foot	14	14	15
Ear (outside)	7½	6	7
Tail	6	6	7
Live weight	34	30½	92

At the time of death, the two diseased animals had suffered a weight loss of approximately 66 per cent of their normal body weight. Small wonder that they were unable to survive.

During the 16-month study period on this phase of the problem, reports that were considered authentic of 92 animals were received. Each of these and several others that could not be verified were investigated. The remains of 34 animals were seen and post-mortem examinations performed on all that were still in suitable condition. Had it been possible, some of these sick animals would have been captured while still alive and taken to the Veterinary Department for diagnosis and study. However, during the entire period, only the two fawns previously mentioned were still alive when found. Usually animals were not found

until putrefaction made them noticeable. By the time reports of such carcasses were received and could be investigated, little remained, save bones and hair, for a diagnosis, Figures 12 and 13.

The location of each diseased or dead deer that was authentically reported or seen during this study was plotted on an outline map and clearly shows that the great majority of cases were located in the southern half of the coastal country, Plate III.

Analysis of records made during the entire study period showed that the great majority, though not all, of the diseased animals found or reported were from ranges subject to joint-usage by livestock and deer. The two areas where the most serious losses of deer occurred had been heavily pastured by sheep for many years past. On one ranch in particular, where eleven deer carcasses were found on one section of land, the rancher reported that a year ago he had lost many lambs in the same area. This year, however, he had not allowed any sheep on that part of the range and had not suffered any losses.

Of 92 diseased and dead deer reported for the whole coast region, 31 were from areas also occupied by sheep, 21 were from areas occupied by both sheep and cattle, 18 were from areas occupied by cattle alone, and 16 were not known. Only 6 of the 92 animals were found on areas where



Fig. 12
The typical appearance of many of the diseased deer that were reported.



Fig. 13
The typical appearance of many of the diseased deer that were reported.

the effect of livestock could be considered negligible.

Ranchers of this region have become somewhat accustomed to the heavy losses of livestock during each year and do not become unduly alarmed if, during a day's trip over a part of their ranch, they find three or four or more dead animals. A paragraph from the field notebook serves to emphasize this fact.

"On Thursday, February 27, 1941, Mr. T. was unable to go out with me but gave me instructions as to where he found the two sick deer about six weeks ago. I followed his instructions and spent most of the day looking for diseased animals. I did not find any deer nor did I see any. I did find one ewe, two lambs, and three goats that had died within the past month. Numerous skulls and skeletons of sheep and goats that had died previously were also found. Mr. T. reports that ranchers lose many sheep and goats in this area."

During the latter part of the field studies, to further supplement the information on extent of the parasite problem, a plan was worked out whereby seat or fecal samples were collected from a wide variety of cover types throughout the whole blacktail range, and examined for eggs or immature forms of the parasite species. Only fresh seat pellets were collected and these packed in iced vacuum bottles and shipped to the Veterinary Department, Oregon State College, for examination. Samples ranged from 5 to 10 pellets and were placed in small individual packages prior to being placed in the iced vacuum container. Each package was numbered and complete data as to locality, date,

land-use, etc. were recorded. The purpose of keeping the samples in cold vacuum bottles was to check further development of any parasite eggs present in the fecal material, thus preventing their hatching prior to examination.

Several series of these pellets were microscopically examined by Drs. Shaw and Chapman and the eggs and larval forms identified and recorded. In almost every case, some parasite eggs were present, showing that practically all deer are subject to at least some parasitism. Sufficient material was not examined on which to base other than general conclusions but in all cases the eggs and larval forms present in the seats were identical with those already found and reported from post-mortem examinations.

A survey of the literature revealed many scattered and incomplete reports of parasites of the Columbian black-tailed deer. Two such papers, however, gave an excellent summary of the internal parasites and a third of the ticks. Dikmans (15) of the United States Bureau of Animal Industry has brought together many scattered reports of various kinds of helminth parasites in North American semi-domesticated and wild ruminants. Shaw (16) and his co-workers have recorded many parasites from black-tailed deer in Oregon and Chamberlin (14) has reported on the ticks found in Oregon. The parasites reported in these three papers are summarized in Tables 9 and 10.

Table 9. A list of the internal parasites that have been reported from the Columbian black-tailed deer.

Name of Parasite	Location in Host	Authority
<u>Ostertagia circumcincta</u> *	Abomasum or 4th stomach	(16) ¹³
<u>Hematodirus filicollis</u> *	Small intestine	(15) ²
<u>Chabertia ovina</u> *	Large intestine	(16)
<u>Oesophagostomum venulosum</u> *	Large intestine	(18)
<u>Dictyocephalus filaria</u> *	Trachea, bronchi and lungs	(15)
<u>D. viviparus</u> *	Trachea, bronchi and lungs	(15)
<u>D. hadweni</u>	Trachea, bronchi and lungs	(15)
<u>Elaphostrongylus edocolei</u>	Trachea, bronchi and lungs	(15)
<u>Protostrongylus macrotis</u>	Trachea, bronchi and lungs	(15)
<u>Onchocerca cervipedis</u>	Subcutaneous tissues of feet	(15)
<u>Fascioloides magna</u> *	Liver	(15)
<u>Thysanosoma actinoides</u> *	Small intestine	(16) ⁷⁴⁰
<u>Cysticercus lyncis</u>	(immature) Heart, lungs	(15)
<u>C. krabbei</u>	(immature) Liver, heart	(15)
<u>C. tenuicollis</u>	(immature)	(16)
<u>Echinococcus</u> *	(immature) Liver, lungs	(15)
<u>Trichouris ovis</u>		(16) ^{random}

*Occurs also in domestic ruminants.

Dikmans (15-97) states, "Hadwen (1916) reported Fascioloides magna (Fasciola magna) from the black-tailed deer, Odocoileus columbianus; he reported also, on the authority of Mr. Kermode, the common liver fluke, Fasciola hepatica, from the same species of deer." These parasites were reported from black-tailed deer in Canada. On page

101 of the same report he states, "A striking feature of the table is the absence of records of the occurrence of the common liver fluke, Fasciola hepatica, in North American wild ruminants. The U. S. National Museum Helminthological Collection contains no specimens of this fluke from any of the hosts listed. The only record in the host catalogue maintained in the Zoological Division, of the occurrence of this fluke in a North American wild ruminant is that of Hadwen (1916). An examination of Hadwen's paper shows that the reported occurrence of this fluke in the black-tailed deer, Odocoileus columbianus, was on the authority of a Mr. Kermodé."

Table 10. A list of the external parasites that have been reported from the Columbian black-tailed deer.

Name of Parasite	Location on Host	Authority
Nose bot fly, <u>Cephenomyia</u> sp.	Sinus, throat	(16)
Louse fly, <u>Lipoptena depressa</u>	External	(16)
Louse, <u>Trichodectes parallela</u>	External	(16)

Ticks--All ticks listed below have been reported as being present or common in the range of the Columbian black-tailed deer in Oregon. All of these ticks have been reported from Columbian black-tailed deer though only the one preceded by an asterisk (*) has been reported from this deer in Oregon.

Spinose ear tick, <u>Ornithodoros megnini</u> (Duges)	(14)
Pacific Coast tick, <u>Dermacentor occidentalis</u> Neum	(14)
American dog tick, <u>Dermacentor variabilis</u> Say.	(14)
Elk or Winter tick, * <u>Dermacentor albipictus</u> Pack.	(14)
Black-lined tick, <u>Dermacentor nigrolineatus</u> Pack.	(14)
California Ixodes, (<u>Ixodes californicus</u> Banks)	(14)
Castor bean tick, <u>Ixodes ricinus</u> (Linn.)	(14)

Sickle Cells:

During the summer of 1938, while examining a male Columbian black-tailed deer that had been raised on a deer farm in southwestern Oregon, a condition of so-called sickle-cell anemia was discovered. This animal was examined by Dr. R. W. Dougherty, Department of Veterinary Medicine, Oregon State College, who subsequently examined blood smears taken from many deer throughout the coastal region. In every blood smear of Columbian black-tailed deer examined some sickle or crescent-shaped red blood cells were present. According to Dr. Dougherty,

"Sickle-cell anemia of deer as it had been called has been reported in Michigan and California. It was first thought to be an active form of anemia, but subsequent accounts seem to indicate that it generally exists in a latent form." (17-17)

During the open hunting season of 1939, ninety blood smears were collected from deer killed in the Siskiyou National Forest and sent to Dr. Dougherty for examination. In every case where it was possible to make an examination, sickle-shaped cells ranging from few to many were present. These blood smears were taken from legal buck deer that were judged to be in excellent physical condition. At the time these smears were made, by forest service personnel, data were also collected on weights and general condition of the animals killed. In no instance was an animal judged to be in "poor" condition but in all cases were judged either

"good" or "fat."

On June 20, 1941, a two-weeks old male fawn was picked up in Douglas county and retained as a study animal. On June 23, a blood smear was taken from this deer and sent to the Veterinary Department, Oregon State College, for examination. This smear was examined by Dr. M. P. Chapman who reported that some sickle-shaped cells were present.

Thus it seems that sickle or crescent-shaped red blood cells in Columbian black-tailed deer in Oregon might almost be called a "normal" condition. To date, this condition has not been proved responsible for any losses of black-tailed deer in Oregon and therefore should not as yet be considered detrimental to the deer's welfare. A warning should be sounded, however, against uninformed and untrained persons who have in the past and may in the future diagnose cases of deer losses to sickle-cell. One such person in Douglas county was responsible for many such false diagnoses without ever so much as taking or examining a blood smear. Naturally such reports were the cause of unnecessary concern among the residents of that area.

NATURAL ENEMIES

Little evidence was collected during this study concerning the effects of predatory animals on black-tailed deer. It is a common opinion, backed up by considerable

fact, that losses due to this cause are considerable. Since no method was known whereby the effects of such predation could be measured, in the short time spent on this study, such instances of predation as were found were merely recorded.

During the study period only one "kill" was found on the 4-township area. This was a small "forked horn" that was believed to have been killed by a cougar. It was dragged into the brush and partially covered with sticks and other debris, scratched up in characteristic cat fashion. During this time, however, "sign" in the form of tracks and droppings was frequently seen of cougar, bobcat, and coyote. Two cougars and six bobcats were known to have been taken by hunters from the four townships during this study period.

In the annual report of the Umpqua National Forest for 1937 (20), it was estimated that 1300 deer were killed by predators as against 230 by hunters. This fact clearly emphasizes the great importance of predators in some parts of this area.

FIRE

During this study period no serious fires occurred in the entire range. Occasionally small fires did break out but these were usually quickly suppressed before any great damage could be done. Often such fires are somewhat bene-

ficial so far as the deer are concerned because they serve to make openings in the dense canopy of the forest and thus stimulate the growth of shrubby plants which are so favored by deer for food.

One important record was obtained concerning part of the area burned over by the second great Tillamook fire in 1939. Mr. J. E. Meehan, resident of the Wilson River road, planted between 700 and 800 acres of the 1939 burn to grasses immediately after the fire. While planting he found the carcasses of 18 deer that had been burned to death. Two of these deer were bucks but no records were kept of age class. The burn covered approximately 267,000 acres. If such losses could be applied to the entire burn it would amount to 0.024 deer per acre or about 6408 deer for the entire burn.

ACCIDENTS

Strange accidents are sometimes responsible for losses among our deer herds. During this study, several such instances were recorded. Two deer, one a yearling, Figure 14, the other an aged buck, became entangled in a woven wire fence in attempting to jump over it and perished there because they were unable to release themselves. This loss has been previously reported for other species of deer, (Crews 18-28) but the scarcity of woven wire fences throughout the

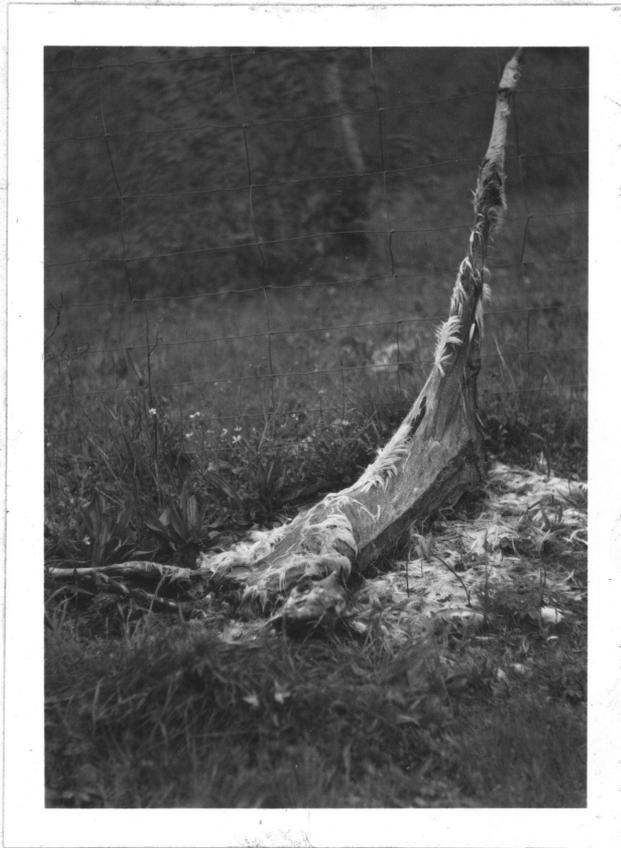


Fig. 14
A yearling buck that became entangled
in a woven wire fence and died
before it could free itself.

black-tailed deer range and the fact that such accidents rarely happen, makes this cause of mortality relatively unimportant.

One small buck lost his life by being caught in a steel trap set for a coyote, Figure 15. This trap, a number 3 with "teeth" on the jaws, was set in a small "crawl hole" under a fence. For some peculiar reason this deer chose to go under the fence, through this small hole, rather than jump over.

One very serious cause for deer losses each year is the annual toll taken by automobiles along the highways. Each year many deer are struck down and killed by motorists. Such losses have been especially evident along the Oregon Coast Highway, number 101.

Einarsen (19) in an unpublished report to the Oregon Game Commission, has pointed out this serious loss, stating, "Of the known causes of deer losses few can be corrected easily, but roadside kills on Coast Highway number 101 is one loss which can be greatly reduced."

During 1941 a total of 39 highway kills were reported to the Oregon Game Commission from the coast region. However, this is only a small fraction of the actual toll taken by this cause in that area. Usually the victim of such an accident is dragged from the road and into the ditch, out of sight, where it is left to decay or be eaten by carnivor-



Fig. 15
A buck fawn caught in a steel trap set
for a coyote, Douglas county.

ous birds and animals. As Binarsen (19) points out, "No estimate can be made of the number of deer which were only injured, or which moved considerable distances after the accident before they died and were never found." His study has led to the following conclusions:

1. Most accidents are in areas where roadside cuts or fills limit the escape route of the deer.

2. Most of these critical areas are found in stands of heavy timber where little forage exists, thus forcing the deer to the highways to eat the clover and other cover plants growing there.

3. That where any species of clover is used for roadside cover, the danger is greatly increased, as deer are especially fond of this plant at all seasons.

4. On roadways where deer crossings are numerous, but where logging works, open burns, and pasture lands carry ample foods, losses are reported only occasionally.

WEATHER

As has been previously stated, weather throughout most of the blacktail range is, year in and year out, very mild and seldom if ever are below freezing temperatures recorded during the entire twelve-month period. However, occasionally a severe winter does come and during such times takes heavy toll of the deer herds.

The winter of 1937 was such a period. During that year snow came early and remained much later than usual over most

of the range. Excerpts taken from the annual report of the Umpqua National Forest (20) for that year clearly illustrate conditions as they were during that winter in many places throughout the blacktail range. Mr. V. V. Harpham, Supervisor, states:

"December 1, 1937. I agree with the Rangers that the deer population in this forest has very materially decreased since last year. Figures show 7,000 deer for 1936 as against 4,700 for this year. I believe the ratio is about right.

"I have made some very careful observations during the past season, particularly during the hunting season, for deer, and I gained the very decided impression that at least for the North Umpqua Ranger District we lost 50 per cent of our blacktail deer population through a combination of the exceedingly long period of heavy snow, plus depredations of predatory animals. In other sections of the forest the loss seemed to be less serious from weather conditions.....

"There was 42" of snow for an extended period at Illahe last winter as against 32" as the maximum ever observed by Wright (Perry Wright, a resident of that area for 32 years) on previous years, and normally the maximum is from 1 to 1½ feet, and usually this lies on the ground for a comparatively short time." (20)

Mr. Avery E. Berry, District Ranger for the South Umpqua Ranger District gives the following report:

"I may be over alarmed as to the number of deer that died as a result of the severe weather and deep snows of last winter but I believe approximately 1000 deer must have died last winter. All of my protective men, trail maintenance and construction crews as well as many fishermen and hunters have reported finding many carcasses of deer that were in no way disturbed or showed any other evidence of having been killed by predatory

animals. I believe at least 75 to 100 such carcasses have been noted." (20)

Mr. Harold Bowerman, another District Ranger reports:

"The severe snow of last winter, the heaviest in several years, has accounted for the winter killing of many black-tailed deer. Nine were reported by Eldon Hargis and Charles McCord in a short section of the Bradley Trail on the rim just north of the North Umpqua River. An additional three were reported by R. A. Milner below Tokatee Falls. The deer tally for 1937 was not reduced from that of the 1936 estimate because it was felt that the latter was low." (20)

Many similar losses were reported by individuals throughout the blacktail range. Mr. Charles Wilson, of the Reston Study Area reported that many carcasses were found in that vicinity during the following spring though hunting during the fall was about the same as always. Mr. Arthur Mathews, another resident of the Reston Area reported finding 8 carcasses of deer that had gotten into one of his fences in the deep snow. These animals were unable to get out and died of starvation and exposure.

SUMMARY AND CONCLUSIONS

Though living in a range of mild winters and apparently abundant food supply, the Columbian black-tailed deer, Odocoileus hemionus columbianus (Richardson) is reported to be greatly reduced in numbers over years past. This study of decimating factors affecting the blacktail was made between August 1940 and October 1941 in order to ascertain the relative importance of each factor in the general welfare of this deer in western Oregon. Additional information on diseases and parasites was collected from October 1940 to April 1942.

This study was financed by the Oregon Cooperative Wildlife Research Unit and was under the direction of Mr. Arthur S. Einarsen, Leader of that unit.

The area included in the study might be generally described as a narrow strip along the Pacific coast of Oregon, lying between the Pacific ocean and an imaginary line about 60 miles inland. This area is within the humid division of the Transition Zone and has an annual rainfall of between 40 and 100 inches. In altitude it ranges from sea level to about 4,000 feet above sea level. The greater part of this area is, or was prior to logging or burning, covered with timber. The dominant species over most of the range is Douglas fir, Pseudotsuga taxifolia.

During the open hunting season, September 20 to

October 25, 1940, attempts were made to measure hunting pressure and quality of bucks killed in this range. Cheeking stations were set up in two representative areas but but sufficient data were not collected for the amount of time expended. Later, measurements were obtained by making weekly trips to cold storage plants in the vicinity and measuring kills stored there. This proved to be a satisfactory method. Using both methods, measurements were obtained from 55 bucks and 3 illegally killed does in the northern half and 13 bucks in the southern half of the area. Additional measurements of 23 bucks in the southern half of the area were obtained from the Siskiyou National Forest. Antler studies showed that an average of 65.6 per cent of the bucks killed in the southern area and 69.1 per cent of those killed in the northern area were fully mature. Observations made during two hunting seasons lead to the belief that the hunter-success ratio is not more than 30 per cent. Thus the legal kill of black-tailed deer in western Oregon is not excessive.

During this study 25 game law violations were recorded on an area of four townships, intensively studied, in Douglas and Coos counties. Of these, 14 were committed by non-residents, 7 by residents, and 2 by unknown persons. Through the courtesy of the Oregon Game Commission records of all arrests made for game law violations were examined.

Between August 1, 1940 and November 1, 1941, 243 arrests were made in 17 western Oregon counties for "deer cases." Three arrests were made on the 4-township area in Douglas and Coos counties. During this period, eleven deer were known to have been killed illegally and two legally on one township of this area.

It is believed that officers in this region are efficient. The fact that only two men are assigned to patrol an area as large as Douglas county, 5,062 square miles, would seem to be sufficient explanation for an apparent laxity in game law enforcement. During the past six years, in Oregon, over 90 per cent of the game law violators arrested have been convicted.

This study indicated that illegal hunting is the most important decimating factor in the northern half and the second most important in the southern half of this area.

During this study 92 authentic reports of so-called diseased deer were received. These deer had died as the result of heavy infestations of internal parasites and not from any contagious disease. Carcasses of 34 of these animals were seen and post-mortem examinations performed on all that were still in suitable condition. The great majority of these reports came from the southern half of the coastal region, Douglas and Coos counties, from areas that were also being used by livestock.

Most, though not all, of these deer had suffered from severe diarrhea or scours. As a result they were extremely emaciated, weight losses up to 60 per cent of normal body weight being recorded.

The critical season for losses due to this condition is during the late winter and early spring months. At this time many of the favored food plants are not available, thus forcing the deer to subsist on plants of less nutritional value. This factor is believed to have a direct bearing on losses from this cause.

Fecal samples, collected throughout the range, were examined for parasite eggs by the Department of Veterinary Medicine. In all cases, the eggs and larval forms found were identical with those already reported from post-mortem examinations.

This condition was considered to be the most important decimating factor in the southern half of the coastal area during this study period.

A list of internal and external parasites reported from the Columbian black-tailed deer is included.

A case of so-called sickle cell anemia in black-tailed deer in Oregon was first reported in 1936 by Dr. R. W. Dougherty, Department of Veterinary Medicine, who subsequently examined blood smears taken from many blacktails throughout the coastal region. In every blood smear

examined, some sickle or crescent-shaped cells were present. To date, this condition has not been proved responsible for any losses of black-tailed deer in Oregon and should not, as yet, be considered detrimental to the deer's welfare.

Insufficient data were collected during this study on which to base conclusions as to the importance of predatory animals as a decimating factor.

Only one important record was obtained concerning fire as a decimating factor. In 1939, following the second great Tillamook fire, J. E. Meehan, resident of the Wilson River road, planted between 700 and 800 acres of the burn to grasses. While planting he found carcasses of 18 deer.

Accidents are considered relatively unimportant causes of deer mortality in the coastal area. However, losses of deer that are struck down and killed by automobiles, are considered serious. In 1941, 39 such kills were reported from the coast region but evidence indicated that these were but a fraction of the actual toll taken by this cause.

Only on rare occasions do weather conditions become so severe as to cause deer mortality in the coastal region. During the winter of 1937, Mr. V. V. Harpham, Supervisor, Umpqua National Forest, estimated that 50 per cent of the blacktail deer population on the North Umpqua Ranger District perished through a combination of a long period of deep snow and exceptionally heavy depredations by predatory

animals. Similar conditions were reported throughout much of the blacktail range for that year but there have been no such losses reported since.

COMMON AND SCIENTIFIC NAMES OF ALL PLANTS MENTIONED
IN TEXT AND TABLES

Douglas fir
Western hemlock
Incense cedar
Sitka spruce
Western yellow pine

Pseudotsuga taxifolia
Tsuga heterophylla
Libocedrus decurrens
Picea sitchensis
Pinus ponderosa

Port Orford cedar
Pacific yew
Red alder
Golden chinquapin
Madrone

Chamaecyparis lawsoniana
Taxus brevifolia
Alnus oregona
Castanopsis chrysophylla
Arbutus menziesii

Vine maple
Big leaved maple
Hazel
Myrtle
Pacific dogwood

Acer circinatum
Acer macrophyllum
Corylus californica
Umbellularia californica
Cornus nuttallii

Cascara
Willow
Rhododendron
Ceonothus
Wild lilac

Rhamnus purshiana
Salix sp.
Rhododendron californicum
Ceanothus velutinus
Ceanothus thrysiiflorus

Manzanita
Elderberry
Salal
Box blueberry
Red whortleberry

Arctostaphylos sp.
Sambucus sp.
Gaultheria shallon
Vaccinium ovatum
Vaccinium parvifolium

Thimbleberry
Salmonberry
Oregon grape
Longleaf hollygrape
Poison oak

Rubus parviflorus
Rubus spectabilis
Berberis aquifolium
Berberis nervosa
Rhus diversiloba

LITERATURE CITED

1. Bailey, Vernon. The mammals and life zones of Oregon. North Amer. Fauna 55, Bur. of Biol. Survey, 416 pp., illus., 1936.
2. Anthony, H. E. Field book of North American mammals. New York, G. P. Putnam's Sons, 674 pp., illus., 1928.
3. Cowan, Ian McTaggart. Distribution and variation in deer (Genus *Odocoileus*) of the Pacific Coastal Region of North America. California Fish and Game Vol. 22, No. 3, pp. 155-246, July 1936.
4. Jackson, H. H. T. Personal letter dated February 24, 1942.
5. McLean, Donald D. The deer of California, with particular reference to the Rocky Mountain mule deer. California Fish and Game Vol. 26, No. 2, pp. 139-167, April 1940.
6. Acts and resolutions of the legislative assembly of the State of Oregon, passed at the seventh regular session 1872, and decisions of the Supreme Court. Salem, Oregon, 1872.
7. McGuire, Hollister D. First and second annual reports of the fish and game protector to the Governor, 1893-4. Salem, Oregon, 1894.
8. McGuire, Hollister D. Third and fourth annual reports of the state fish and game protector of the State of Oregon 1895-1896. Salem, Oregon, 1896.
9. Quimby, L. P. W. Third and fourth annual reports of the game and forestry warden to the Governor of Oregon for the years 1901 and 1902. Salem, Oregon, 1903.
10. Johnson, F. W. Deer kill records--A guide to management of deer hunting. California Fish and Game Vol. 25, No. 2, pp. 96-165, April 1939.
11. Dixon, Joseph S. A study of the life history and food habits of mule deer in California. California Fish and Game Vol. 20, Nos. 3 and 4, 146 pp., illus., 1934.

12. Shaw, J. N. Scours in sheep and goats in Oregon. Station Circular 93, Agricultural Experiment Station, Oregon State College, Corvallis, Oregon, 16pp., illus., 1929.
13. Hellmers, Henry. A study of monthly variations in the nutritive value of several natural winter deer foods. Journal of Wildlife Management, Vol. 4, No. 3, pp. 315-325, July 1940.
14. Chamberlin, W. J. The ticks of Oregon. Station Bulletin 349, Agricultural Experiment Station, Oregon State College, Corvallis, Oregon, 34 pp., illus., 1937.
15. Dikmans, G. Helminth parasites of North American semidomesticated and wild ruminants. Proc. Helminth. Soc., Washington, Vol. 6, No. 2, pp. 97-101, July 1939.
16. Shaw, J. N., Simms, B. T., and Muth, O. H. Some diseases of Oregon fish and game and identification of parts of game animals. Station Bulletin 322, Agricultural Experiment Station, Oregon State College, Corvallis, Oregon, 23 pp., illus., 1934.
17. Dougherty, R. W. Sickle cells in the blood of western deer. Journal of Wildlife Management, Vol. 3, No. 1, pp. 17-18, January 1939.
18. Crews, Arthur Kendrick. Thesis on a study of the Oregon white-tailed deer, Odocoileus virginianus leucurus (Douglas), Oregon State College, Unpublished, 1939.
19. Einarsen, Arthur S. Roadside cover and its effect upon black-tailed deer. Unpublished report to the Oregon Game Commission, 1942.
20. Harpham, V. V. Annual report of the Umpqua National Forest to the regional forester. Loaned from the files of the Umpqua National Forest, Roseburg, Oregon, 1937.
21. Shaw, J. N. Use of phenothiazine in Oregon sheep. The North American Veterinarian, Vol. 22, No. 5, pp. 280-283, May 1941.