THE ECONOMIC VALUE OF THE BOBWHITE.

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INTRODUCTION.

No birds have so firm a hold on public interest as the game birds. The laws enacted on their behalf exceed in number a hundred fold those relating to other kinds of birds. Among game birds the bobwhite is held by many to be preeminent. Easily accessible over a wide area of the country, small enough of size and swift enough of wing to test the sportsman's skill, delicious enough to please the epicure, to most sportsmen it is without a peer, the king of our feathered game.

The name 'bobwhite' is derived from a fancied resemblance to this word in the familiar utterance of the bird. It has been adopted by several writers because of the inaccuracy of the two names by which the species is usually known—quail in the North and West and partridge in the South. The name 'quail' properly belongs to a smaller migratory bird of a different genus, found in the Old World, the quail of the Bible story; while 'partridge' in New England, universally applied to the ruffed grouse, is strictly the name of another Old World genus, though also used to designate the group to which bobwhites, quail, partridges, and other closely related birds belong.

The bobwhite (Colinus virginianus—PI. XVI) is found from southern Maine and southern Ontario to the Gulf of Mexico, except in mountainous regions, which are too cold for it, and exclusive of southern Florida and southern Texas, in each of which an allied race occurs. It ranges as far west as South Dakota and eastern Colorado. It has been introduced into New Mexico, Utah, Idaho, California, Oregon, Washington, and the island of Jamaica. The bobwhite of Florida (Colinus virginianus floridanus), which is confined to the peninsula, is a much smaller and darker bird than its Northern relative. The Texas subspecies (Colinus virginianus texanus), which is resident north to western Kansas and south into Mexico, though no smaller than the Northern form, is less deeply colored and somewhat differently marked. At least ten subspecies occur in Mexico, many of them differing markedly in appearance from the familiar bobwhite of the United States, but with no appreciable difference in notes. In the present paper the Mexican races are excluded, and the Florida and Texas forms are not distinguished from the common bobwhite.
The aesthetic pleasure derived from the presence of the bobwhite has a certain definite value. Much money has been spent for merely the enjoyment of the beauty and companionship of birds. For the protection of gulls and terns along the Atlantic coast thousands of dollars have been appropriated at the instance of bird lovers in whose eyes these delicate creatures are the crowning grace of a marine landscape. To pastoral inland scenes—woodlots in a green mist of young leaves, summer grass fields and bushy pastures, brown stubble and skeleton cornfields—the bobwhite adds a charm, homely but no less enjoyable. As it calls in summer from the fence post or runs fearlessly across the road, the stroller can see it closely enough to admire its trim, alert figure, and its tasteful color pattern of black, white, and brown, set off by delicate tints of blue. Its mellow whistle seems a proffer of good-fellowship, investing even a solitude with cheerful friendliness, while the plaintive covey call, heard in the growing darkness as it summons a scattered flock to its nightly resting place, is one of the tenderest of evening sounds. Many people, appreciating these features of its presence, welcome the bird for the pleasure of its company, and are ready to spend time and money to keep it undisturbed in their neighborhood. The writer has known several men who, for this purpose, incurred considerable expense in posting land and hiring keepers to prevent poaching. There are no doubt many who, in similar ways but with smaller outlay, set up some measure in money for the aesthetic value of the bobwhite.

In three ways the bobwhite is of strictly economic importance—as a destroyer of noxious seeds and insects; as a delicate and nourishing food; and as an object of sport.

The Bobwhite as a Weed and InsectDestroyer.

A study of the bobwhite was undertaken by means of field observations, experiments with captive birds, and examination of the contents of crops and stomachs in the laboratory. The results obtained may be thus summed up: The bobwhite is probably the most useful abundant species on the farm. It is one of the most nearly omnivorous birds, consuming large quantities of weed seeds, and destroying many of the worst insect pests with which the farmer has to contend. It does not injure grain, fruit, or any other crop.

Food of the Bobwhite.

In the investigation 801 stomachs were examined, collected in every month of the year, though mostly during the hunting season, and obtained from 21 different States, and from Canada and the District of Columbia, but chiefly from New York, Maryland, Virginia, Florida, Ohio, Indiana, Illinois, South Dakota, Nebraska, Kansas, and Texas.
Bobwhite in Potato Field.
As indicated by this material, the bobwhite is notable for the great variety of its food. It lives mainly on seeds, fruits, leaves, buds, insects, and spiders, though myriapods, crustaceans, mollusks, and even batrachians have been found in its stomach. The character of the diet varies with the season. The greatest proportion of animal matter is taken in late spring and early summer. The food for the year as a whole, estimated from the analysis of the contents of stomachs, and calculated by volume, is divided thus: Animal matter, 14.93 per cent; vegetable matter, 85.07 per cent. The elements of the animal food are distributed as follows: Beetles, 6.38 per cent of the total food; grasshoppers, 2.56 per cent; bugs, 2.83 per cent; caterpillars, 0.87 per cent; miscellaneous insects, 0.48 per cent; other invertebrates, largely spiders, 1.81 per cent. The vegetable food consists of grain, 28.64 per cent of the total food; various seeds, chiefly those of weeds, 50.78 per cent; fruit, 8.53 per cent; miscellaneous vegetable matter, 2.12 per cent.

Seeds.

The bobwhite is preeminently a seed eater. Of its food for the year as a whole, seeds form 50.78 per cent, and include those of many different plants.

The bulk of this seed diet consists of the seeds of weeds. Fully 60 different weeds are represented in the food and constitute more than a third of the food for the year as a whole. Some idea of the value of the bird as a weed destroyer may be gained from the number of seeds taken at a meal. Thirty buttonweed seeds, 200 to 300 smartweed seeds, often 500 seeds of sheep sorrel, and 700 of three-sided mercury have been taken at one feeding. Crops and stomachs are frequently crammed with nothing but ragweed. One bird, taken at Marshall Hall, Md., November 6, 1902, had eaten a thousand ragweed akenes; another, killed the previous November in the same place, had eaten an equal number of the seeds of crabgrass, a troublesome weed in truck land. Birds have been shot in Mecklenburg County, Va., whose stomachs contained 3,000 leguminous seeds, mostly of tick trefoil and various species of bush clover. Pigeon grass, which is extremely common and mischievous in truck land, is a favorite food. No less than 5,000 seeds of this troublesome plant were found in the stomach of a bird shot in October, 1902, at Pinebrook, N. J. Finally, a bobwhite taken on Christmas Day, 1901, at Kinsale, Va., was discovered to have eaten 10,000 seeds of that abundant and obnoxious pest of the garden, the pigweed.

A careful computation of the total amount of weed seed the bobwhite is capable of destroying is surprising in the magnitude of its result. In the State of Virginia it is safe to assume that from September 1 to April 30, the season when the largest proportion of weed
seed is consumed by birds, there are four bobwhites to the square mile, or 169,800 in the entire State. The crop of each of these birds will hold half an ounce of seed, and as at each of the two daily meals weed seed constitutes at least half the contents of the crop, or a quarter of an ounce, a half ounce daily is certainly consumed by each bird. On this very conservative basis the total consumption of weed seed by bobwhites from September 1 to April 30 in Virginia amounts to 573 tons.

**ANIMAL FOOD.**

The bobwhite is insectivorous as well as granivorous. Insects are eaten during every month of the year, and amount to 14.93 per cent of the food for the year as a whole. From May to August, inclusive, when insects are most numerous, the percentage for the period rises to 31.5 per cent. The variety of insect food is large. In the present investigation 116 species of insects have been noted as entering into the diet, a number that will probably be greatly augmented by further knowledge. Furthermore, the proportion of injurious insects habitually eaten by the bobwhite makes its services as a destroyer of insects more valuable than those of many birds whose percentage of insect food, though greater, includes a smaller proportion of injurious species. Conspicuous among the pests which the bobwhite destroys are the potato beetle, the 12-spotted cucumber beetle, the bean leaf-beetle, the squash ladybird, wireworms and their beetles, May-beetles, such weevils as the corn bill bug, the imbricated snout-beetle, the clover leaf weevil, and the Mexican cotton boll-weevil, the striped garden caterpillar, the army worm, the cotton worm, the boll worm, various species of cutworms, the corn-louse ant, the red-legged grasshopper, the Rocky Mountain locust, and the chinch bug. Some of these pests are relished, for a dozen army worms or cutworms are frequently eaten at a meal. Thirty Rocky Mountain locusts have been found in a single crop. Weevils are greatly sought after, 47 cotton boll-weevils having been eaten in a morning by one bobwhite. Striped cucumber beetles are destroyed by the score, potato beetles by the hundred, and chinches bugs by the tablespoonful.

From May to August, inclusive, beetles form 17.9 per cent of the food of the bobwhite; bugs, 6.2 per cent; caterpillars, 2.4 per cent; grasshoppers, 2.3 per cent; miscellaneous insects, 0.8 per cent, and spiders and other invertebrates, 1.9 per cent.

The losses caused by some of these pests show how desirable it is to protect a bird that habitually destroys them. The Mexican cotton boll weevil damages the cotton crop to the extent of $15,000,000 a

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*a Including 1.81 per cent of allies of insects, principally spiders, with a few snails, crustacea, and other invertebrates.
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year, the potato beetle lops off $10,000,000 from the value of the potato crop, and the cotton worm has been known to cause in a year a loss of $30,000,000. The chinch bug and the Rocky Mountain locust, scourges that leave desolation in their path, have each caused, in certain years, a loss of $100,000,000.

By far the greatest insect destruction by the bobwhite occurs during the breeding season. Not only does a third of the food of the adult birds then consist of insects, as has been stated, but their growing broods consume insects in enormous quantities. The food of the young of practically all land birds contains a much greater percentage of insects than that of the mature birds; and the amount of food the young require is immense in proportion to their size. No stomachs of young bobwhites have been examined in this investigation, but 19 droppings that were collected from two broods of chicks, on July 24, 1902, disclosed a purely insectivorous diet.

GRAIN.

An impression prevails among sportsmen who have bagged most of their game on the stubble field that the bobwhite eats little else than grain. The analysis given above shows, however, that grain forms only one-fourth of the food. Corn and wheat appear to be eaten in greater quantity than other cereals. The former constitutes 19.14 per cent of the food, the latter 3.04 per cent. As experiments with captive birds fail to show any marked preference for either corn or wheat, the disproportion between the two cereals in the usual food is due to some other cause, probably the fact that more corn than wheat is grown in the part of the country where bobwhites are most abundant. The remaining cereal food, 1.46 per cent of total, is composed of miscellaneous grain, including kafir corn, sorghum, millet, barley, oats, and rye.

Grain-eating birds, as a rule, are likely to do much harm to crops. They may pull up sprouting grain, plunder the standing crop when it is in the milk, or forage among the sheaves of the harvest field. The bobwhite, however, is a notable exception. It is necessarily in the period of germination that grain is susceptible of the most serious injury. Nevertheless not a single sprouting kernel was discovered in the contents of the crops and stomachs examined in this investigation.

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*a According to information received by the Division of Entomology of the Department of Agriculture. This is a statement of the actual damage caused the crops of 1903 by the Mexican cotton boll-weevil, which, in this country, is practically confined to some of the cotton-producing counties of Texas. The damage is 50 per cent of the entire crop of the infested territory, and as the normal cotton crop of the United States is estimated to represent a value of $500,000,000, the probable ultimate damage, when the pest, if not checked, has spread over the entire cotton belt, may amount to about $250,000,000 a year.

*b Insects Injurious to Staple Crops, by E. Dwight Sanderson, 1902, p. 3.


*d First Report U. S. Entomological Commission, 1878, p. 121.
Some field observations made in 1899 and 1900 at Marshall Hall, Md., give confirmatory evidence. While crows injured sprouting corn so seriously during May that several extensive replantings were necessary, the bobwhite, which was unusually abundant at the same time in the vicinity, was never seen to disturb germinating grain. No data are available regarding rye and millet, but in newly sown buckwheat fields of Essex County, N. J., which the writer saw ravaged by doves, there was no sign of injury by the bobwhite. Publications on economic ornithology and reports received by the Biological Survey add testimony of like character. It may be safely asserted, therefore, that so far as is at present known, the bobwhite does no appreciable harm to sprouting grain. Damage to grain at any other time entails a loss of a comparatively insignificant part of the crop.

In order, however, to learn how far the bird might injure ripening wheat, observations were made for several years at Marshall Hall, Md. During November immense flocks of crow blackbirds made such havoc in winter wheat that diligent use of the shotgun was necessary to save the crop. But no bobwhites were ever seen in the act of taking grain. A hen bird shot June 18, 1903, in a field of ripe wheat, however, had much grain in its crop, though whether it obtained the food from standing stalks or from kernels dropped on the ground was not known. As the bobwhite usually feeds on the ground, the latter source appears the more probable. Farmers whom the writer has consulted, who were well aware that goldfinches feed on ripening oats, that English sparrows take wheat, that crows tear open field corn, and that red-winged blackbirds ruin whole fields of sweet corn, say that the bobwhite does no harm to standing wheat or other standing grain.

The bird is, however, a notorious stubble feeder. Where fields of wheat stubble support a rank growth of ragweed, as in some of the Eastern States, the sportsman is most likely to find a covey feeding. On the Western plains no ragweed grows amid wheat stubble, therefore the birds are more often found in cornfields where the stalks have been left standing after removal of the ears. In such a place at Badger, Nebr., six bobwhites were shot in November, 1901, whose distended crops contained in all 181 kernels. Birds that feed in wheat stubble often take from 100 to 200 grains of wheat at a meal. A bobwhite was taken in December, 1902, at West Appomattox, Va., whose crop contained 508 grains of wheat, and was distended almost to bursting. This habit of gleaning waste grain after harvest is beneficial to the farm, as the germination of volunteer grain is not desirable, especially where certain insect pests or parasitic fungi are to be combated. As the scattered kernels are often too far afield for domestic poultry to gather, the bobwhite's services in this respect are especially useful.
FRUIT:

The bobwhite eats fruit to the extent of 8.53 per cent of its diet for the year, a very moderate proportion compared with the corresponding proportions in the diets of the catbird and the cedar bird, in whose food fruit forms one-half and three-fourths, respectively, of the whole. Although the amount of fruit eaten by the bobwhite is small, the variety is large.

The bobwhite is seldom troublesome to the horticulturist. Mr. M. B. Waite, of the Department of Agriculture, has reported its pecking into his ripening strawberries near Washington; but on the other hand, birds that were kept for several months in captivity for investigation refused strawberries at a time when they were hungry. The bobwhite is partial to wild grapes, and so might be expected to injure cultivated varieties, especially as its California relative, sometimes in a flock of a thousand, plunders vineyards; but so far as the writer knows, cultivated grapes have sustained no appreciable injury from bobwhites in the East. The period when the largest proportion of fruit (23.5 per cent of the total food) is eaten is not the season when man is gathering his fruit, but is during December, and sumac berries are then the fruit mainly eaten. Large quantities of dewberries, wax-myrtle berries, and bayberries also appear in the food. It may be interesting to note that the bobwhite is not nearly so frugivorous as the ruffed grouse.

LEAVES AND BUDS.

Neither does the bobwhite approach the ruffed grouse in destructiveness of leaves, buds, and tender shoots. It sometimes eats the leaves of yellow sorrel (*Oxalis stricta*), sheep sorrel (*Rumex acetosella*), red and white clover (*Trifolium pratense* and *T. repens*), and cinquefoil (*Potentilla sp.*). Captive birds ate grass, lettuce, and chickweed.

THE BOBWHITE AS AN ARTICLE OF FOOD.

The flesh of the bobwhite is juicy and of delicious flavor, easily digested, and highly nutritious. It is a very popular table luxury, and is well adapted to the needs of invalids. In families where fresh meat is not often available, it may furnish a welcome supply. No game is more popular in the market. Countless numbers of bobwhites are sold every year. There came to the writer’s attention one instance of a single dealer in Washington, D. C., who in the year 1902 sold 100,000 of the birds. Still, the supply is far short of the demand, and the price is constantly rising. In connection with the present (1903) price, $3 to $5 per dozen, it is interesting to recall Audubon’s statement that in 1831 these birds could be bought for 50 cents a dozen, and in 1810 for 12 cents. Then they were found on the tables of rich and poor alike.

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*a American Ornithological Biography, 1831, p. 392.*
Edwyn Sandys says of the bobwhite: "He is truly the king of his race, and not only that, for, in the opinion of hosts of enthusiastic sportsmen, he is the best bird that flies." Another well-known sportsman writer, T. S. Van Dyke, says: "Dear little bobwhite has brought more rest to the business-wearied soul, more new life to tired humanity, than nearly all other American game combined." The pursuit of many other kinds of game is possible only in the far-off wilderness or plain, or where traveling is difficult and lying in wait a dangerous exposure; but the hunting of the bobwhite belongs to open, accessible country, and is not too severe a tax upon men unbraced by a sedentary life. To thousands of such men it is the yearly means of restoration, refreshing the senses and rejuvenating the whole body. On the stubble field, in pursuit of the bobwhite, man and dog are brought into close companionship. The bird lies well to the dog and offers an admirable shot. The winded covey crouches before the dog, often almost under its nose; then, exploding like a bomb, tests the skill of the hunter to bring one of the burring, meteor-like projectiles to the ground. Probably from 300,000 to 400,000 sportsmen go out from cities every fall to hunt the bobwhite. This means a considerable expenditure of money, much of which goes to owners of good shooting land. Where nonresident licenses are required, with their fees of from $5 to $25, the State also derives an income from the sport. Good hunting dogs are worth from $25 to $100, or more, each, and the keeping of many of them is intrusted largely to farmers, often at a remunerative figure. The training of these animals is also an item of expense. A good breaker charges $50, and at that price has all the dogs he can handle.

Paradoxical as it may seem, sportsmen exert a powerful influence for the protection of the bobwhite. Many individuals and clubs own or lease large tracts where they maintain the birds and kill off only the surplus. These enthusiasts assist in the enforcement of game laws, restock depleted covers, and provide food for the birds in times of scarcity. Certain clubs are organized for the purpose of holding field trials, the object of which is to test the ability of competing dogs to find and point birds. As retrieving is not required, the birds are not shot. One of the best-known patrons of field trials told the writer recently that he had not killed a bobwhite in ten years. A number of the clubs control each a preserve of from 5,000 to 30,000 acres, on which no shooting is allowed, and suitable measures are taken for protecting birds and facilitating their propagation. These trials are held in a score or more of States. More than a hundred dogs are entered in some of the larger contests, and money is often spent freely in furthering the sport. Some of the owners of dogs that are entered have preserves of their own, stocked with hundreds of pairs of

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*a Upland Game Birds, 1902, p. 5. *b Game Birds at Home, 1895, p. 17.
bobwhites. Thousands of live birds for these purposes are in demand, and at high prices. If the bobwhite could be domesticated and reared successfully in captivity for sale for this purpose, the enterprise would doubtless be highly profitable.

The cost of training a dog for the field trial is greater than that of training it for shooting. Reputable handlers ordinarily charge $100, and wealthy patrons of field trials employ high-salaried trainers, who attend to the dogs as carefully as race horses are cared for. The field trial is, in reality, a dog race. The dog that wins must be able to go like a shot, and find and point game before his antagonist comes up to him. Such an animal usually sells for a price ranging from $300 to $1,000. In one sporting paper a score of winners (pointers and setters) are advertised, which command stud fees of $25 to $50; and it has been stated on good authority that $5,000 was refused for one of these dogs.

From these facts it is apparent that the hunting of the bobwhite is a sport of considerable importance to the health and enjoyment of thousands of sportsmen, and that in various ways it can be made to contribute to the prosperity of farmers and other people who supply its needs. Every farmer has the power to secure a fair price from hunters for the surplus birds that he is willing to spare. It is believed that if suitably managed, some farms of from 500 to 1,000 acres would yield a better revenue from bobwhites than from poultry. The time is probably not far off when farmers will try to protect their game birds from injurious hawks, foxes, and human poachers as diligently as they do their hens. The sportsman is generally willing to pay several times more for the sport of shooting his birds than they bring in market, and a farm on which bobwhites are sedulously guarded and the trespass laws strictly enforced may be made to render a steady income during the hunting season.

Preservation of the Bobwhite.

The value of the bobwhite as a destroyer of weeds and injurious insects, as an article of food, and as an object of sport gives importance to the question of its maintenance. So assiduously is it sought by sportsmen and market hunters that under lax laws it might easily become very scarce, especially should inclement weather, as sometimes happens, greatly impede the natural increase. On the other hand, gallinaceous birds are prolific, and with proper protection the bobwhite might be readily increased to the point of abundance. West of the Mississippi it has extended its natural range, as more and more land has come under cultivation, until now it is found as far west as eastern Colorado. In the East there is considerable fluctuation in its numbers, owing to the far greater proportion of sportsmen by whom it is sought. Each fall the birds are reported scarce or plentiful according to the locality from which the report is made. Within the last few years.
several projected field trials have been abandoned, or, if attempted, have failed, because of scarcity of birds. Besides natural causes, the reasons for these irregular decreases in the abundance of the birds are to be found in diversity of open seasons, shooting out of season, excessive shooting in season, and unrestricted shooting and trapping for market. Lack of uniformity in laws of adjoining States and in some cases of adjoining counties makes their observance difficult and their enforcement often out of the question. With suitable and more uniform laws well enforced there should be a regularly abundant supply of bobwhites each hunting season in every locality adapted to their presence.

No other kind of game, large or small, has been the subject of so much legislation, and as there has been little cooperation in the matter, the result is great diversity of protection. The open season varies in length from three weeks in Ohio to seven months in Mississippi; and in North Carolina, where each county has its own law, there are five counties in which the bird may be shot at any time of the year. It is gratifying to note that in 1903 the open seasons were shortened by New York, Illinois, Kansas, Texas, and Virginia. Other States, especially those of the South, should follow this example. In order that the laws may be respected, an effective system of State game officials should be established in every State where it is lacking. A number of States depend solely on county officers for enforcement of game laws; but experience has shown that without a central State organization and special game wardens, the game law is apt to be largely a dead letter. Finally, market hunting should be curtailed, or perhaps at least temporarily abolished, and modern restrictions on sale and export imposed.

Although the bobwhite is hardy, has enormous fecundity, and takes kindly to civilization, encouragement and propagation of the bird is not an easy undertaking. During the breeding season, as well as in severe winters, it has to struggle hard for existence. Mowing machines destroy its nests, crows steal its eggs, and domestic cats, as well as foxes and certain hawks, prey on its young. During the winter, especially in the northern part of its range, it is sometimes destroyed in great numbers by deep and crusted snows. The greatest need in severe weather is a food supply that will not be rendered inaccessible by a heavy snowfall. The berries of sumac, wax myrtle, and bayberry, and the hips of the wild rose furnish a palatable supply of such food. Bayberry and wax myrtle are eaten eagerly along the coast where they thrive, but sumac is generally the most important of these staples. Nine-tenths of the food of a dozen bobwhites shot in North Dakota during December consisted of the bright carmine berries of the sumac, some of the birds having eaten from 200 to 300 of them. The food supply can be improved, and owners of game preserves and others who wish to have the bobwhite as a neighbor can insure the
presence of a greater number of birds to the acre if they will adopt this means of securing them. In the Northern States buckwheat planted late will give an abundance of food for the young, growing birds. In damp situations climbing false buckwheat and smartweed yield them an excellent support that will continue well into the winter. In the South the cowpea makes a good winter supply, and millet, kaifir corn, and bald barley planted late are also excellent. Ha'iry vetch, alfalfa, tick trefoil, Japan clover, and the hog peanut furnish excellent food for the bobwhite. Sunflower and ragweed seeds are also palatable and nutritious. Acorns, chestnuts, and beechnuts are utilized, especially by those birds that are kept in the woods by gunners. In Florida pine seeds are eaten in winter. During summer the running blackberry is an important article of food.

Suitable cover is especially important in order that the birds may escape from hawks. Thickets of rose, blackberry briers, holly, laurel, and cat brier, adjacent to the birds' feeding grounds—that is, along the edges of fields—afford the best refuge from winged enemies. Young pine woods are the safest retreat when the enemy carries a gun. If grain is provided in winter for the birds, it should be scattered along the edge of cover, so that they will not be imperiled when they take it. The birds must have, also, good roosting places. An ideal situation is a field covered with broom sedge, intermingled with briers. A good water supply is of course essential.

Experience has shown that in suitable situations the bobwhite will thrive if a chance be given it, and the friends of the bird should see that such a chance is afforded. The Audubon societies, with a total membership of 65,000 to 70,000, which cherish the bird for the pleasure it brings to eye and ear; the sportsman, who loves the whirr of its brown wings bursting from the stubble; and the farmer, whose enemies it destroys and whose resources it enriches, should work together to secure for its preservation laws adequate and generally enforced.

SEEDS.—Scrub pine (Pinus virginiana); long-leaved pine (P. palustris); slender paspalum (Paspalum setaceum) and other paspalum species; crab grass (Panicum sanguinale); slender finger-grass (P. filiforme); barnyard grass (P. crus-galli); barbed pascucum (P. barbulatum); tall smooth pascucum (P. virginatum); spreading pascucum (P. profliferum); witch grass (P. capillare); yellow foxtail grass (Chas- teebula glauca); green foxtail grass (S. viridis); timothy (Phleum pratense); sheathed rush grass (Sporobolus vaginiforma); slender spike grass (Echino laxa); wild rice (Zizania aquatica); sedge (Cyperus sp.); rush (Scirpus sp.); tussock sedge (Carex stricta); skunk cabbage (Symplymenia foetida); swamp oak (Quercus palustris); white oak (Q. alba); live oak (Q. virginiana); beech (Fagus americana); hornbeam (Carpinus caroliniana); chestnut (Castanea dentata); sheep sorrel (Ehlium acetosella); dock (Rumex crispus); persicaria (Polygonum lapathiflorum); Pennsylvania persicaria (P. pennycrinitum); smartweed (P. hydropiper); knotweed (P. aviculare); black bindweed (P. convolvulus); climbing false buckwheat (P. scoumiana); pigweed (Chenopodium album); rough pigweed (Amaranthus retroflexus); carpetweed (Mollugo verticillata); corn cockle (Agrostemma githago); chickweed (Althaea media); charlock (Raphanus raphanistrum); witch-hazel (Hamamelis virginiana); acacia (Acacia sp.); redbud (Cercis canadensis); sensitive peo (Cassia nicthiana); partridge pea (C. chamaecrista); cowpea (Vigna cajana); garden pea (Pisum sativum); lima bean (Phaseolus lunatus); red clover (Trifolium pratense); white clover (T. repens); undetermined Cassia seeds; lupine (Lupinus sp.); trefoil (Lotus sp.);
psoralea (Psoralea sp.); locust tree (Robinia pseudacacia); Florida coffee (Sesbania macrocarpa); tick trefoil (Melilotus nudiflora); tick trefoil (M. grandiflora); hairy bush clover (Lespedeza hirta); creeping bush clover (L. repens); bush clover (L. violacea); Japan clover (L. striata); vetch (Vicia sp.); hog peanut (Pediculus comosa); downy milk pea (Galia flavolobata); prairie rhyneochas (Rhyneochas latifolia); trillium wild bean (Strophostyles helvola); pink wild bean (S. umbellata); cranberry (Geranium carolinianum); yellow sorrel (Galisia striata); Texas croton (Croton tennesse); three-sided mercury (Asclepias gracilis); spotted spurge (Euphorbia maculata); flowering spurge (E. coriifolia); red maple (Acer rubrum); box elder (A. negundo); jeweled weed (Impatiens sp.); side (Pia) (Epilobium angustifolium; Viola sp.); ash (Faginaria sp.); morning glory (Ipomoea sp.); lindweeds (Onvolurus sp.); gromwell (Lithospermum officinale); corn gromwell (L. arvensis); puccoon (L. eaeccensis); vervain (Verbena striata).

FRUITS.—Saw-palmetto (Seroloma serrulatia); cabbage palmetto (S. petiolaris); Solomon's seal (Polygonatum sp.); greenbrier (Smilax sp.); wax myrtle (Myrica cerifera); bayberry (M. carolinensis); red mulberry (Morus rubra); saw-salra (Sassafras sassafras); thimbleberry (Rubus occidentalis); highbush blackberry (R. villosus); dowberry (R. occidentalis); strawberry (Fragaria sp.); rose (Rosa sp.); hawk (Crataegus sp.); apple (Pyrus malus); cultivated cherry (Prunus sp.); polon fox (Psias radiicans); dwarf sumac (R. copallina); staghorn sumac (R. glabra); holly (Ilex sp.); black alder (J. verticillata); climbing bittersweet (Calatrus scandens); frost grape (Vita cordifolia); flowering dogwood (Cornus floridus); sour gum (Nyssa sylvatica); checkerberry (Gautheria procumbens); huckleberry (Gaylussacia baccata); blueberry (Vaccinium sp.); ground cherry (Physalis sp.); nightshade (Solanum sp.); sambucus (Sambucus eaeccensis); black lau (Viburnum prunifolium); honeysuckle (Lonicera sp.); partridge berry (Mitchella repens); sarsaparilla (Aralia sp.); Virginia creeper (Parthenocissus quinquefolia); bastard pennyroyal (Phytonomns punctatus, Sitones hispidulus); snout beetle (Sitones imbricated (Cem<t<s sp.); Chelcndora collaris, Thecesternus humeralis); golden tortoise beetle (Ceratoma trifurcata); cotton boll weevil (Anthonomus grandis); three-lined potato beetle (B. Eodionychis (Lema B. mellicollis, B. quinquevittata); locust leaf-mining beetle (Lema lineata); seven-spot ladybird (Coccinella septempunctata); squash ladybird (Hispa parenthesis, Coccinella sanguinea, Adalia bipunctata); ladybirds (Coccinella septempunctata, Scudderiasp.); ladybug (Coccinella septempunctata, Scudderiasp.); katydid (Microcentrum sp.); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrióles); soldier beetle (Reduviidae); dung beetles (Histeridœ); click beetles (Blapstinus Agrío...