1915 111

THE VALUE OF BIRDS TO MAN

BY

JAMES BUCKLAND

London, England

Reproduced by consent from the proceedings of the Smithsonian Institution with the author's approval to aid the work of the Canadian Society for the Protection of Birds

TORONTO:
Printed and Published by L. K. CAMERON, Printer to the King's Most Excellent Majesty
1915

THE VALUE OF BIRDS TO MAN

BY

JAMES BUCKLAND

Every reader of the accompanying pamphlet is earnestly asked to assist in the protection of wild birds.

Communicate with the Secretary of the Canadian Society for the Protection of Birds, Royal Canadian Institute, 198 College St., Toronto.

Reproduced by consent from the proceedings of the Smithsonian Institution with the author's approval to aid the work of the Canadian Society for the Protection of Birds

TORONTO:
Printed and Published by L. K. CAMERON, Printer to the King's Most Excellent Majesty
1915

THE VALUE OF BIRDS TO MAN

BY

JAMES BUCKLAND

London, England

Reproduced by consent from the proceedings of the Smithsonian Institution with the author's approval to aid the work of the Canadian Society for the Protection of Birds

TORONTO:

Printed and Published by L. K. CAMERON, Printer to the King's Most Excellent Majesty

1915

THE VALUE OF BIRDS TO MAN

By James Buckland,

London, England.

I saw with open eyes
Singing birds sweet
Sold in the shops
For people to eat.
Sold in the shops of
Stupidity Street.

I saw in vision
The worm in the wheat,
And in the shops nothing
For people to eat;
Nothing for sale in
Stupidity Street.

—Ralf Hodgson.

Number, Fecundity, and Voracity of Insects.

Man imagines himself to be the dominant power on the earth. He is nothing of the sort. The true lords of the universe are the insects. While it is true that man has invented and perfected so many destructive agencies that he has attained to a predominance over the most fierce and powerful mammals and the most deadly reptiles, it is also true that in face of an attack of insects he and all his works are set at naught.

"A little one shall become a thousand and a small one a strong nation." Few people know how enormous is the number of insect species or how amazing is their power of multiplication. The number of insect species is greater by far than that of the species of all other living creatures combined. Over 300,000 have been described, and it is considered not improbable that twice that number remain to be described. Practically all living animals, as well as most plants, furnish food for these incomputable hordes. More than this, Kirby, in the "Introduction to Entomology," devotes no less than five entire epistles to the injuries we sustain from insects, while two only are sufficient to describe the benefits they yield.

The fecundity of certain insect forms is astounding, the numbers bred reaching such prodigious proportions as to be almost beyond belief. Riley once computed that the hop aphis, developing 13 generations in a single year, would, if unchecked to the end of the twelfth generation, have multiplied to the inconceivable number of ten sextillions of individuals. Noting the preceding, Forbush says if this brood were marshaled in line, 10 to the inch, it would extend to a point so sunk in the profundity of space that light from the head of the procession travelling at the rate of 184,000 miles per second would require 2,500 years in which to reach the earth.

Kirkland has computed that one pair of gypsy moths, if unchecked, would produce enough progeny in eight years to destroy all the foliage in the United States.

A Canadian entomologist states that a single pair of Colorado beetles, or potato bugs, as we call them, would, without check, increase in one season to 60,000,000. At this rate of multiplication the disappearance of the potato plant would not be long delayed. The chinch bug, a fecund and destructive pest, has been found in a clump of grass 8 inches in diameter to the number of 20,000. The progeny of this colony alone, if unchecked, would soon become incomputable hordes, devastating wide areas of the earth's surface. Those of you who have

been in South Africa probably have seen locusts in flight which filled the air and hid the sun. What a potency for evil lies hidden in the tiny but innumerable eggs of these ravening pests! If every egg was permitted to hatch and every young locust to come to maturity, the consequences would be too dreadful to contemplate.

The voracity of insects is almost as astounding as their power of reproduction. The daily ration in leaves of a caterpillar is equal to twice its own weight. If a horse were to feed at the same rate, he would have to eat a ton of hay every 24 hours. Forbush says that a certain flesh-feeding larva will consume in 24 hours 200 times its original weight, a parallel to which, in the human race, would be an infant consuming, in the first day of its existence, 1,500 pounds of beef. Trouvelot, who made a special study of the subject, affirms that the food taken by a single silkworm in 56 days equals in weight 86,000 times its original weight at hatching. What a destruction this single species of insect could make if only a one-hundredth part of the eggs laid came to maturity.

Mission of the Birds in Organic Nature.

Who or what is it that prevents these ravening hordes from over-running the earth and consuming the food supply of all? It is not man. Man, by the use of mechanically applied poisons, which are expensive, unnatural, and dangerous, is able to repel to an extent the attacks on his orchard and garden. Out in the fields and in the forests he becomes, before any very great irruption of insects, a panic-stricken fugitive. Neither is it disease, or the weather, or animals, or fungi, or parasitic and predaceous insects within their own ranks. However large may be the share of these particular natural agencies in keeping insects in check, experience has shown that it is lamentably insufficient. Then what is it? The bird. Bird life, by reasons of its predominating insect diet, is the most indispensable balancing force in nature.

Man at War with Nature's Laws.

Yet man has been engaged in the past half century in the blind and wanton destruction of this essential part of nature's great plan. He has taken no thought of the needs of the hour, nor concerned himself with the wants and claims of those to come. Within the space of a few years, under no constraint of necessity, he has carried out a policy of destruction more effective than that accomplished in centuries by the slow processes of nature. Armed with a weapon that annihilates space, he has constituted himself the master and the ruler of the animal world, and has delegated to himself the right to adopt a utilitarian standard by which he measures the value of all other forms of life. It is not for man to say what shall live and what shall be destroyed. The whole system of nature is in exquisite poise, and it is not possible to lay rough hands upon it without disturbing it in directions and on a scale which at the time may not be guessed at. If we remove or reduce the working power of one living organism which acts as a check on another, the latter, freed from restraint, will inevitably multiply. As we destroy the insect-eating birds the insects on which they prey will multiply to scourge us as Egyptian plagues. It is a fact which agriculture has learned to its cost in many parts of the world.

Serious Consequences of Bird Destruction.

Some years ago the agriculturists of Hungary, moved to the insane step by ignorance and prejudice, succeeded in getting the sparrow (*Passer domesticus*) doomed to destruction. Within five years the country was overrun with insects, and these same men were crying frantically for the bird to be given back to them, lest they should perish. The sparrow was brought back, and, driving out the hordes of devastating insects, proved the salvation of the country.

In the island of Bourbon once, because of the same ignorance and prejudice, a price was set on each martin's head. The birds all but disappeared, and grasshoppers took possession of the island. The edict of banishment was hurriedly revoked and the exile recalled. Fortunate, indeed, was it for the island of Bourbon that the bird was not beyond recall.

During the year 1861 the harvests of France gave an unusually poor return, and a commission was appointed at the instance of the Minister of Agriculture to investigate the cause of the deficiency. By this commission the deficiency was attributed to the ravages of insects which it was the function of certain birds to check. These birds, it appeared, had been shot, snared, and trapped throughout the country in such numbers that but little repressive influence had been exerted upon the insects. It was concluded that by no other agency than the birds could the ravages of insects be kept down, and the commission called for prompt and energetic remedies to prevent the destruction of birds.

For some years prior to 1877 vast numbers of red-winged blackbirds were poisoned in the spring and autumn around the cornfields of Nebraska. This was done in the belief that the blackbirds were damaging the crops, especially the wheat. Great numbers of prairie chicken, quail, plover, and various other insect-eating species were destroyed at the same time by eating the poisoned grain. Then came 1877, and with it Nemesis. The locusts appeared in countless numbers. There were no birds to eat them, and Nebraska mourned.

In 1895 the ravages of two species of cut-worms and some 10 species of locusts produced a famine in the region of Ekaterinburg, which is in Russian Siberia. The local Society of Natural Sciences inquired into the cause which had permitted such a numerous propagation of insect pests, and reported that it was due to the almost complete destruction of birds, most of which had been killed and sent abroad by wagon loads for millinery purposes.

Those grass ticks which now make the keeping of most breeds of cattle impossible in Jamaica, are not mentioned in the records of the early nineteenth century. The appalling destruction in more recent years of insect-eating birds, chiefly to supply the demands of the millinery market, has led to an inordinate increase of the ticks and to the dying out of all but Indian cattle. This correlation of birds and ticks—to say nothing of mosquitos and other insect plagues in Jamaica—was put fully and circumstantially before the Secretary of State for the Colonies by a deputation in 1909.

E. D. Morel has recently pointed out how the reckless destruction of the guinea-fowl (*Numida*) in French West Africa is coincident with the increase of certain germ diseases, and, above all, with ravages to crops on the parts of the larger insects, especially beetles, the grubs of which were devoured by the guinea-fowl, which scratched them out of the ground.

Though I could give a hundred cases similar to the foregoing, I must rely on the few I have cited to show that the wholesale destruction of birds is surely followed by disaster to man.

Value of the Bird in Checking Insect Irruptions.

When the Mormons first settled in Utah, their crops were destroyed utterly by myriads of black crickets that streamed down from the mountains. Promising fields of wheat in the morning were by evening as bare as though the land had not been sown. The first year's crop having been destroyed, the Mormons had sowed seed the second year, and again the crop promised well. But again the crickets appeared, devouring every blade of wheat, and the followers of Joseph Smith were on the verge of starvation. At this juncture Franklin's gull came by hundreds of thousands, and, feeding greedily on the crickets, freed the fields of the pest. The settlers at Salt Lake regarded the advent of the gulls as a heaven-sent miracle, and practically canonized the birds.

Since that hour this black-headed gull has remained a faithful servitor of the farmers of Utah. At the present moment a movement is on foot to erect a monument to this bird in Salt Lake City, thus showing a befitting and seemly sense of gratitude for its inestimable services in guarding the State from the ravages of insects.

It is a common practice with all settlers in a new country to at once set about killing the native birds in a thoughtless and foolhardy manner. This stupid practice is all the more deplorable, because an enormous increase of insect pests invariably attends the operations of the pioneer agriculturist. Finding in cultivated crops new and more succulent sources of food supply, insects change their primitive habits, to swarm and multiply exceedingly upon the fertile fields of man's creation.

When the farmers in New Zealand began to break the virgin soil on an extensive scale, a certain caterpillar, which hitherto had gleaned a somewhat meagre sustenance from the scanty native verdure of the open lands, disappeared from its old haunts and attacked the cultivated areas. So speedily did it increase by reason of a more favorable environment that it soon became a blasting plague. It came not singly, nor even in battalions, but in mighty armies which laid waste the land. I have seen these atoms cover the pastures in such numbers as to make the green one brown. I have seen countless millions of them pass out of one cornfield, having stripped every stalk bare, cross the road in solid phalanx, and pass into another. I have seen big mobs of sheep mustered in hot haste and driven to and fro over these serried ranks that they might crush them with their scurrying feet. I have seen every horse roller in a district brought up hurriedly, like steam engines to a fire, and drawn backward and forward over the crawling masses until the cylinders stuck fast in a mire of squashed insects. I have seen huge ditches dug in an attempt to stop the invaders' progress. The effort was as futile as that of a child who builds a bank of sand by the sea, thinking it will stem the oncoming tide. Even railway trains were brought to a standstill, the wheels of the engines being unable to grip the rails owing to the hordes of caterpillars which were crossing the line.

In time it became abundantly clear that if this disastrous condition of affairs continued it would be useless to attempt to carry on agriculture in New Zealand. Realizing that any attempt which they might make to rid the smitten land of the plague would be but a mockery, the farmers turned their eyes longingly to the natural enemy of the caterpillar—the bird. But the native birds—though they had lived in closest companionship with the Maoris—had been taught the treachery of the white man in a school that reeked with blood, and those that had

not been killed had retreated from the vicinity of the settlements, visiting the insect-ridden fields occasionally only.

Wherefore insectivorous birds from the old country were introduced and the one that multiplied most rapidly was the common house sparrow. And *Passer domesticus* soon cut short the career of the caterpillars.

As digestion is exceedingly rapid in birds, and as they feed for the most part throughout the day, they are peculiarly adapted for the suppression of abnormal outbreaks of vegetable as well as of animal life.

That formidable imported weed, the Scotch thistle, threatened at one time to overrun the whole of New Zealand. Much time and money was spent by the settlers in cutting off the plants close to the ground, and in pouring turpentine upon the split stumps, hoping thereby to kill the roots. Vain labor. The wind-driven clouds of thistledown, which were planting the weed far and wide, grew yearly denser and more frequent. At length the fields became a packed growth of prickly plants, which nothing could face.

The sparrows took to eating the seed. In tens of thousands they fed on it, giving it the preference of all other hard food, and the weed was conquered.

To-day in New Zealand the sparrow is looked upon as an impudent thief without a redeeming feature in its character. No one, of course, can say what would happen if the bird was dismissed from the country, though it is probable that the Dominion would be again overrun with caterpillars and thistles. Setting aside this hypothetical question the good the sparrow does must far outweigh the evil. This statement receives confirmation in the bountiful harvests with which New Zealand is blessed. Never were the sparrows more numerous; never the complaints against them more bitter; yet the yield of grain is without precedent.

The growling of the New Zealand farmer at the sparrow justifies Virgil's complaint of the "miserly husbandman." Miserly, indeed, and blind. Not a grain will he give to the bird which has labored unceasingly with him for the production of his crops; but whole fields of wheat to the caterpillar.

Parenthetically I may mention that, though I have written here in defense of the introduction of the European sparrow into New Zealand, I am not an advocate of acclimatization. It is true that one can point to cases where a foreign bird has been introduced to perform the function of a native species that has been driven out, and where that function has been performed satisfactorily. But, as a rule, such substitutions are fraught with danger. Birds so rapidly change their habits in new surroundings that few species remain loyal to the reputation for honesty which they enjoyed in the land of their origin. Like most aliens, it would have been better had they remained in their own country. Although the spread of civilization unconsciously demands some victims, man and indigenous birds can, speaking generally, occupy the same territory without much difficulty. If one requires proof of this, he has but to turn his thoughts to British India, where native birds of all kinds, owing to the protection accorded them by the Hindu doctrine of the sanctity of all life, are found living in closest proximity to dense human populations.

The moral of all of which is that it behooves every man who has the welfare of his country at heart to do all in his power to foster native birds.

In Australia a plague of grasshoppers periodically visits the fields to devour the crops. The ruin they would otherwise bring on the farmer is averted by the good offices of ibises and other native birds. As a destroyer of grasshoppers, the straw-necked ibis (*Carphibis spinicollis*) has no equal among birds. Dudley Le

Souëf, the director of the Melbourne Zoological Gardens, some years ago visited a rookery of this bird in the Riverina, and, after a careful estimate, came to the conclusion that the minimum number of birds breeding there was 200,000. He procured a number of specimens and ascertained by actual counting that the contents of an average crop of an adult bird were 2,410 young grasshoppers, 5 fresh-water snails, and several caterpillars, which multiplied by 200,000, amounts to a total of four hundred and eighty-two million and odd grasshoppers, as well as vast numbers of caterpillars and snails. "Then, again," says Mr. Le Souëf, "the average number of young is about two and one-half to each pair of parent birds, and the contents of their stomachs must reach an enormous total, as they all seemed gorged with food."

As this enormous amount of food is being eaten every day by ibises in Australia during the hatching time of the grasshoppers, some little idea can be formed of the immense utility these birds are to the farmer. Without them the balance of nature would be disturbed and successful agriculture would be impossible.

In addition to its great value as a destroyer of all-devouring insects, the straw-necked ibis feeds with avidity on the fresh-water snail—the host of the dreaded liver fluke, which sheep so easily get in certain damp localities.

Yet, in face of these facts, people surreptitiously visit the breeding grounds of these birds and collect their eggs by the cartload. One party in 1912, having gathered more than it required, drove away and left 4,800 eggs to rot on the ground.

The Value of Birds in Forests.

Omitting all mention of many another notable instance of the quelling of insect outbreaks by birds, I will pass at once to the consideration of those perennial services which act as a constant check on the undue increase of insects, rodents, weeds, and other pests.

Birds attain their greatest usefulness in the forests, because the conditions there closely approach the primeval.

Forest trees have their natural insects foes, to which they give food and shelter, and these insects in turn have their natural enemies among the birds, to which the tree also gives food and shelter. Hence it follows that the existence of each one of these forms of life is dependent upon the existence of the others. But for the trees the insects would perish, and but for the insects the birds would perish, and but for the birds the trees would perish; and, to follow the inexorable laws of nature to the conclusion of their awful vengeance, but for the trees the world would perish.

Consider for a moment the life of a tree in connection with the insects that prey upon it. At the very beginning, before the seed or nut has germinated, it may be entered by a grub which destroys it. Should, however, the seed or nut be permitted to grow, the roots of the seedling may be attacked by beetles. Escaping this danger, a worm lays its eggs in the cracks of the bark. On hatching, the worm or borer perforates a hole in the stem. This hole, admitting water from every passing shower, causes a decay in the wood to commence, from which the tree may never recover. Other borers feed upon the bark, eating the soft inner layer and the sap. The twigs are affected by the larvæ of certain beetles, which act as girdlers, sometimes destroying limbs over an inch in diameter. Weevils bore under the bark and into the pith, making excavations in which the eggs are laid.

For the same purpose the cicada makes a terrible wound, which often proves fatal. The limbs of trees are affected by aphides, which puncture them and feed upon their juices, exhausting the sap. Many species of plant lice and scale insects infest trees, doing great damage, while over 100 different species of gall flies are parasitic upon them. The buds of trees are entered and destroyed by the larvæ of certain moths, while the leaves are devoured by caterpillars. To take the oak as an example, it is known that altogether over 500 species of insects prey upon it. Finally, be it remembered that in the bark and in the underlying tissues lie the vital energies of a tree.

It is difficult to perceive the usefulness of these insects which feed on the different parts of the tree, though they may, perhaps, when in normal numbers, exert a useful influence by a healthful and necessary pruning. It is certain, however, that if they were not in turn preyed upon by birds they would so increase in numbers that the tree could not survive the injuries they would inflict.

How dependent trees are on birds for their existence may be gathered from the following illustration: As many of you probably know, trees breathe through their leaves. Consequently, if the buds of the leaves are prevented from developing, or are eaten, when developed, by caterpillars, the tree is weakened. Many coniferous trees will die if stripped of their foliage for one year. Deciduous trees, if deprived of their respiratory organs for several years in succession, will also perish, though these trees linger as a rule for two or even three years before finally succumbing.

Now, injury to its breathing organs is not the only danger to which a tree afflicted in this way is subjected. The tree, being in a weakened condition, is at once beset by beetles and other borers, who, multiplying rapidly under such favorable conditions, tunnel under the bark until all the vital tissues of the poor tree are wasted. Thus a tree which might have recovered from the injury to its lungs falls a victim to the attacks of an insidious enemy which took advantage of its enfeebled state.

Woodpeckers or other birds of similar feeding habits would have flown to the rescue of the tree and possibly saved its life; but when that corrective influence is missing, the tree must die.

This illustration of the dependence of the tree on the bird and of the bird on the tree is, of course, but one of a long series that could be cited, and it is because of this most delicate adjustment between the tree, the insect, and the bird that I regard as profoundly true Frank M. Chapman's statement "that it can be clearly demonstrated that if we should lose our birds we should also lose our forests."

It is an ignorant schoolboy who does not know that if we lost our forests we should lose also the moisture necessary for the production of crops upon which man is dependent for his living.

If, in his arrogance and folly, man exterminated the bird, thinking himself capable of taking its place, he might be able to make shift with his sprays to save some portion at least of his orchards and gardens; but of what avail would be his puny efforts to protect from the ravening maws of insects the forests of America and Africa, the jungles of Asia, or the bush of Australia? Should he not, then, protect by every means in his power every one of the forest birds, who, as a matter of course, and without trouble or expense to him, ordinarily accomplish, on his behalf, the herculean task of saving the lives of the trees? One would think so. Yet in these very regions, in these vast areas of valuable timber, every trunk of which man will some day need, there are being killed annually millions of the

feathered guardians of the tree, and killed, too, for no worthier purpose than that, dead, they may defame a woman's head.

The Value of the Bird in the Orchard.

For man's purposes the work of the bird in the orchard is not so thorough as that done by them in the forest. Birds are the slaves of nature, and, in the main, nature's endeavors are put forth only to produce such fruits as will insure the perpetuity of each species of tree. With man the case is altogether different. His main object is not the propagation of trees, but the production of a giant gooseberry. Moreover, by introducing arsenical spraying, tarred and greased bands, and other devices to counteract the evil action of insects, he has, to a certain extent, taken upon himself the office of the bird. In this he is wise, for it must be admitted that if he wishes a large crop of fruit he must himself prevent the inroads of those insects which attack the fruit directly. It can not be expected of the bird that it will become an efficient ally of man in protecting the artificially produced fruit from the attacks of the numerous insects that are drawn to the orchard by a vastly increased quantity of fruit of a vastly better quality than the natural product.

For all that, fruit growers are largely indebted to the bird for a great part of their annual crop.

In the Union of South Africa, for instance, it is found that near towns, where the birds have been more especially persecuted and driven away, the growing of fruit and other market produce has become increasingly difficult, or even impossible, owing to the prevalence of insect pests which are not affected by spraying operations.

But let us suppose for a moment—though the supposition is absurd—that the modern fruit grower could do without the services of the bird. Would that give him a right to slay it? Apart altogether from the agriculturist, what of the millions of people who, as an increment to their ordinary livelihood, grow fruit, but who cannot afford either the time or the money to treat their trees in the most approved and scientific way

What would happen to this poorer class of fruit growers if they were deprived of the services of the bird is best seen in what happened to Frederick the Great. This worthy, in a fit of passion because a flock of sparrows had pecked at some of his cherries, ordered every small bird that could be searched out to be instantly killed. Within two years his cherry trees, though bare of fruit, were weighed down with a splendid crop of caterpillars.

Call the bird in the orchard an evil, if you will; but it is a necessary evil, and the fruit grower must make up his mind to pay the bird its wages lest worse befall.

The Services of the Bird in the Garden.

The garden is the insect's paradise. It fares sumptuously every day on the most succulent of vegetable foods. Every opportunity is thus offered for its increase. The greatest insect enemy of the gardener is a small, dull-colored, hairless caterpillar known as the cut-worm, which is the larva of a Noctuid moth. This chief of the brigand band of garden pests usually hides during the day beneath matted grass or under the loose soil along the rows of plants. It comes forth at dusk to feed. The bird is abroad at the first peep of day, and it finds the robber worm in the morning before it has retreated to its place of concealment.

But the early bird has to come stealthily to the garden to catch the worm. Its visits are regarded by man with more than suspicion, and it is fortunate if it escapes with its life. In consequence it snaps up a caterpillar and is off again, leaving thousands it would have eaten, if unmolested, to run riot amongst the vegetables.

Occasionally a bird more bold than its fellows will visit the garden in broad daylight to dig the cutworms out of their hiding places. Nature never having begrudged it the reward of its toil, the bird takes a few peas before leaving.

The gardener notices the damage done to his peas, and next morning is up betimes. He sees the bird running along a row of peas, stopping frequently to peck at something on the ground. There is a loud explosion, followed by a puff of smoke. The smoke slowly drifts away, to disclose a bird lying dead.

Caterpillars are not gifted with voice; if they were, they would scarce forbear to cheer.

The bird is dead. Mark the sequel. One fine morning the gardener issues proudly forth to cut his mammoth cabbage—the one with which he intends to put to utter confusion all other competitors at the local fruit and flower show. Alas for human hopes and the depredations of caterpillars. The cabbage is riddled like a colander.

The gardener when he shot the bird forgot, if, indeed, he ever knew, that the ancient law forbade a muzzle to the ox that thrashed out the corn.

Utility of Birds in the Meadow.

Each season, until hay making commences, the grass offers cover and shelter for the nests of such birds as breed on the ground. The fields also provide food for birds, and for the insects on which birds feed. Thus there is established a natural interrelation and interdependence between the bird and its food and shelter—that is to say, the insects and the grass. This simulates the condition of the earth before man made discord in the grand harmony of nature's laws.

Where the birds of the field are undisturbed they tend to hold the grass insects in check. On the other hand, when the numbers of birds in the field are for any reason insufficient, the insects increase.

Here is an instance of this: Some years ago in Bridgewater, Mass., a great battue was held by the ignorant townspeople in the spring of the year, and so many field birds were killed that their dead bodies were plowed into the land for manure. The following summer whole fields of grass withered away and died. This was due solely to the fact that the number of field birds had been reduced, and in consequence the pressure which nature demands the field birds shall exert upon the field insect had been released.

Again, at one time in New Zealand it was no uncommon thing to see English grass wither up in large patches, as though scorched by fire. This was due to the work of a crane fly and click beetle, the larvæ of both of which were addicted to the habit of eating the roots of the grass, just under the surface. English grass was then comparatively limited in the up-country districts, and, as there are large tracts of land in New Zealand destitute of native grasses, the depredations of these insects became a serious matter to those settlers who had stock to feed and who were relying on the English grass to feed it. It was all the more serious because the insects were without any natural check, the native birds which had kept them in subjection before the advent of the white man having been either killed or

driven from the vicinity of the homesteads. So the beetles continued to make merry, to marry, and to multiply. In a corresponding ratio the grass continued to fade, to wither, and to die.

Then came the English starling, and so voraciously did it feed on the larvæ that soon all was green again.

A case similar to the foregoing occurred about five years ago in an inland district of Australia, where, owing to the ruthless destruction of wild bird life, grubs took possession of the land, and, eating out the grass by the roots, transformed what had been a rich pastural country into an unprofitable waste.

Without the aid of birds grass could not be grown. The grub of a single species of beetle, if unchecked in its multiplication, could destroy all the roots in our meadows; or any one of the several species of cutworms, if its reproduction was not restrained by birds, might be sufficient to destroy all the verdure above ground.

Hawks and Owls.

The injury to trees, crops, and grass by insects is not the only evil that threatens man as a sequence to the destruction of birds. Rapacious birds hold a chief place among the forces which are appointed to hold in check small rodents, which breed rapidly, and unless kept within bounds are exceedingly destructive. Yet, notwithstanding the unanimous testimony of careful students of birds and their food habits to the effect that almost all hawks and owls are beneficial, a widespread prejudice still exists against them. They are slain as relentlessly as if they were enemies instead of friends of the farmer.

The destructive habits of the small rodents, which are the natural prey of hawks and owls, are much the same all the world round. They do an incalculable amount of damage to standing corn, to corn in the stock or when stacked, to grain, to root crops when growing or when piled on the ground or stored in pits, to orchards and forest trees, to the roots of clover and other grasses, to ground-growing fruit, and to gardens, both flower and vegetable. In addition to this list of crimes, certain rodents are active agents in carrying and disseminating the germs of plague and other diseases.

Here in England—though on account of their small size and secretive habits they are often undiscerned by man's dull eyes—they swarm in such numbers in the fields and hedgerows that the damage they do must prove a steady drain on the resources of the farmer.

The number of small rodents eaten by the rapacious birds is almost as remarkable in proportion to their size as is the number of insects eaten by small insectivorous birds. During the summer of 1890 a pair of barn owls occupied a tower in a building at Washington. After their departure there were found in the regurgitated pellets, with which the floor was strewn, 454 skulls of small rodents.

The young of hawks and owls remain a long time in the nest, and require a great quantity of food. During this period the resources of the parents must be taxed excessively in the effort to satisfy the hunger cravings of their offspring, and it is not to be wondered at if some individuals are forced occasionally to snap up a chicken. But what is the worth of the chicken, or of the young pheasant, occasionally taken, compared with the hundreds of thousands of pounds' worth of damage that is wrought in the orchards and fields by rodents that hawks and owls, had they been spared, would have fed upon for the maintenance of their species?

In 1885 the Legislature of Pennsylvania passed an act, known as the "scalp act," which provided a bounty of 50 cents each on hawks and owls killed within

the State limits, and a fee of 20 cents to the notary taking the affidavit. As the result of this act $90,000 was paid in bounties during the year and a half subsequent to the passage of the act. An irruption of small rodents followed and did damage to the agricultural interests of the State amounting to $3,850,000. And even these figures, enormous as they are, do not represent the entire loss. Years must elapse before the balance of nature, which was destroyed, can be restored.

In Montana the destruction of hawks and owls was so complete that rodents, freed from the pressure of their natural check, became as one of the plagues of the Book of Exodus. Then the legislature passed a law offering bounties for the destruction of these four-footed pests. During six months of 1887 such large sums were paid out in bounties for the destruction of small rodents—a work that the hawks and owls had previously done free of charge—that a special session of the Legislature was called to repeal the act, lest it should bankrupt the State.

In 1907 Nevada went through a very trying experience with mice, while Utah, Wyoming, California, and several States farther east have all had occasion to bitterly rue the day that they shot their hawks and owls.

But the destruction of small rodents is not the only function of rapacious birds in the economy of nature. Several species are voracious insect feeders. Nor is this all. It is well known that when small insectivorous birds increase abnormally in numbers they, too, become a pest. Hawks and owls materially assist those other agencies of nature which act as a check on the undue increase of small birds. If rapacious birds were rigorously protected in this country we should have fewer complaints of the damage done by sparrows.

Birds of prey, if unmolested, not only prevent the overproduction of small birds, but they also confer a salutary benefit on each species on which they prey by checking the propagation of weakness or disease by killing off the sickly and most unfit individuals, for these are the most easily seen and the most readily captured. This is particularly true of game fowl, and one of the most plausible hypotheses explanatory of the occasional outbreaks of disease among grouse has been the removal of this corrective by ignorant gamekeepers.

Yet it is my belief that nothing but a miracle will ever make these men see the error of their ways.

Some years ago, when lying in the sweet-smelling heather on a mountain side in Scotland, I pleaded for the life of the hawk before one of its executioners. The gamekeeper listened in silence until my address to the jury, so to speak, was concluded. Then he said, "Ye've a cold i' the heid." I did not see the relevancy of this remark, but I nodded assent. After a pause, he added, "Ah, weel; ye canna complain. The cold aye attacks the weakest place first."

Kaffirs say, "He who kills a hawk must be put to death."

The Economic Value of the White Heron.

The destruction of the white heron for its scapular plumes has robbed half the world of a bird which is most useful to man. It never touches grain, but feeds solely near water and over damp ground, the breeding places of innumerable batrachians, small crustaceans, and pestiferous insects, all of which directly or indirectly injuriously affect crops in the neighborhood. The presence of the white heron in the rice fields, for instance, is distinctly beneficial to the farmer, and rice is one of the most extensively grown crops of India and of China.

In Australia the slaughter of this and other wading birds for their plumage is causing in that country a decline in its fish resources. It is the destruction of

these birds which has led to the ever-increasing multitudes of crustaceans which destroy the fish spawn and the young fish hatching out in the Coorong and in the lakes at the Murray Mouth.

In his report on Egypt for the year 1912 Lord Kitchener stated that the indiscriminate destruction of bird life had allowed an enormous increase of insect pests, steps for the combating of which were to be taken. Lord Kitchener knew that in spite of the improved methods of fighting insects there was only one step that he could take that would be effective. A Khedivial decree was issued forbidding the catching or killing of, or taking the eggs of, Egypt's insectivorous birds. In issuing this decree, two things were prominent in Lord Kitchener's thoughts—the destruction of the egret for its plumes, and the fact that in the valley of the Nile this bird is one of nature's checks on the cotton worm.

White herons consume many flies, as well as the larvæ of insects in water. This fact is well known to those who have watched the habits of oxen and buffalo in Asia or Egypt. There the smaller white herons—the paddy birds of India—live with the oxen or the buffaloes, and pick the flies or the ticks from their bodies.

The late George Grenfell noted once on the Congo how a dying white heron, which he had shot and put into his canoe, roused itself, even on the approach of death, to snap at the tsetse flies which were settling on his boatman's legs.

Value of Birds to Live Stock.

The injury done to domestic animals by biting and parasitic insects is very great. Herds of cattle are often stampeded by these tormenting creatures, which carry disease and death among them. Another great affliction is the warble, which is a small tumor produced by the larva of the gadfly on the backs of cattle, and the constant irritation of which causes considerable depreciation in the value of hides, besides a lessened quantity and poorer quality of beef.

Horses, sheep, and other farm animals are subject to the attacks of similar parasites and other persecuting insect foes.

If it were not for the services the bird renders in alighting on animals in search of these parasites, or in catching the flies on the wing, or in eating them in the embryo state, man would be unable to keep his live stock.

More than this, man himself would be unable to inhabit many places on the earth which he now cultivates, or where he carries on other lucrative industries.

Shore Birds and Disease.

Deadly maladies are carried about by the myriads of mosquitoes and flies that abound on the coasts of tropical and subtropical countries. Yet the shore birds, which render invaluable services to man by destroying these venomous pests, are thoughtlessly killed by him in countless thousands.

To his honor, be it said, one of the first acts of Mr. Wilson when he became President of the United States was to issue an Executive order prohibiting, under heavy penalties for infraction, the destruction of any wild bird in the Canal Zone.

Game Birds as Weed Destroyers.

Unquestionably weeds serve a useful purpose in nature, but that purpose is not the occupation of cultivated land. Without check they would speedily choke all grain to death.

Constant use of harrows and hoes will do much on farm lands and in gardens to keep down weeds, but as most earth is full of weed seed, which retains its vitality for years, the life of the tiller of the soil is one continuous struggle against these troublesome plants. In this battle the bird is of great assistance, for the number of weed seeds eaten by birds on cultivated land must be beyond any assignable quantity.

Game birds generally are the greatest eaters of weed seeds. They are also useful to man in several other ways. Not only do they devour mature locusts, but they scratch up and eat the eggs. They also consume in large quantities termites and other equally pernicious insects. The reckless shooting of game birds is to be deprecated. They are of far more use alive than in swelling the bag of the sportsman.

The quail is perhaps the greatest weed destroyer of all the game birds. It is doubtful, indeed, if the quail is not more useful to man than any other bird. It is very nearly wholly beneficial. During spring and summer it feeds on many of the most destructive of insects, and in autumn and winter it eats an enormous amount of seeds of many harmful weeds.

The report of the United States Biological Survey says:

> It is reasonable to suppose that in the States of Virginia and North Carolina from September 1 to April 30 there were four quail to each square mile of land. The crop of each bird holds half an ounce of seed and is filled twice a day. Since at each of these two daily meals harmful weed seeds constitute at least half the contents of the crop, a half ounce daily is consumed by each bird. On this basis the total consumption of harmful weed seeds by quail from September to April in Virginia and North Carolina amounts to 1,341 tons. As destructive insects form about one-third of the bird's food from June to August, quail consume 341 tons of these pests in these States within those two months.

But perhaps the most valuable service that quail render the people of the United States is the greedy way in which—and they stand almost alone among birds in this particular taste—they eat the evil-smelling potato bug, or, as we call it, the Colorado beetle.

In addition to this inestimable service it is partially due to this bird that the cotton boll weevil has not swept over the entire cotton belt of America, bringing ruin to thousands of human beings on both sides of the Atlantic.

The Bird as a Scavenger.

The fishing population of these islands has declared war on the gulls, and is demanding the withdrawal of certain species from the list of protected birds, on account of the damage they are alleged to do to the fishing industry. People who believe fishermen's tales are apt to be duped and led into repeated errors. The gull is a surface feeder. It may occasionally levy toll on useful fish, but to say that it does any appreciable injury to the fishing business is absurd.

On the other hand, the presence of the gull is essential to man's health. While the bird fulfills many useful minor offices—such as destroying larvæ in land along the seaboard and in eating enemies of fish that are exposed during low tide—its chief function in the economy of nature is that of scavenger of the harbors and of the littoral, just as vultures are the scavengers of the mainland. The wholesale destruction of gulls for their plumage in Yucatan was followed by a great increase of human mortality among the inhabitants of the coast, which mortality was irrefutably due to the loss of the birds that had kept the harbors and bays free from the decaying matter which the sea is constantly casting ashore.

I wonder if these men who wish the gull destroyed ever give a thought to what would happen to their own smelling villages if this bird was not present to eat the refuse they throw about? Or, again, if they ever reflect on that feeling of relief they experience when in thick weather they hear, through the fog, the clamor of these feathered bell buoys, warning them that they are nearing rock or bar?

The Bird as a Guano Producer.

Now that I am on the subject of pelagic birds, I will speak of their value as guano producers.

Undoubtedly the present enormous trade in fertilizers owes its origin to the bird, for the fertilizing properties of the phosphoric acid and nitrogen contained in fish was not recognized until guano—which is the excrement of sea birds mixed with fish—became a stimulus to intensive agriculture.

The value of guano as a fertilizer was known to the people of Peru in the time of the Incas, though the nineteenth century had dawned before the information was carried to Europe by Humboldt. Under the rule of the monarchs of old Peru the birds were rigorously protected and the guano deposits carefully guarded. Three centuries later these protective measures materialized in a source of revenue to the country. Generation after generation of sea birds had placed on their breeding grounds deposits of guano which, in 1853, were estimated by the Peruvian authorities to be worth $620,000,000.

It is our pleasure to think of the Incas as barbarians and to look upon their times as dark and rude. In our own enlightened age man kills at one fell swoop over a quarter of a million sea birds on an island valuable for its guano deposits.

Value of Wild Bird Life as a Food Supply.

Under certain conditions wild bird life is invaluable to man as a food supply. The pioneer must—at any rate, at the commencement of his farming operations—live in great part on the wild products of the earth. In days gone by the forerunner of civilization could confidently rely on his gun to keep his larder constantly stocked with edible birds. Now, in many parts of the world, he is confronted with an alarming scarcity of this kind of food. The great straits to which the pioneer of the future will be reduced on account of the present-day slaughter of valuable bird life is foreshadowed by what is happening to-day in Hudson Bay. Fifty years ago the number of wild duck in North America was beyond computation. But man could not slay this bird fast enough to glut his blood lust. Sportsmen, professional hunters, and agents of the millinery interest smote them by the million. Such blind and wanton butchery could have but one result. Ducks are now so scarce along the west coast of Hudson Bay, where there are no moose, caribou are scarce, and the fishing is poor, that the people living there, who had always depended on the ducks they could pack away in the autumn, find it difficult to get sufficient food to carry them through the winter.

The Æsthetic and Sentimental Value of Birds.

Omitting all mention of various other material benefits which birds confer on man, I will, before concluding, notice briefly their æsthetic and sentimental values.

Bird life is the part of the creation in which nature has done more in the way of bestowing mental benefactions on man than in any other of her works. Unconsciously received, yet born of it, there is a spiritual teaching, an uplifting

influence, in the study of birds which tends to make a man act more constantly from principle, which tends to give a new and a more wholesome tone to his whole life.

The companionship of birds affords a happiness as pure, perhaps, and as permanently exquisite as man in his present state of being can possibly enjoy. Never came purer joy into my life than when, rising at dawn from my couch of fern, I heard the approach of the coming day heralded by a chorus of glad bird voices. Never have I experienced emotions which have so lastingly impressed my mind as when, in the inexpressible mystery of the darkened forest, with the stars drifting over, I listened to the sublime notes of some feathered psalmist, itself in night invisible.

The world itself is but an outline sketch; it is the birds which fill in the details and complete the picture. Towered vapors of the summer firmament hang on the wall of the sky against a setting of immutable blue; the trees are motionless; the glassy waters of the lake too idle to curve and break upon the shore. Nothing speaks of life or action. Suddenly, hitherto unseen in leafy tracery, a bird rushes out and up into the air, telling the sunshine all its joy. One can almost hear the mechanism start. The world begins to live and move. What artist is there who does not know this? Even when painting either of the two most majestic scenes on the earth—the ocean or the Himalayas—he adds this stimulating power to his canvas.

To turn from the palette to the pen, what poet is there who has not been inspired by birds? From the background of my memory a thousand instances of such inspiration come leaping forth. Shelley, Coleridge, and Longfellow, to mention three only of our singers, have been each rendered immortal in virtue of the power exerted on their minds by the bird. "To a Skylark," "The Ancient Mariner," and "The Birds of Killingworth" are poems that are imperishable.

The Mexicans felt the poetry when they looked upon the humming-birds as emblems of the soul, as the Greeks regarded the butterfly, and held that the spirits of their warriors who had died in the defense of their religion were transformed into these exquisite creatures in the mansion of the sun.

Earth holds no joy to the eye more sweet than the sight of one of these living gems as it flits to and fro with the shrillest vibration of swiftly beating wings, hovers for an instant in the shade of a pendulous blossom, shoots out again into the sunshine, darts away after an insect, wheels round and round in sheer exuberance of spirit, returns to sip at the nectared cup, then flashes up again, glittering with all the colors of the prism, into its home in the air.

Was all this beauty for no purpose but for the gratification of a passing fashion? Is man constitutionally unable to realize that in the beauty of these feathered jewels there is a value greater than the value that is entered in a ledger? Children gather flowers of the field, and, presently, their fleeting fancy sated, toss them aside to wither and die. But the seeds, the roots, remain. The daisy will bloom another year; the cowslip will stain the meadows yellow as of yore; but these blossoms of the air will never bloom again. Once gone, they are gone forever.

Conclusion.

Birds unquestionably are one of man's most valuable possessions, yet it is just the possession on which he sets the least value.

Wherever there are birds whose plumage is suitable for millinery, there will the cruel and rapacious agents of the feather dealers be found engaged in orgies

of wasteful destruction. Wherever there are birds that are classed as "game," there hastens the market hunter to kill, kill, kill, so long as any salable thing remains to be killed. Wherever there are species that have been harried by man to the brink of extinction, there will be the collector also, anxious to obtain the last lingering representatives of a race before his rival gets a chance to do so. Wherever there are birds whose eggs are valuable, there hurries the egg collector to destroy not only the embryonic life, but often the mature life as well by shooting the bird that laid the egg for the purpose of identification. Wherever in the wild places of the earth there are birds which are considered to be "good sport," there saunters that vandal of creation, the hunter of means and leisure, to expend on the most beautiful and the most harmless works of nature his instinctive desire to kill.

It is the nature of infamies, as well as of disease whose progress is not checked, to daily grow worse; and if the present-day wasteful and depraved practice of denuding the world of one of its most valuable natural resources is not checked, there will be wrought a mischief, a universal disaster, more awful in its results than words can express.

LONDON, 1914.