OUR CHANGING FAUNA.*

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There are two radically different approaches to a consideration of the problems of conservation. A strictly scientific procedure lacks in appeal to the general public. A wholly sentimental approach usually savours of the utopian and of the emotional rather than of the practical. The problems of conservation have so many scientific aspects and such great emotional appeal that both sentiment and science should be enlisted in an educational program for the advancement of conservation principles. If such a program were carried out, conservation would cease to be a mere matter for discussion and would become a real living issue.

Statistical studies and popular impressions unite to provide us with ample evidences that our native animals and plants are being treated with exactly the same degree of consideration that has been accorded to the Indian. As a nation we have cherished the tradition of freedom from taint of conquest for territory. But within our own borders we have waged a continuous conquest against the native life of our continent which has been as cruel and unrelenting as the sword of a Tartar. Like a Roman gladiator, with heel on the chest of a vanquished wild life, we have paused and have looked around the arena. Nearly half of the thumbs are down but many of the spectators are either asleep or not interested enough to turn a thumb one direction or the other in favor of or against the remnants of our depleted native life.

When we begin to think and to talk of conservation, our minds usually turn to the problems in terms of the desirability of increased numbers of indigenous plants and animals. In face of the dilemma of diminishing numbers we long for conditions that would augment the population of our native species. At such times rarely do we think of the fact that there may be limits which if exceeded would render some of our most desirable animals pests. We contrast the millions of passenger pigeons of a generation ago with the complete disappearance of this bird from our fauna. We compare the roaming herds of bison with the sparse, fenced-in, semi-domesticated herds of to-

* Address of the retiring president.

day. We talk of the good old past when bass and trout were as plentiful as the carp is today. Nothing is more evident than the fact that our fauna is changing. But what factors are responsible for the changes which we lament?

Man's Responsibility For Changes.

It is well known that long before man entered upon the stage of Earth's pageant of life, comparable changes took place. Forms of life abundant in one period of the Earth's history became reduced or entirely exterminated in succeeding periods. Under conditions of nature these changes were slow and gradual. Man in a single generation may wipe out species that are so well adapted to their environment that they have withstood all other forms of competition.

Too frequently attention is directed to the obviously criminal aspects of human responsibility for reducing the numbers of native plants and animals without realization that responsibility for change in the flora and fauna does not stop here. Without for a moment condoning the guilt or minimizing the responsibility for the pollution evil or the greed of poor sportsmanship, I would like to have you look at a fuller picture of the varied ways in which man has served as an agent in producing changes within our fauna.

The Balance of Nature.

At times when we witness the rapid decimation of the ranks of our native wild life we wish for and even exert our efforts toward indefinite increase in numbers of individuals. Such attitude fails to give consideration to certain principles of balance which seem to operate throughout nature. The law of overpopulation in the writings of Malthus is credited as one of the stimulating factors in starting Darwin upon his studies in evolution. Every school boy has read and has stood in awe of computations which demonstrate that even in the slow breeding animals the offspring of a single pair would overrun the entire face of the earth were it not for the catastrophes of one sort or another which tend to keep down the numbers of individuals. Of the numerous factors working toward the maintenance of this so-called "Balance of Nature," predatory enemies and parasites are important while limitation of food supply is also operative though probably in smaller measure than many

writers have maintained. The links in the chain of interrelationship between the organisms of a given habitat are numerous and have been admirably portrayed in that excellent study by Professor Forbes entitled "The Lake as a Microcosm."

Under conditions of nature, the population of any given species does not remain an absolute constant. The Balance of Nature is not so sensitively poised as to permit of perfect and immediate adjustments. The population of many species seems to run in cycles during which progressive increase through one period is followed by a check imposed by predatory enemies or disease. Man's chief influence upon plant and animal life has been in the direction of disturbing the Balance of Nature. Some of this disturbance has been inevitable and essential for man's continued existence. Other elements in the disturbed balance have been produced only incidentally and yet other conditions have resulted in ruthless and uncalled-for slaughter.

Dependents and Pests.

Few animals in the wild state can endure contact with man. Close association with him usually spells either extermination or some degree of domestication. Depending upon the basis along which the new adjustment is made, the animal becomes either a servant, a pest, or a pauperized dependent upon his human associate. Flies, bedbugs, rats and mice and the hordes of insects attacking crops and stored food-stuffs have become pests as the consequence of surviving the relationship with man. They have become successful competitors with man in the new artificial environment which man has created. Their present day condition stands in sharp contrast with that of the swans, the deer, antelope, bison and dozens of lesser forms which have retreated before the advance of human frontiers and were unable to become adjusted to the new environment created by man and including the human species. Pauperization is a sort of half-way adjustment which some species have attained. Bears in the national parks and squirrels in the cities have reached that stage in domestication which might well be designated as pauperization. Even some birds have successfully solved the problem of relationship with man. The English sparrow, the pigeon, and the starling fit into the human environment as readily as we who have arranged it, and because of their acceptance of this new order of things we brand them as pests. Who

is able to predict what the future holds in store for the martins, swifts, bluebirds, wrens and some of the woodpeckers? All of these are becoming adapted in varying degrees to human surroundings. So far they have retained their native habits to such an extent that neither they nor their human associates reap anything but profit from the association.

Wanton Destruction of Life.

Extermination is not always by way of direct brutal slaughter of individuals. Direct slaughter is fortunately fairly obvious and its course is capable of being checked before a species becomes completely anihilated. By intelligent laws the antelope of our western plains has been given a new lease on life, though for a time this animal stood on the edge of the chasm of extermination. Thanks to the operation of many conservation agencies, chief among them the federal treaty with Canada protecting migratory bird life, many of the migratory wild fowl seem to be actually increasing in abundance after a period of marked gradual decline. These are examples aiming to show how extermination may be averted, not by adjustments to the new conditions upon the part of the animal, but by consideration and protection afforded through legal enactment. Some of the outstanding instances of averting anihilation make it seem worth while for us to look at the problem from its various angles to see wherein evils exist and to enumerate some of the remedies or to cite methods of preventing the elimination of our indigenous animals.

Changes Due To Development of Agriculture.

By the ever increasing intensity of cultivation of land and because of inevitable increase in density of population we are forced to alter conditions which are either directly or indirectly essential for the life of many species of animals. The grazing range of mammals is thus restricted or entirely taken away. Nesting sites for birds are destroyed and many species of amphibians, reptiles and mammals are deprived of natural living conditions when new ground is put under cultivation. Many of these emigrants from human contact find refuge in swamps and waste lands only to be routed out by the "improvements" of a drainage project or local development which more frequently than otherwise yields profit only to the promoter. The drainage of swamps and lakes, ostensibly for agricultural development,

has rarely proved profitable in this country while the loss of life entailed is beyond grasp of the imagination. The burning of fields, and of pastures as a means of controlling insect pests under some conditions inflicts heavy damage. The toll of nestling birds and of eggs as well as of amphibian and reptile life may be great if an improper season is chosen for this practice.

Many of the most valued fishes which we associate with the open waters of lakes and rivers seek the shallower waters of backwater lakes and lagoons to lay their eggs and to rear the young. Moreover, these same regions have long been known to produce much of the plankton which finds its way into the larger bodies of water and there serves as an indispensible link in the chain of food relations. Consequently, the drainage of swamps and lakes has much greater biological significance than the direct slaughter of the aquatic animals that happen to perish when the water is drained off. In fact the most insidious of the attacks upon our animal life are these instances of murder in the second degree. As a people we have progressed far enough in civilization to formulate and administer rather effective measures against outright wanton murder at the hands of the sportsman and market hunter. For the fisherman, we impose a rigid limit upon the number of black bass which he may take per day, but at the same time we permit other individuals, corporations, and municipalities to murder millions of fish by dumping untreated sewage wastes and industrial byproducts into the streams.

The removal of hedges advocated by some of our present day authorities in agriculture and the clearing of all brush from pasture lands destroy the nesting sites for many species of seed eating and insectivorous birds. Ground nesting birds such as the bob-white and the pheasants are becoming more and more restricted to uncultivated and ungrazed areas such as are found along the right of way of railroads. Birds are not the only sufferer from the intensity of modern agriculture. Snakes, many species of which are not only harmless but have direct value as rodent and insect destroyers, are being rapidly and inevitably exterminated in Illinois because of the destruction of conditions suitable for their protection.

Changes In Streams.

In addition to the conditions already referred to under the topics of drainage of swamps and lakes and pollution there are

many other directions in which human intervention is militating against the aquatic life which never comes into direct competition with man. Power dams are known to have marked influence upon the breeding of migratory fishes such as the Pacific salmon. Even small dams in local streams are apt to influence the life of a stream profoundly. Physical conditions for existence such as depth of water, temperature, and amount of oxygen are apt to vary above and below a dam and many species of animal found below a dam never reach the waters above it. In many localities the drainage of agricultural lands is facilitated by dredging the beds of streams to a lower level. Though such practice may inflict no direct injury to the larger aquatic life of the stream the whole fauna may become radically changed by this procedure. Many of the bottom forms of molluscs may be eliminated outright, while others find themselves unable to survive in the new type of bottom left after the dredging operations. Changes in type of bottom and removal of the plant life similarly react upon the insect and crustacean life. Incidentally, fishes depending upon insects, crustaceans, and mollusks for their food supply, disappear when these elements are withdrawn, even though all other conditions might remain favorable for their continued existence.

Toll of Life On the Highways.

Even the hard roads, with their wide popular appeal, present new and serious problems in conservation. Two of these problems are peculiarly outstanding. Regions which a generation ago stood as isolated, self-appointed refuges to game birds and animals because of inaccessibility, are today the paradise of the hunter and stand easily accessible from the great centers of population. If scientifically valid laws are framed and enforced such natural sanctuaries need not be desecrated even though frontiers have been obliterated because of the ease of travel. Another direction in which the modern roads and the automobile militate against conservation is in the destruction of animal life by traffic. Smaller mammals and birds suffer heavy toll along the highways. In these days the tourist may see more dead rabbits and red-headed woodpeckers flattened on the pavement than he is able to observe in living condition by the roadside. Especially in the instance of the woodpeckers, man's indirect influence upon these birds has been marked. With the progress of deforestation they have become accustomed

to accept telegraph and telephone poles in lieu of the dead trees which originally served them as nesting sites. But with the destruction of the trees much of the normal food supply of wood-boring insects has disappeared. As what seems to be an adjustment to all of these new conditions the red-headed woodpecker seeks much of his food on wing after the custom of the fly-catchers. The roadside nesting sites provided by the lines of poles make this a dangerous habit. Mammals and birds are not the only animals slaughtered on the highways. Where roads pass through bottom lands and swamps the toll levied against the lives of snakes, turtles, and frogs becomes astounding.

Successful Adjustment.

Most of the illustrations cited so far have been instances wherein man has been responsible for a decrease in numbers of individuals. Unfortunately illustrations in the opposite directions are restricted to the pests which thrive under the new man-made environment. The chinch bug is a native insect which under primeval conditions lived upon native vegetation and never became conspicuous. When man through his cultivated fields provided an unlimited food supply the balance of nature became upset and this insect increased in proportion to its increased possibilities and became a serious competitor with man for the grains which man cultivates. Such is the inglorious history of scores of native insects which thrive at man's expense and stand as challenging contenders to every human advance. Among the insects, our foreign born invaders are the penalty which we pay for the development of ready communication between the corners of the Earth. The San Jose scale, the Japanese beetle and the European corn borer are illustrations of immigrants which have prospered inordinately under the artificial conditions created by man for they have left their predatory and parasitic enemies behind and in their new home find no checks available to hold them within restricted bounds. In a new country these immigrants have escaped their natural enemies and are running rampant before a new Balance of Nature may be struck. Mouse plagues and the ravages of rats are further examples of the abnormal increase made possible under the favorable conditions prepared by man. The English sparrow and the starling are foreigners who have found an adaptation so readily that they have given up desirable traits from a human

standpoint and have become little short of a plague threatening extermination for some of our native species of birds.

Similar conditions exist even among the lower animals. The large European earthworm *(Lumbricus terrestris)* is in some localities actually replacing desirable native species of earthworms and is wreaking damage to lawns. The carp, intentionally introduced into our streams and lakes, has become so numerous that some of the game fishes are unable to maintain themselves because their breeding grounds are so seriously disturbed by the bottom feeding activities of the carp. The foregoing are but a few of the isolated instances taken from local problems in readjustments necessitated by introduced species. If were were to turn to the continent of Australia there we would find similar problems except that there the problem of amalgamating the immigrant fauna is much more serious than anything experienced in this country.

As previously indicated, the native and invading hordes of enemies we term pests, because they cope successfully with man. Until recently control measures directed against these pests held as an aim the extermination of the undesirables. The mere fact of their achieving success in competition with man speaks loudly for their powers of adjustment. In a diversified country such as ours the extermination of insect pests is impracticable if not wholly impossible. Only recently have scientists sensed the futility of efforts toward extermination and directed their attention toward feasible methods of control. In the disturbed balance of nature where man has created new conditions more favorable for some species than ever existed under a natural order, man must divide the spoils with these creatures whose very existence has been made easier by his practices.

Restoring Our Native Life.

It would be an unfortunate though realistic picture if we stopped our sketching here. We have left in relief only the cold facts of a fauna suffering transformations. In numerous instances species are facing decimation because of conditions which man has imposed. On the other hand we view a protracted struggle between man and other animals, all competing for supremacy with only a relatively small margin of the advantage in man's favor. This struggle is as old as man and will doubtless continue as long as man and the insects stand as the

two pinnacles in the evolutionary process. Let us then drop this less promising phase of the discussion and turn to possibilities of remedying some of the deplorable circumstances for which man is responsible.

We have gone far in squandering the natural resources of both plant and animal life. It might well be recognized that any active program of conservation must operate along two distinctly different lines. These we may for convenience refer to as the restorative and the preventive aspects of conservation. Even in the face of rapid disappearance of their native habitats many species are capable of readjustment to new conditions produced by man if merely allowed to live. The enactment of laws protecting the bob-white and the beaver furnishes examples of preventive measures operating to avoid extermination in regions where extermination seemed imminent. But enactment of laws afford little protection to the animals and plants which the laws are designed to protect unless there is an intelligent attitude of the public regarding the reasons for the laws and a strong public sentiment supporting their enforcement. The general public too often looks upon laws for the protection of birds and game as open infringement of personal liberty.

For many species of indigenous plants and animals the conflict has gone too far to enable them to come back under a truce with their human competitors. The only means of avoiding total extermination of these lies in the direction of applying effort beyond mere protection. Reforestation, provision of sanctuaries and purification of streams are constructive aspects of conservation that must operate along with the enactment of protective measures for a program of restitution that may be capable of effectual rejuvenation of natural conditions.

Even the restoration of natural conditions may in many instances prove inadequate. Species are frequently reduced so near the vanishing point that revival cannot follow the return of correct environment. Here artificial rearing under controlled conditions is resorted to. In our own State, as well as in many others, support is granted for the rearing of game birds and game animals for distributing and restocking purposes in regions where game has become scarce or entirely exterminated. Under carefully controlled conditions this serves well as a factor to offset the destructive influence of man upon his animate environment. In like manner, the fish hatcheries maintained by federal, state, and private agencies provide a means of restocking streams

and lakes which have become depleted. Only very recently has it been discovered that direct liberation of fishes from the hatcheries is poor conservation practice. A new provision in the form of fish nurseries has been added to the list of compensating agencies. Newly hatched fishes held for some months in nursery ponds become established with a minimum of loss when transplanted to natural waters. Another form of conservation of aquatic life is practiced at times of floods. When the waters recede following the overflow of a river immense numbers of fishes are left marooned in backwater ponds and lagoons. Ultimately, these die if not rescued. Federal and State agencies have been carrying on rescue work of this nature for some time. The fishes are seined out from the temporary ponds and are returned to the main watercourses. In saving the lives of these stranded fish another conservation measure is commonly practiced. The fresh water mussels which provide the shells for the pearl button industry, must live for a time as parasites upon certain species of fish before they are able to lead independent lives. Taking advantage of this fact, the rescue workers subject the fishes to a heavy infection with larval mussels before they are liberated. Thus the one act of rescuing the fishes simultaneously increases the mussel population of the stream.

Wild Life Refuges.

As a sanctuary for species that find it impossible to adjust themselves to the environment produced by man it is difficult to estimate the value of the National Forests and National Parks. Some of our neighboring states have gone far in a systematic program of founding natural parks which become game and wild life refuges. In our own State, we have been preposterously passive in directing any adequate policy toward this type of conservation. It is unfortunately true that it at times becomes difficult to separate conservation measures from political entanglements. Some of the most effective proposals for conservation have failed, not because of lack of favorable sentiment but because of the weight of interests of an opposing minority. If stream pollution were an inseparable consequence of civilization and modern industry, I think that most of us would admit that the life of our streams must go. But when pollution is known to be only a matter of expediency or convenience or of financial saving, then the justice of permitting pollution vanishes.

In attempting to restore conditions favorable for the native

fauna, we sometimes forget that the habitat or conditions under which animals live is not a simple thing. Detailed studies have been carried out in many regions to show how conditions favorable for the maintenance of the present inhabitants have evolved. Under conditions of nature a region progresses from one type of plant and animal life to other types with fairly well defined sequence. This succession, as it is termed, is seriously altered by human intervention. Most species of plants and animals can live only under restricted kinds of surroundings. In contrast, man is able to modify his surroundings to meet his needs. The changes which man makes for his own convenience or purely incidental to his dwelling in a given locality modify the normal conditions for the native plant and animal life. Many species are unable to make the needed readjustment and become reduced in numbers or even become obliterated. Others find the new conditions more favorable than the original state of their environment. These withstand their ground and assume the role of competitors with man or become dependents upon him.

Plea For Conservation Program.

Change is inevitable but we as a race cannot be proud of the wanton destruction of life which is laid at our threshold. Yet we are doing little to compensate. Our Academy should unite with other available agencies in a program of education and of conservation. Such a program would of necessity be diversified and would include as objectives the purification of streams, and the adequate protection of our native wild life through the enactment of legislation and the establishment of natural parks and sanctuaries commensurate with the needs of a native fauna rapidly changing under human contact.