ARTICLES

EAGLES, AFFLUENCE, AND PESTICIDES[1]

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Modern man has progressed from a point in the misty past where he was part of the vicious animal-eat-animal system, which some now call the balance of nature, to material abundance and a safer, longer life. In order to accomplish this it was necessary to upset this mythical natural balance by eliminating the competition of his food plants, a process now called cultivation, and by domesticating some of the more useful animals and protecting them from their enemies.

So he moved from a condition of hunter and gatherer to one of farmer and animal husbandman. Not many generations ago almost 100 percent of the people were engaged in farming as a necessity of survival. Owing to improved agricultural technology, the condition now prevails in some affluent countries like the United States where one farmer produces enough food and fiber to supply himself and approximately 40 others. And, the only way that modern man can maintain this condition is to keep nature unbalanced in his favor. This great achievement in food production has freed more than 95 percent of our people to engage in other vocations, crafts, professions and miscellaneous activities. Some have become so detached from the land that they do not look beyond the suburban supermarket as the source of their food, and there is a small minority which seems determined to destroy the very technology that sustains us all. It is this subject which I wish to discuss.

Many charges have been made against pesticides, *e.g.*, pesticides in the sea, pesticides in Antarctica, pesticides in food, pesticides causing thin eggshells, pesticides causing cancer, pesticides in mothers' milk, pesticides in rain, and on and on *ad infinitum*. One obviously cannot discuss each of these in a brief address; therefore, I have chosen two relevant points of this controversy for examination in some depth.

The members of this Association are well acquainted with the absolute necessity of using insecticides for mosquito control and for protecting millions of people against such scourges as malaria, filariasis, onchocerciasis, yellow fever, encephalitis, and other deadly diseases. And we know of the strong stand of the World Health Organization for the continued use of DDT in the worldwide malaria eradication program. Therefore, rather than repeat these well-known statements, this presentation will emphasize some vital points recently made on the subject of pesticides and food production and the effects of pesticides on bird populations, especially the birds of prey, which seem to be of most concern to the anti-pesticide lobby.

As a preface to this discussion, I wish to state that the members of this Association want a clean environment as much as any other group of responsible citizens. It is the policy of the American Mosquito Control Association to use pesticides properly so as to minimize any possible hazard to the environment, and they are used as supplements to water management and other methods of mosquito control in an integrated program of pest management. We are proud of the fine cooperative program of the National Mosquito Control-Fish and Wildlife Management Coordination Committee. The professional wildlife scientists who are a part of that

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program are not included in the anti-pesticide lobby referred to in this paper. Neither are the many responsible conservationists both in and outside of various conservation organizations.

The real hard core anti-pesticide lobby appears to include a very small minority of scientists many of whom seem to think that their scientific training in other disciplines qualifies them to discusss pesticides authoritatively, a classic example of a little learning being a dangerous thing. This group and their supporters make it appear that pesticides are the major environmental pollutants. This just isn't true. The mere presence of a substance in minute quantities does not prove harmful effects, which is the logical basis of judging the importance of a polluting substance.

Harmful pollution is a result of our high standard of living, and all Americans contribute their part, including the environmentalists. Damaging pollution can and should be corrected, but this is a job for everyone—not just industry or those who farm or control insects.

PESTICIDES AND FOOD PRODUCTION. While we are an affluent people, this is not true of about 75 percent of the world population. A visiting minister who has been converted by the "ecology" movement came to my church a few months ago and in his sermon blasted DDT for polluting the environment. More recently a Bishop of this church stood in the same pulpit and asked the congregation to help feed those in developing countries where 12,000 people die of starvation every day.

Dr. Norman E. Borlaug, winner of the Nobel Peace Prize in 1970, is much better qualified than I to tell the story of pesticides and food production, and tell it he did in the McDougall Memorial Lecture at the 1971 Conference of the Food and Agricultural Organization of the United Nations. I have leaned heavily on this great man's lecture for the following points on this subject. Dr. Borlaug developed improved varieties of wheat that are the basis of the Green Revolution which is reducing the number of deaths by starvation in developing countries. The continued success of this program depends not only upon the availability of improved varieties of food plants, it also requires the continued availability and input of agricultural chemicals, including pesticides.

The subject of modern agricultural technology as it affects available wildlife habitat is another very cogent point. This technology, including pesticides, has saved 292 million acres of wildlife land in the United States in the past 30 years by increasing the yield per acre of 17 principal crops, thus making it possible to leave this much additional land for trees and wildlife. According to Dr. Borlaug, this is an area equal in size to the entire land area east of the Mississippi and south of the Ohio Rivers.

On this same subject, the point is also made that within the next 30 years the large animals of East Africa and the elephant, tiger, and peacock of India will all be poached out of existance unless agricultural food production is increased sufficiently to take the pressure off these animals. These startling pronouncements deserve careful consideration by biologists and others who continue to demand the banning of the very pesticides that might help prevent this.

To close this subject, a statement by Dr. Earl L. Butz, Secretary of Agriculture, seems pertinent. He says that we can return to organic farming, which was our production technology of 75 years ago; but first someone has to decide which 50 millions of the *American* people are willing to starve, for this would be the result without a large production input of chemicals.

PESTICIDES AND BIRDS OF PREY. For the purpose of this address, the emphasis will be on eagles with a few comments about other birds of prey. These birds appear to be the basis of most of the opposition to pesticides.

On the subject of eagles, there is one thing about which there seems to be general agreement: these great birds are declining in numbers. But the anti-pesticide

minority would have us believe that this unfortunate situation only started or became serious with the general use of persistent pesticides about 26 years ago and that these chemicals are the most important cause of the problem. The published record reveals some interesting information of this subject.

Fifty years ago (1921) a paper was published in the scientific journal *Ecology* entitled, "Threatened Extinction of the Bald Eagle." This paper stated in part that the bald eagle was fast becoming a rare bird in the United States. Again, in *Science News Letter* of July, 1943, several years before there was general use of persistent pesticides, attention was called to the declining eagle population and the author attributed this to the cutting of nesting trees and pollution of nearby streams by sewage and industrial wastes which destroyed the fish that comprised the principal food of eagles. So, scratch one false charge. The decline of eagles started many years before DDT or any other persistent pesticide was ever used.

And here is more from the record about what has happened to eagles in more recent times. Of 147 eagles found dead in the United States and examined at the Patuxent Wildlife Research Center in the period 1960–68, only nine, or 6.1 percent, were suspected of being killed by pesticides, only one of which was by DDT. The other 138 were shot or died of disease or unknown causes. But hear this! Prior to 1951, Alaska is reported to have paid bounties on 100,000 eagles slaughtered in a 36-year period because they were believed to be detrimental to the salmon industry. This is almost 3,000 eagles per year for 36 years. In this connection the following statement from Smithsonian U. S. National Museum *Bulletin* No. 167, published in 1937 is pertinent: "Where eagles are sufficiently abundant and are known to be doing serious damage to salmon fisheries, fur farming activities, or other human interest they should be reduced in numbers. There is no danger of their extermination in the vast uninhabited regions of Alaska. Elsewhere we can afford to protect such a picturesque feature as our national emblem."

And there is more! Although the practice was banned in 1962, the record states that 20,000 eagles were shot from small planes, presumably in the American West. But the ban on this practice notwithstanding, a press report as recently as August 3, 1971 stated that 500 Bald and Golden Eagles were shot from planes in Wyoming and Colorado for predator control that year. And speaking of predator control, it is well known that poison baits placed in the environment for control of other predators have inadvertently killed hundreds of eagles. This has been done for many years with the approval of the U. S. Department of Interior and was discontinued only about a month ago.

Another published report states that the Department of Interior authorized the killing of Golden Eagles in some Montana Counties in 1967 to protect livestock.

Now, this is 120,645 dead eagles, an average of 2,116 per year during the past 57 years, that have been accounted for by the published record, and this does not include the unknown hundreds killed by poison baits, electrocution by power lines, etc. that were not recorded. But of those accounted for, only nine are reported as having succumbed to pesticides, only *one* of which was by DDT.

Much is said about reproductive failures of birds, expecially birds of prey, due to pesticides. These chemicals are blamed especially for causing thin eggshells that break before hatching. This charge is based primarily on laboratory studies where various kinds of birds were fed rather large amounts of pesticides daily for long periods. In a frequently cited recent paper on this subject by Hickey and Anderson, there are data showing reductions of average weights of eggshells of Florida eagles of about 19 percent in the late 1940's and the 1950's when compared to average weights of eggshells collected before that time. But the published

record also shows that this difference is similar to the normal range of egg size for Florida eagles as determined by measurements of 50 eggs collected prior to 1937. As reported in U. S. Museum *Bulletin* 167, the length of the 50 eggs varied by 26.2 and the width by 18.4 percent. It seems reasonable, therefore, that the difference in weights of the shells of these pre-DDT eggs would have varied by at least the 19 percent reported by Hickey and Anderson, especially since their samples of recent eggs were only 8 and 12 in number. The authors relate their data of eggshell weight to a declining eagle population in Florida.

There can be no debate about another factor that has prevented thousands of birds' eggs from hatching over the past 100 years. This is the practice of egg-collecting by some ornithologists and bird protectionists for scientific or private collections. Collecting a reasonable number of eggs for scientific study is understandable and necessary, but the practice appears to be much more widespread than this.

The paper by Hickey and Anderson (ibid) states that 1,729 eggs from 39 museums and private collections were examined in their study. On page 361 of U. S. Museum *Bulletin* 167 it is reported that the measurements of 312 American Osprey eggs in a private collection averaged 61 by 45.6 millimeters. In discussing possible causes of the osprey abandoning a nesting area in New England we find this statement: "Considerable egg collecting was done in certain parts of the area, but no more than, if as much as, in the area where the birds still breed." Also, there are many references to average sizes of eggs of several of the birds of prey based on measurements of 40 to 50 eggs from various collections. There is another reference to robbing the nest of a pair of peregrine falcons repeatedly until the birds gave up in despair. It seems evident from these and many similar references that egg collectors have probably prevented the hatching of a much larger number of birds' eggs than any pesticide ever has.

The record also indicates that many additional eggs are prevented from hatching as a result of molesting birds on their nests, causing them to abandon the eggs at various stages of incubation. There are many references to this practice in past years, but a more current report also is available. In a recent paper entitled, "The Truth about the California Brown Pelicans," Dr. J. Gordon Edwards blames "scientific persecution" during the 1970 breeding season for the near failure of these birds to rear young that year off the California coast, on Anacapa Island, rather than pesticides as claimed. Dr. Edwards states that the superintendent of Channel Island National Monument, was deeply concerned over the Anacapa Island disruption by biologists and the widely publicized misinformation about the pelican colony there. Moreover, in 1971 the National Park Service refused to permit scientists to hover over or land on Anacapa Island by helicopter, as they did frequently in 1969–70, because noise and excitement are known to upset the birds, causing thin eggshells and nest desertion. Dr. Edwards states further that research biologists were no longer permitted to roam among the nests frightening off the brooding females or shooting them on the nests for analysis, as they had also done earlier.

One final comment on bird hunting should be adequate to make this point. These excerpts are from a letter published in the Monthly American Journal of Geology and Natural Science of 1832. Again the subject is bird collecting and the place is the East Coast of Florida. Quote: "At sun-rise the next morning, I and four negro servants proceeded in search of birds and adventures. The fact is, that I was anxious to kill some 25 brown Pelicans, (*Pelicanus fuscus*) to enable me to make a new drawing of an adult male bird, and to preserve the dresses of the others—I proceeded along a narrow shallow bay, where the fish were truly abundant . . . I shot some rare birds, and putting along the shore, passed a point, when lo! I came in sight of

several hundred pelicans perched on the branches of mangrove trees, seated in comfortable harmony, as near each other as the strength of the boughs would allow. I ordered to back water gently: the hands backed water. I waded to the shore under cover of the rushes along it, saw the pelicans fast asleep, examined their countenances and deportment well and leisurely, and after all, levelled, fired my piece, and dropped two of the finest specimens I ever saw. I really believe I would have shot one hundred of these reverend sirs, had not a mistake taken place in the reloading of my gun. A mistake, however, did take place, and to my utmost disappointment, I saw each pelican, old and young, leave his perch and take to wing; soaring off, well pleased, I dare say, at making so good an escape from so dangerous a foe . . . After shooting more birds, and pulling our boat through many a difficult channel, we reached the schooner again; and as the birds, generally speaking, appeared wild and few—(you must be aware that I call birds few when I shoot less than one hundred per day)—my generous host proposed to return towards home again." The letter also states that in celebration of getting their boat afloat, the party set fire to the whole salt-marsh just for fun, and saw marsh rabbits etc., scampering from the fire by the thousands, as they pulled their oars. The letter was written by John J. Audubon, December 31, 1831. This reference is included only to emphasize how attitudes have changed, not to discredit this famous man in any way.

In concluding this discussion it is pertinent to cite an example from the record concerning pesticides and bald eagles in nearby Everglades National Park. The Park is next door to two of the most intensely sprayed areas in the world, the Everglades muck farms a few miles to the north and the Homestead vegetable farms on the eastern boundary of the Park. These farming areas are cultivated almost yearlong and sprayed almost continuously with just about every pesticide available, including DDT, and this has been going on for many years.

Consider also that South Florida is a network of canals connecting the farming areas with the drainage and water storage areas of the Everglades and that the main source of water for the Park is from this farming district a few miles to the north. Now, a news release datelined Everglades Park of January, 1969 reports a biologist of the National Audubon Society as saying that pesticides are being washed into canals, streams, lakes, etc. in increasing volume where eagles hunt fish, their primary food. One can easily demonstate the effect of this kind of publicity. About a year ago my wife and I were riding along listening to an interview on the car radio with an influential official at the Washington level about the fires that were then destroying forever much of the Everglades muck. When asked about his thoughts on this, the official stated that the fires were not too important because they had been occurring for years in the glades. He said the real danger was all that DDT in the water that was flowing into the Park.

Now, on the basis of these pronouncements, the Everglades National Park should be the perfect model for conditions which the anti-pesticide people claim are responsible for thin eggshells and declining populations of eagles. Therefore, any citizen who is not knowledgeable on the subject would have to conclude that, if there are any eagles left in the Park, they must be just hanging on by one claw and soon will be gone forever, because there could not possibly be any hatching of eggs with all those pesticides building up in the food chain.

But wait! According to the published record this is not the case. The same news release quotes the biologist further as saying that the Everglades National Park has the healthiest bald eagle population in the United States, outside of Alaska, and that a Park official estimates the reproductive success of the eagles there at close to 60 percent, while only a 50 percent rate is required for maintaining a

stable population. The healthy nature of the eagles in the Park also is confirmed by a scientific report in the *Pesticides Monitoring Journal* of December, 1970.

But, the news story also points out, that of the other three eagle populations in Florida, the two coastal colonies are declining and the one between Lake Okeechobee and Orlando is just holding its own.

Now, when you put it all together, the record clearly shows that the eagles that are getting along well in Florida are those in or near the farming areas that are heavily sprayed with pesticides but are also far removed from people, and the declining eagle colonies are those along the coasts where people are numerous and are intruding on former eagle territory. The news release does mention shooting, habitat destruction, and competition between people and eagles for waterfront property as important factors affecting the coastal populations of eagles. But the most amazing statement of the news release is a quotation attributed to the biologist which says that unless measures are taken to prevent it, pesticides, and DDT in particular, eventually will eradicate the bald eagles. The Mrak report, a scholarly study of pesticides and environmental health, submitted to the Secretary of the Department of Health, Education, and Welfare just over two years ago, seems to put the subject of pesticides and reproductive success of eagles in proper perspective. This report states on page 437 that there is a reasonable doubt that chlorinated hydrocarbon pesticides are found in the natural feed of these birds at levels required to adversely affect reproduction.

Now, according to the published record, it appears that shooting, collecting of birds and their eggs, encroachment of suburbia on former eagle habitat, poison baits, electrocution, and molesting of nesting birds are all important factors adversely affecting the population of these great birds of prey. Based on this evidence, it seems reasonable to conclude that birds might profit a great deal more by a ban on some of these practices than by banning pesticides. If pesticides are an important cause of declining bird populations, this will be determined in time by unbiased, objective science—not by environmental rhetoric. At the present time, the evidence for this is not impressive.

What is impressive about the published record is that wildlife, like people, is dependent upon the *continuing use* of pesticides—not their elimination. For the simple truth is that people are going to see to their own survival first, and if present high yields per acre of food are reduced by banning pesticides, more wildlife land will be cleared and farmed to make up this loss of production.

I find no more reason to apologize for using a legally labeled chemical pesticide than would a physician for using penicillin, which is also a pesticide, especially when that chemical pesticide has saved more lives than penicillin and all the other so-called antibiotic drugs combined. But there is a real danger that we will lose these vital tools of food production and public health protection through mosquito control unless more people start telling the positive side of the pesticide story. The challenge I leave with you is to acquaint yourselves with the scientific facts about this matter and use these facts in every possible way in defense of pesticides in your work.

Let's not be members of the silent majority of the affluent 40 while the militant minority destroys the technology that man has developed for his own survival and health, as well as for the protection of wildlife. With 2.8 billion people in the world of 1972, all having a need for housing and food, there might not be enough caves to go around if we are forced to return to the "balance of nature" culture of our prehistoric ancestors, and in those circumstances the few eagles that remain would surely end up in stew pots.

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MALATHION RESISTANT STRAINS OF *AEDES AEGYPTI* IN PUERTO RICO IN 1969[1]

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Malathion is the favored insecticide against *Aedes aegypti* in Puerto Rico but its effectiveness is questionable. Following an epidemic of dengue in 1963, a large scale eradication program involved the spraying of hundreds of thousands of gallons of 2.5 percent solution over most of the Island at a cost of millions of dollars. The results were not impressive. In 1969, after five years of effort, *Aedes aegypti* was abundant everywhere, another epidemic of dengue broke out, and malathion continued to be applied in huge quanities.

Although earlier studies had indicated that *Aedes aegypti* in Puerto Rico was resistant to various chlorinated hydrocarbon and organophosphorus insecticides (Fox, 1960, 1961; Fox and Garcia-Mall, 1961; Fox *et al.*, 1961), including malathion but before standard tests were available of OP insecticides, malathion was chosen as the program's basic insecticide in 1964. Flynn *et al.* (1964) interpreted results from standard laboratory tests which had become available by this time as representing satisfactory susceptibility levels. By 1968, however, after several years' field experience, experts were not satisfied with the performance of malathion and searched for more efficient insecticides by means of field tests (Regnier

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