Mankind and Civilization at Another Crossroad

In Balance With Nature - A Biological Myth

Norman E. Borlaug

The following has been excerpted from the 1971 McDougall Memorial Lecture delivered at the 8 November Conference of the Food and Agriculture Organization of the United Nations.

"We do not propose to avoid controversy because we believe that differing viewpoints should be heard, but the subject must have biological relevance. We will, of course, publish expressions of opposing opinions." (from editorial, The New Team, *BioScience* **21**:353)

The current vicious, hysterical propaganda campaign against the use of agricultural chemicals, being promoted today by fear provoking, irresponsible environmentalists, had its genesis in the best selling "half-science-half-fiction novel" *Silent Spring*, published in 1962. This poignant, powerful, book – written by the talented scientist Rachel Carson – sowed the seeds for the propaganda whirlwind and the press, radio and television circuses that are being sponsored in the name of conservation today, but which are to the detriment of world society, by the various organizations making up the environmentalist movement.

It is both sad and unfortunate that *Silent Spring* was the last book which was written by this gentle, great scientist and authoress. She had previously contributed so much to the understanding of the beauties of nature in the best sellers *Under the Sea Wind* and *The Sea Around Us.*

Silent Spring was not typical of her gentle, kind nature. It was a diabolic, vitriolic bitter one-sided attack on the use of pesticides, especially insecticides and weed killers. DDT was the main villain. She made no mention of the importance of DDT in protecting our food and fiber production. What was even worse was that she made no mention of the great contribution of DDT in bringing malaria – one of the worst scourges of mankind – under control.

Silent Spring has become the Holy Writ of the environmentalist movement. This distorted, oversimplified book of biologic half-truths is now required reading in many high schools, thanks to the influence of our environmentalist organizations. Rachel Carson has become a martyr.

The moving forces behind the environmental movement today include The Sierra Club, National Audubon Society, Isaac Walton League, The Boone and Crockett Club, and the new legal arm of the movement: The Environmental Defense Fund, with its scores of lawyers baptized into the movement with the motto "Sue the Bastards." The principal individual supporters of the movement are wilderness explorers, bird-watchers, wildlife lovers, ill informed press and television personalities and confused youth and older members of society who have been frightened so badly by the doom sayers that they have joined. Although the collective active membership in these organizations is perhaps less than 150,000, their superb organization and tactics make them as extremely effective force in lobbying for legislation to ban pesticides, and for brainwashing the general public. The propaganda and lobbying tactics being used today by the environmentalists are very similar to the tactics that were used effectively in lobbying for wildlife legislation by Hornaday and Grinnell during the first two decades of this century, judging from Graham's description of their efforts. The righteousness of their cause seemed – in their minds – to justify whatever questionable methods were needed, such as over-exaggeration and half-truths for furthering their cause. History repeats itself today, but it is being done even more flamboyantly.

The scare tactics used by The Environmental Defense Fund, based on bits of unsubstantiated scientific data, questionable ethics, emotion and oratory has been used very effectively for raising funds and gaining support for their battle against DDT. One of their advertisements in The New York Times – on Sunday March 29, 1971 – headlined "Is Mother's Milk Fit for Human Consumption?" was especially effective. It stated that DDT had been found in mother's milk. No mention was made of the fact it was present at very low levels. Of course no mention was made of the fact that caffein, nicotine or alcohol in small quantities might also be present in mother's milk when she drinks coffee, smokes cigarettes or drinks cocktails. Nevertheless, the report of detection of DDT in mother's milk provoked indignation and brought in much financial support.

Previously, both the Environmental Defense Fund and the National Audubon Society had stated that DDT causes cancer, even though the Surgeon General of the U.S. Public Health Service has stated: "We have no information on which to indict DDT as a tumorigen or carcinogen for man and, on the basis of the information now available, I cannot therefore conclude that DDT represents an imminent health hazard".

The gravest defect of *Silent Spring* was that it presented a very incomplete, inaccurate and oversimplified picture of the needs of the interrelated world-wide complex problems of health, food, fiber, wildlife, recreation and human population. It made no mention of the importance of chemicals such as fertilizers and pesticides for producing and

Norman E. Borlaug is the Wheat Program Director, CIMMYT, Mexico and recipient of the Nobel Prize for Peace, 1970.

protecting our food and fiber crops. Nor did it mention that by producing more food per unit of cultivated area more land would be available for other uses, including recreation and wildlife. Certainly the greatest inexcusable error of omission was that of neglecting to mention the valuable role DDT has played in bringing malaria under control in many countries.

Silent Spring convinced the general public that the use of pesticides – and especially DDT – was upsetting the "balance of nature" and was doing great damage to wildlife, especially birds and fishes. It implied that a number of species were facing extinction because of its use. Moreover, it left the impression that agriculture really did not need insecticides if it changed its methods. It indicated that farmers by adopting a system of extensive mono-culture, have made their crops more vulnerable to pests than necessary. According to this expert, farmers have compounded their errors more by applying insecticides in attempting to kill insect pests and in the process have generally only killed off the predators, parasites and pathogens that normally kept the insect under control, and thereby only further upset the "balance of nature." Moreover, according to the author, insects have invariably soon developed resistance to the insecticide. It implied that, by shifting to other suitable insect control measures already available, that the losses from insects could be kept under control without chemicals. Let us examine this general hypothesis:

The Parade of the Species

I am in complete agreement that we should try to preserve all forms of wildlife as part of our heritage, as far as it is possible to do so. On the other hand, let us not become egotistical to the point of assuming supernatural powers. A glance at the book of rocks tells us of the impotency of many species, including man against the forces of nature. Yet it is incredible that only a few, if any, of the leaders of the current environmentalist movement have studied paleontology and the "parade of the species", in the geologic past. Spencer estimates that 99% of all the species that have lived, since the candle of life was first lit on the planet earth about 3.2 billion years ago, have flunked the adaptation imperative: "evolve or perish", and consequently have now become extinct.

The implied command: "evolve or perish" has been an unwritten natural law from the beginning of time. It is equally evident in the physical and biological world. Astronomers tell us change is a universal phenomenon throughout the cosmos. The process of physical change is most evident within our own solar system and especially on our planet Earth. Long before there was life on earth there were countless physical changes in the earth's crust. Repeatedly mountains were built through volcanic action or by physical shifts in the earth's crust. The mountains in their turn were eroded away and the debris deposited elsewhere as sedimentary rock. The oceans invaded and inundated what was once the land only to in turn recede again. Physical changes, of course, continue to reshape the planet Earth to this day.

The multitude of changes in the physical features of the earth, as well as in our solar system itself, have repeatedly greatly modified the environment of the earth. Climates have changed time and again in many parts of our world. Vast areas that once possessed tropical climates have subsequently been covered by continental ice sheets. Areas that once were blessed with heavy rainfall have become desert and vice versa. These changes in environments have, in turn, exerted strong selection pressure on the evolution of all forms of life.

There are undoubtedly many subtle changes being exerted on the environment of the planet today that are beyond the influence and control of man. Man too, however, is exerting strong influence on the environment. The composite effect of the present day selection pressure of the environment, affected both by natural and man influences, will undoubtedly continue to take its toll of some species that are poorly adapted to the current world environment.

Rhodes, Zim and Shaffer estimate that there are at present approximately 1,100,000 species of animals, many of them very simple forms, and 350,000 species of plants that currently inhabit the planet Earth. Of these, the United States Fish and Wildlife Service in 1966 listed 33 species of mammals, 49 species of birds and 9 species of reptiles and amphibians, and 38 species of fish in the USA, which were either rare or endangered. In discussing the causes for reduction in numbers and possible disappearance of these 129 species, the destruction of the habitat and disturbances resulting from man's activities were paramount. Pesticides were mentioned as possible contributing factors in only two cases. In the past three or four years there has been much propaganda, but little convincing scientific evidence, put forward by environmentalists indicating that DDT has contributed to the decline of the Bald Eagle, Peregrine Falcon, American Osprey and California Condor. One does not need a thin egg shell hypothesis due to DDT to explain the reduction in the population of these species. The truths of the matter is that many ornithologists had reported on the reduction on populations of these large birds of prey as far back as the 1880's and 1890's, long before the time of DDT. It is almost a forgone conclusion, for anyone who uses some common sense, that one or more of these species is about to flunk the imperative "evolve or perish". His habitat is being destroyed by the encroachment of man. Protective legislation alone will not, in the most cases, be adequate to save them. Dynamic research, propagation and good sound game management might do so, providing human population pressures on their habitat are not too great.

Although it is generally the long time continuing effects of changes in the environment which exert its effects on the evolution and survival or the extinction of a species, there are many other changes in the environment that effect the more short term "balance of nature," among the many species in a given habitat or ecosystem. These are the seasonal shifts we are concerned with in producing and protecting our crops or animals. The cliche "in balance with nature," which is in common usage today by modern day environmentalist is very misleading. It implies we would have a favorable "in balance with nature" to assure the protection of our crop species if the "balance of nature" were not upset by man. This, of course, is not true. Nor is there in existence a single in balance with nature ecosystem. Rather there is, within a given area, an infinite number of local and many merging more extensive ecosystems. None of them are in static equilibrium. They are in a constant state of dynamic change, responding to the changes in the environment. At different times, the selection pressure provoking change is drought, floods, frosts, heat, insect or disease attacks, or invasion of the habitat by other species.

Early in my career as a forester working in a large primitive or wilderness area completely isolated from the influence of man, I learned of the fickleness of nature. I have seen 20 forest fires ignited by a single "dry thunder (electric) storm." Some of these fires started by lightning destroyed or damaged vast areas of several forest types (ecosystems). In the same area I have seen 10's of thousands of acres of lodgepole pine killed by *Dendroctonus* spp., infestation. The havoc done by the Dendroctonus beetle should not have happened according to some pseudo-ecologists, for it was, after all, a native insect pest with its entire army of natural predators, parasites and pathogens, and consequently should have been "in balance with nature."

Many times I have seen attempts made to grow cotton without the use of insecticides in the native home of the boll weevil in Mexico where all of the native predators of this insect were present. The results were disastrous. Similarly, I have observed cotton grown without insecticides in West Pakistan, the native home of the pink bollworm, with all of its natural predators and parasites present. In this case also the results were disastrous. In fact, in both of the cases it was difficult to tell from casual observation whether the cotton was being grown for the production of fiber to cloth man or for the production of feed for a native insect. Nevertheless, in both cases there should have been, according to our environmentalist jargon, an "in balance with nature" equilibrium.

I must also point out that modern agriculture – with 3.7 billion people demanding food and fiber – has no choice but to grow extensive areas to a single crop in areas ecologically best suited to the culture of that crop. This was not true 5000 years ago when there was less population pressure so that crops could be grown in small isolated fields. Nevertheless, we must also recognize that mother nature, even before civilized man, sometimes took the initiative of establishing 10's of thousands of acres of even aged single species stands of douglas fir, redwood, lodgepole and jack pine stands. Most of these pure stands ("mono-cultures" to the new environmentalists) were, of course, postfire types.

It, therefore, becomes abundantly clear that we cannot relay on the biologic control alone to protect our food and fiber crops from the fickleness of nature. If left to mother nature whims, we will harvest only one third or one half of the yield per unit of cultivated area that can be harvested using a modern balanced technological package of practices. Dr. Knipling has clearly indicated that we must, for the forseeable future, continue to use an integrated approach to control the insect pests of man, of the crops and of the animals on which he depends. Insect control is a complex problem for there are more than 200 insects that are or have been important on our main crops, animals and forests. We will need to use an integrated approach to hold them in abeyance. It is true that in the past few decades spectacular control of a few insect species have been obtained with biological, bio-environmental or other nonchemical methods i.e. cottony-cushion scale of citrus, the spotted alfalfa aphid and the screw-worm of livestock in Florida. Someday it may be possible to use alternate non-chemical methods to control many of the insects responsible for the most severe crop and animal losses, but that day, if ever attainable, lies far in the future. Today, however, conventional insecticides are needed to control 80 to 90 percent of the insect problems affecting agriculture and public health. Meanwhile, research to find new techniques and methods, must be strengthened. Present control programs must be designed to take advantage of the best materials and techniques available so as to reduce losses to an acceptable level.

The control methods that are now being studied or used on different insects include: 1) the use of natural predators, parasites and pathogens, 2) the breeding of resistant varieties – which may provide long time protection against some species, but may be ephemeral against other species which have great genetic variability combined with many generations per year, 3) the genetic male sterile technique developed by Knipling, which has proven highly effective in controlling the screw-worm, and shows promise now on a number of other species, 4) the use of attractants, both sex and food, 5) use of traps, i.e., light and sound, 6) development of hormones to interfere with life cycles, 7) improvement of cultural practices, which have been long used effectively in reducing losses from species, and 8) the development of better biodegradable insecticides that will effectively combat the target species without doing damage to beneficial insects, to wildlife or to man.

What does this have to do with the controversy over the use of DDT in the USA?

As Knipling has pointed out, today in the USA conventional insecticides are still required to control 80 to 90 percent of the insect problems affecting agriculture and public health. The use of DDT in the USA has gone down greatly in the past five years, since other more effective controls have become available. It is still, however, used extensively in the south and southeastern part of the USA on cotton insects, especially on the boll weevil.

The environmentalists would now like to have a legislative ban placed on DDT so as to prohibit it for any use in the USA. Almost certainly as soon as this is achieved, these organizations will begin a worldwide propaganda barrage to have it banned everywhere in the world. This must not be permitted to happen until an even more effective and safer insecticide is available, for no chemical has ever done as much as DDT to improve the health, economic and social benefits of the people of the developing nations.

The World Health Organization (WHO) with the assistance of the Pan American Health Organization and the United Nations Children's Fund (UNICEF) in 1955 launched a worldwide campaign against malaria, based on spraying the interior of all houses with DDT, so as to kill the Anopheline vector and break the cycle. Of the 124 countries and territories in the tropics where malaria has existed, the disease has been eradicated from 19. There are 48 other countries in which eradication programs are in progress and an additional 37 where extensive control programs are underway. There remain only 20 nations in malarial areas where no programs have yet been initiated.

There is also dramatic evidence from Ceylon of what can happen if a program is stopped before eradication is accomplished. When the campaign was initiated in the mid 1950's there were more than 2 million cases of malaria in Ceylon. By 1962 it had dropped to 31 cases and by 1963 to 17, at which point the spray program was discontinued for budgetary reasons. By 1967 the number of cases had jumped to 3000 and by 1968 to more than 16,000. Before the

programs could be reestablished, in late 1969, 2 million cases had reappeared.

In summarizing the progress in this World-Wide Malaria Campaign on February 2, 1971 officials of WHO made the following statement:

"More than 1,000 million people have been freed from the risk of malaria in the past 25 years, mostly thanks to DDT. This is an achievement unparalleled in the annals of public health. But even today 329 million people are being protected from malaria through DDT spraying operations for malaria control or total eradication.

The improvement in health resulting from malaria campaigns has broken the vicious circle of poverty and disease resulting in ample economic benefits: increased production of rice (and wheat) because the labor force is able to work; opening of vast areas for agricultural production: India, Nepal, Taiwan and augmented land value where only subsistance agriculture was possible before.

The safety record of DDT to man is truly remarkable. At the height of its production 400,000 tons a year were used for agriculture, forestry, public health, etc. Yet in spite of prolonged exposure by hundreds of millions of people, and the heavy occupational exposure of considerable numbers, the only confirmed cases of injury have been the result of massive accidental or suicidal swallowing of DDT. There is no evidence in man that DDT is causing cancer or genetic change."

Although more than 1400 chemicals have been tested by WHO for use in malarial campaigns, only two have shown promise and both of these are far inferior to DDT.

Despite the wild rhetoric of the environmentalists about the DDT pollution of the world, its getting into the food chain, and causing untold damage to both human and wild life, as more and more scientific evidence accumulates, the charges against DDT become less and less convincing. There, of course, is evidence that man and most species of birds, fish and animals that have been examined have small quantities of DDT and/or other related compounds such as polychlorinated biphenyls in their fat. But there is very little convincing evidence available to date which indicates that it is threatening the existence of any species, nor is it causing any discernible injury to man.

Part of the past confusion concerning pesticides in the environment derives from the tremendous improvements that have been made in recent years in chemical analysis. Prior to the development of gas chromotography in 1956, the level of detection of many compounds with the paper chromatography was 1 ppm. With gas chromatography it became possible to detect 1 or 2 parts per billion, or even a few parts per trillion, both of which, of course, would have gone unnoticed 20 years ago. But such sensitive methods can also detect contaminants and in the hands of inexpert operators may lead to wrong conclusions. The environmentalists have used detection to such trace amounts to mount scandalous propaganda campaigns against DDT. A recent article by Dr. Thomas H. Jukes, a reputable biochemist, emphasizes this dilemma:

"How reliable is the test? There is a delicate analytical procedure called gas liquid chromatography with electron capture. Sometimes I wonder whether this method in the hands of inexpert people has done more harm than good. There has been a great hue and cry over alleged traces of DDT in the Antarctic penuings, amounts of the order of 1 or 2 parts per billion. I have not yet been convinced by the validity of these results. A few months ago at the University of Wisconsin, some soil samples that had been sealed since 1910 were tested for synthetic organochlorine pesticides by the latest most delicate gas chromatographic procedure. Several pesticides were detected in 32 of the 34 samples. The only flaw was that these pesticides not only were not used in 1910, they did not even exist until 1940. Another complication is that the residues of a class of modern compound called polychlorinated bi-phenyls (PCBs) interfere with the DDT test. The PCBs are used in water-proofing compounds, asphalt, waxes, synthetic adhesives, hydraulic fluids, electrical apparatus and general plastics. They are widely distributed in the fat of wildlife species, in which they have originated as industrial wastes taken up by aquatic species. They overlap in the tests with DDT and its metabolic breakdown products, DDD and DDE. PCBs are sufficiently toxic to kill fish in hatcheries. To sum up, PCBs are not used as pesticides, but they interfere with pesticide residue analysis and they are toxic. Thus I do not believe the stories of newspaper scientists about pesticide residues until they have been published in the scientific literature, scrutinized and reliably confirmed."

Another complicating factor in identifying the origin of chlorinated hydrocarbons in human, animal, bird or fish tissue is that many thousands of tons of chemical wastes of all kinds have been and are still being dumped into the oceans. Do not some of these also get into the food chain, even if they still have not got into the "hysterical word chain?"

DDT the First of the Dominoes

It is now obvious that the current aim of the Environmental Defensive Fund and its affiliated environmentalist lobby groups is to ban DDT, first in the USA and then in the world if possible. *But DDT is only the first of the dominoes.* But it is the toughest of all to knock out because of its excellent known contributions and safety record. As soon as DDT is successfully banned, there will be a push for the banning of all chlorinated hydrocarbons, then in order, the organic phosphates and carbamate insecticides. Once the task is finished on insecticides, they will attack the weed killers, and eventually the fungicides. As a matter of fact, by default, they have already been successful in having organic mercury seed disinfectants and slimcides for papermills banned. This ban was achieved during all of the confusion resulting from finding mercury in fish, first in fresh water species, in the Great Lakes, and rivers of the USA, and subsequently in both tuna and swordfish. The ridiculousness of some of this rhetoric came to light recently when someone analysed tuna caught 90 years ago and found it contained about the same level of mercury as those caught today. Moreover, it has been shown that swordfish recently caught in ocean waters hundreds of miles from possible industrial contamination contained 1 to 2 ppm of mercury. This indicates clearly that both tuna and swordfish are picking up the low levels of mercury from the ocean food chains of which this metal has always been a part.

If the use of pesticides in the USA were to be completely banned, crop losses would probably soar to 50%, and food prices would increase 4 to 5 fold. Who then would provide for the food needs of the low income groups? Certainly not the privileged environmentalists.