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A.M.C.A.'S RESPONSE TO THE CURRENT ECOLOGICAL ERA

A PANEL DISCUSSION

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(Summaries prepared by authors)

SOUTH ATLANTIC REGION

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My comments are supposed to represent the situation in the South Atlantic region but will actually be more representative of the situation in Florida than the other states in the area. Alabama has little organized mosquito control. South Carolina, I am told, has had little impact thus far from the Eco-era. Georgia has one very active district, which is patterned after the best of the Florida programs and I will comment on its problems and responses as we go along.

Generally, the policy in Florida is to do as much mosquito control as possible with as little harmful effect on the environment as necessary, an easy thing to say.

This policy was first stated by the Florida State Board of Health (*Florida Health Notes*—Vol. 40—No. 5 written by Dr. Maurice W. Provost), in their definition of strategy in mosquito control operation—"killing mosquitoes at such times and places and in such ways that people get maximum relief for every dollar spent

and lose nothing of value in the obtaining of this relief."

In those early days it was very difficult, however, to practice such strategy because too little was known of the relation between mosquito and estuarine biology to say nothing about the lack of mosquito control knowledge in general. Even so, the same issue of *Florida Health Notes* contains this strong warning issued in 1948, not 1971—"DDT is a poison to many more forms of life than just mosquitoes. So, for that matter, are many other accepted and widely used insecticides. Certain formulations of DDT are highly toxic to aquatic animals such as fish, crayfish, crabs and others. Beyond certain dosages, it can be very toxic to birds and mammals and, finally no matter how used, it is certain to kill many non-mosquito forms of life. And yet, in spite of all this potential for serious damage, if used properly in mosquito control, DDT can be as safe as any insecticide used against corn-borers,

boll weevils, tobacco worms or other unwanted insect pests. The danger is definitely there, and the anxiety of conservation interests over the broadcast use of DDT is appreciated."

These definitions and statements express the overall attitude of mosquito control workers in Florida toward the problem of mosquito control conflicts with conservation, whether it be in the estuarine area, or elsewhere.

Naturally, there have been some deviations from these ideal policies—persistent and highly toxic insecticides were broadcast on the salt marsh—hydraulic dredging and filling of salt marches was practiced. These shortcomings were eliminated, however, for biological and economic reasons, if not for those of conservation alone.

Today the practice of mosquito control in estuarine areas generally follows the policies set out in 1948. The use of insecticides in the salt marsh has been restricted to paris green in the form of paris green granules, developed by the State Board of Health, and to low volume oils.

Insecticides for adulticiding are now restricted to three—fenthion, malathion or naled. Mosquito control districts are directed by the Division of Health to apply these insecticides in certain approved ways and never to dispense these materials over the salt marshes or breeding areas.

Marsh management today in estuarine areas is performed in two main ways—ditching and impounding (diking and flooding). Hydraulic dredging was used in three districts for a number of years but has been discontinued and the equipment sold.

Although only in the past two decades has the role of the estuarine area become understood, the role of a ditching system or minnow access system in the upland salt marsh can hardly be expected to be anything but beneficial to the ecosystem.

Diking and flooding, on the other hand, present problems which can be serious. Plant and animal life is affected adversely by continuous flooding and/or deep flooding—access to the marsh by certain fish dependent on the marsh is sometimes

denied. Ecological changes affect the bird life in the marsh, some for better, some for worse. The effect on economic invertebrates is unknown, or little understood.

Before mosquito control agencies in Florida can manage impoundments to minimize the effects they can cause in the estuarine system, they must be given a scientifically based management plan. Water management in a salt marsh impoundment for mosquito control is a simple and flexible technique. All that is needed is a study of the problem, but a study with funds other than those supplied totally by mosquito control.

Many examples of cooperation between mosquito control agencies and conservation groups exist in Florida. To name a few instances, I cite the following.

IN VOLUSIA COUNTY: A cooperative study of the impounding of the Tomoka marsh to enhance its beneficial biotic potential while controlling mosquitoes.

IN BREVARD COUNTY: Establishment and maintenance of a 58,000 acre refuge on NASA land which is 95 percent mosquito control impoundment—an effort to restore the salt marsh habitat of the dusky seaside sparrow within the impoundment system of the mosquito control district.

IN INDIAN RIVER COUNTY: A cooperative study of the effects of flooding on mangrove in salt marsh impoundments—a cooperative effort on the part of many, including the mosquito control district, in the establishment and preservation of the Pelican Island Wilderness area.

IN ST. LUCIE COUNTY: The setting aside, at the instigation of the mosquito control district, of a large salt marsh island impoundment to become a state park—the establishment of the first Nature Conservancy Chapter in Florida led by the former director of the mosquito control district, Mr. Frederick W. Harden.

IN LEE COUNTY: The water management plan on Sanibel Island which not only controls mosquitoes but provides ideal wildlife areas as well as a fresh water supply for the island.

IN CHATHAM COUNTY, GEORGIA: A three

year study of the effect of ditching in their salt marshes—an investigation of the program by Nader's Raiders which yielded either favorable comments or no comments at all.

IN ALL OF THE CONTROL DISTRICTS ON THE UPPER WEST COAST AFFECTED BY DOG FLIES: A switch from DDT to methoxychlor for the treatment of onshore breeding areas.

FOR THE ENTIRE STATE: A new cooperative program in which all marsh management projects will be presented to the Florida Dept. of Natural Resources for study, recommendation and approval before approval is issued by the Division of Health for construction.

FOR THE FLORIDA ANTI-MOSQUITO ASSOCIATION: A new position paper which reaffirms our concern for the environment.

As time passes the policy in Florida, in all activities, toward estuarine areas is changing from one of indifference to one of great concern. Florida mosquito control agencies have shared this concern for years and have demonstrated it by deed as well as word, and consequently have had little or no trouble and expect none now.

The final paragraph of the same publication of *Florida Health Notes* referred to above is a summary, which, written in 1948, is prophetic of today's sentiments concerning the pest mosquito problem in Florida.

"We are told that this is a great country and Florida is a great state. Promotionists may tell us and tell everybody that mos-

quito-control will make Florida an even greater state. But there's an old, old story about a certain goose having laid a golden egg which apparently recent generations of Americans have never heard. These words may sound caustic to those for whom they were admittedly meant to be so, but to the majority of Floridians they are solely words of warning. One of the reasons why America is great is that this is one country where almost anything can be done—for a price. But the real price is too often something far more valuable than money: the natural resources which are the one and only Godgiven, material inheritance of generations unborn. The price of too many industrial and community expansions in Florida has been pollution of waters of great importance to industry and communities. Here is the goose and here is the egg. In like manner, the price of mosquito-control can be the pollution of land and water, for insecticides used excessively are, in every sense of the word, pollution. Thinking people, while granting mosquitoes are undesirable, will also see beyond the mosquitoes. They will realize that the infinitely intricate pattern of soil, water, plant and animal which is man's non-man environment on earth has values which dwarf on a grandiose scale the mere elimination of mosquitoes. Therefore they can adopt but one logical attitude toward mosquito-control: It is desirable and yet in the perspective of value and time it must be practiced with utmost care."

NORTH ATLANTIC REGION

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I had originally planned to introduce my remarks by telling you that we have so much ecology in the North Atlantic Region that we package it and sell it to other parts of the country. Actually, a

concern in New Jersey has in fact manufactured a household non-phosphate detergent called "Ecolo-G." However, the State Department of Health recently seized all the "Ecolo-G" in the Company's

warehouse because it was causing rather severe cases of dermatitis among individuals using it.

I think this might serve as an object lesson of what can happen when people become emotionally involved, rather than looking for solutions or answers to problems which are based on sound scientific and technological studies.

In the North Atlantic Region practically all the citizens are self-styled "ecologists"—not ecologists involved with the study of the interrelationships of living organisms and their environment, but rather housewives, school children, teachers, and legislators who have suddenly developed instant expertise in ecology. As a result, over the past few years state legislation has been enacted in several of the North Atlantic States.

Massachusetts was the first to do so when the Pesticide Board was created in 1962. This Board, originally made up of six members and recently (in 1970) enlarged to eleven appointed members, establishes rules and regulations relating to the use of pesticides and conducts examinations for a license required by "any person applying pesticide on the land of another." This exempts agricultural use by farmers. P.C.O.'s are also exempt.

Both Connecticut and Rhode Island, in 1970, banned the use of chlorinated hydrocarbons except "under emergency declaration by the Director." In Rhode Island it is the Director of the Department of Natural Resources. In Connecticut it is the Board of Pesticide Control.

The Water Resources Commission of the State of New York adopted rules and regulations governing the use of chemicals for the control of aquatic insects, effective April 1, 1969. This Bill allows limited use of methoxychlor, malathion, Abate, and Flit MLO for mosquito control use. (More recently, the new Department of Environmental Conservation has been given jurisdiction over pesticides.—Ed.)

The State of New Jersey presently has a bill before the legislators which would endow the Commissioner of Environmental Protection with *one-man* authority to regulate any and all uses of pesticides.

Mosquito control interests have requested an amendment to this bill which would exempt the county mosquito extermination commission, thus, keeping the regulation of pesticides used in mosquito control with the State Agricultural Experiment Station where it has been for the past half-century.

Bills regulating the conduct of water management procedures in tidal salt marshes are in effect in Massachusetts and New Jersey. In both of these states mosquito control work has been exempted, thus allowing the maintenance of salt marsh ditches (some of which date back to the early 1900's) as well as the continued utilization of sound water management techniques in areas of high mosquito productivity.

In Massachusetts, since the late 1950's and in New Jersey since 1968, conservation commissions have been established in many municipalities to conserve the "natural habitat." Many of these commissions, which are composed of lay persons appointed by the municipal governing body, are opposed to both pesticide usage and water management programs for mosquito control. In most instances, the source of guidance to these groups has been the State and National Audubon Societies. Local mosquito control programs in some areas have been successful in working out programs compatible with the interests of these conservation groups; others, I'm afraid, have not been so successful.

So, it would appear that in the North Atlantic Region mosquito control interests have a multi-faceted challenge in (1) meeting the concern of the new ecology of the average citizen; (2) providing a workable program within the limits of present state regulations; and (3) dealing with conservation commissions at the local level.

The title of this panel, "AMCA's Response to the Current Ecological Era," presents an awesome challenge to each and every member of our Association. Legislation, which drastically limits our programs, has already been enacted and more is sure to follow.

As with the case of the detergent "Ecolo-G," some of the replacement materials in our arsenal of mosquito weap-

only have not undergone the laboratory and field testing that the old standbys have. We may find that the replacement material could be of more ecological concern than the material which it replaced.

We must be prudent and cautious. We must consult with and advise those charged with the responsibility of adopting rules and regulations at the local, state, and

Federal levels so that sensible, practical, and useful legislation will be the final outcome. This is not only our responsibility, but an obligation incumbent upon each of us so that at some future point in time we can look back on these days and say this *was* truly an Ecological Era and *not* an Ecological Error.

WEST CENTRAL REGION

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The West Central Region of the AMCA includes the states of Colorado, Kansas, Nebraska, North Dakota, South Dakota, Montana, New Mexico, Utah and Wyoming. The states of Colorado and Utah require licenses for all mosquito control operators. Local Boards of Trustees license operators in Montana. Other states in the region are considering operator licensing.

Colorado, Utah and Wyoming have air and water pollution control boards. USDA pesticide registrations have been enforced in the past on the use of pesticides in Colorado, Kansas, Montana and Utah. An Act of 1970 placed restrictions of economic poisons in the New Mexico State Department of Agriculture. Senate Bill #84 was introduced and passed in the 1971 Utah legislature. This bill provides for the establishment of a pesticide advisory committee.

Most states in the region are experiencing pressures from such groups as bird watchers, women society groups and earth day fanatics. Utah has experienced more pressure from ecologists, beekeepers and milk producers in 1970 than in any other time in the past twenty years. This is mainly due to the extensive mosquito control work being done in the state.

All states in the West Central Region are taking a harder look at pesticides in mosquito control. Most programs will shift control work more along lines of drainage, source reduction and biological control with emphasis on fish. *Gambusia* use in Utah dates back to the year 1928

and the fish are now generally distributed throughout the state.

Fish and game agencies are skeptical on the use of pesticides, but are confident their interests are receiving honest consideration by mosquito control people. Livestock groups generally support mosquito control in the region. However, honey producers are much more vocal against spray operations.

Some research work has been done on the effects of pesticides on other organisms. Mary Bengé, a graduate student at the University of Utah, has just completed a 2-year study on this problem. She concludes, "At the rates which mosquito control districts apply parathion to control mosquitoes there appears to be little if any damage to other invertebrate fauna." Colorado State has also done research along this line.

OUTLOOK FOR THE FUTURE. Chemical spray materials will continue to be questioned and restrictions will become more and more strict. Mosquito control districts in the West Central Region will place more emphasis on programs involving water management, source reduction, habitat modification and biological control. Utah will continue its integrated control programs involving all phases of control. Chemical control will continue to play an important part in the control work in the state. More states in the West Central Region will require licensing of all mosquito control operators.

SOUTH CENTRAL REGION

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The South Central Region consists of the states of Arkansas, Louisiana, Mississippi, Oklahoma, and Texas. Reports from various areas of this region indicate that mosquito control efforts vary considerably. A number of organized control districts do exist (13) but these are mainly limited in location to heavily populated coastal areas. Some of the larger inland municipalities conduct control programs as a function of local health agencies. In most cases, state health departments serve in advisory capacities, coordinating in a general way control activities in their respective areas.

In those states where most control districts exist, Louisiana and Texas, regulation of control activities is quite limited. District directors work mainly with local boards in determining the type of control measures which are to be employed. City and county health officers (Houston and New Orleans) as well as drainage district personnel (Galveston and Jefferson Counties) and pollution control agencies (Orange County, Texas) work quite closely with control districts, coordinating activities where responsibilities are in common. The Gulf States Coordinating Council on Wildlife, Fisheries and Mosquito Control meetings the past few years have served as a useful forum for all groups concerned. "Environmental" groups have as yet presented few problems for control

district activities, possibly because their attention has thus far been directed toward other environmental problems and control district officers have worked well with these groups in the past.

At the present time broad public support of mosquito control efforts in the South Central Region appears to exist. This is probably due to the fact that each control district has done an exceptionally fine job in the area of public relations. Although more interest in control activities is shown now than a few years ago, most district directors seem to have handled complaints and inquiries with little difficulty and with considerable effectiveness.

Control methods employed are based mainly on the use of insecticides applied for adult control. A few districts promote permanent control measures either conducted by cooperating flood control districts, as in several Texas counties, or done by the district itself as in some areas of Louisiana. The alligatorweed flea beetle has been introduced into Harris County, Texas, although this possible biological control method is yet experimental. Most districts are employing LV or ULV procedures or have plans to convert to these methods within the near future. Limited funding, however, has prohibited extensive modifications of control procedures and has permitted only modest research efforts through the years.

SOUTH PACIFIC REGION

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ENVIRONMENTAL IMPACT ON VECTOR CONTROL AGENCIES, RESEARCHERS, TEACHERS, AND INDUSTRY BY THE "NEW" ECOLOGISTS. Questionnaires with requests for

information were mailed to all members of the South Pacific Region of the American Mosquito Control Association.

1. What prohibitions or limitations upon

use of pesticides for mosquito (larval or adult) control?

The general response indicated that there were few or no changes in pesticide usage for mosquito control. A few respondents indicated that there was pressure from an occasional individual or citizen group and in one case, a California State Agency. It was the consensus from respondents in California, that the Pesticide Usage Agreement of agencies with the Bureau of Vector Control and Solid Waste Management, California State Health Department, was useful in responding to attempted prohibitions or limitations.

2. What prohibitions or limitations upon use of pesticides for control of other organisms such as flies, and cockroaches?

Those agencies which are involved in control or recommendations for control of organisms such as cockroaches and flies reported some difficulties in recommendations since so-called hard insecticides have essentially been prohibited.

3. Have official environmental standards in use or recently promulgated affected control practices?

Several respondents indicated that some federal and state agencies are concerned about materials used for mosquito and vector control but have not made outright demands. This problem of official environmental standards is a day-to-day situation since legislation is being promulgated or standards are being adopted by official agencies such as the Environmental Protection Agency.

4. Have legislators influenced program changes or emphasis?

Legislators have influenced program changes particularly in the field of use of herbicides 2-4D and 2, 4, 5T. Actual legislation introduced by legislators has not affected mosquito control agencies to a great extent but has affected agencies such as Health Departments and pest control operators in the control of vectors such as cockroaches and insects such as termites.

5. Have volunteer groups or individuals influenced program changes?

Volunteer groups and individuals have not affected programs of mosquito con-

trol agencies directly. Their total lobbying effect on legislators, however, has been considerable. There are some volunteer groups such as "Friends of the Earth" who apparently have objectives other than just the limitations of the use of pesticides and may cause considerable trouble for all control agencies, no matter what vector or other pest has to be controlled.

6. What voluntary and forced shifts in control technology (physical, biological, chemical) and cost effects have occurred?

Mosquito control agencies have not been affected as much as agencies controlling other vectors and pests since the early development of resistance to insecticides used by mosquito control agencies forced early shifts to pesticides that are not being panned as vigorously as others at this time. The publicity and legislative gambits have been helpful in one way in that they have given control agencies additional leverage either to force or get voluntary cooperation in needful source reduction programs. Several respondents stated that they have changed from materials such as organic phosphates to almost complete use of larvicide oils including materials such as Richfield's Larvicide A, Phillips Annalos 11, and Flit MLO. Publicity has also helped to force greater emphasis and hopefully more funds for biological control and genetic manipulation research.

7. What public education and information actions have you taken?

Several respondents advised that they had been forced into more comprehensive public relations and publicity programs.

8. What is the outlook for the future?

The respondents were optimistic for the future and felt that the "Pesticide Panic" had reached its peak. They felt that other pollution problems such as solid waste disposal and other air and water pollution would occupy increasing time of the "Instant Ecologists."

9. Finally, other comments received:

A good many of the respondents felt that there were some pluses in the shrill

and pervasive attack on use of pesticides. They felt that some farmers who had been careless in use of pesticides would now be more careful, the same as for some pesticide operators in their activities. They, also, felt that this "Pesticide Panic" had

forced official agencies such as State Departments of Agriculture to become worried so that they are now beginning to inform the public in a responsible manner, which is having the effect of counteracting the effects of the "Instant Ecologists."

MID-ATLANTIC REGION

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Sincere documented concern for the decline in the quality of the environment has been a fundamental guideline for mosquito control practices. In general, the use of DDT and other persistent insecticides was abandoned long before any legislation that required their demise. However, it is of interest to note that Delaware has no state pesticide regulation laws; Maryland passed a strict pesticide law in 1970, limiting the use of "hard" pesticides. Virginia passed a new law in 1970 that limited the use of persistent insecticides such as DDT, and North Carolina, although no laws presently exist that restrict the use of persistent materials, has made it a mosquito control policy to eliminate these kinds of materials. Delaware has not employed DDT for mosquito control during the past nine years.

In general, most states within the AMCA Middle Atlantic Region do not follow any specific outside environmental standards, although the region will no doubt receive direction or influence from the new federal Environmental Protection Agency (EPA).

States within the region stress permanent water management practices such as ditching and impoundment. These accomplishments are evidence of a large scale contribution to the conservation effort. Over 17,000 acres of coastal wetlands have been impounded. These practices have contributed substantially to raising the quality of the environment.

In view of the human population explosion, mosquito control is linked irrevocably with the struggle to maintain our extravagant life style and its concomitant pollution problems. We have long observed that increased organic enrichment of the environment and the need for mosquito control are often positively correlated. Water pollution causes listed, in the order of their importance are: (1) chemical effluents from industry, (2) sewage and domestic waste disposal, (3) thermal pollution and (4) bottles, cans, and other trash. Mosquito control practices do not contribute to these sizable problems.

In the Middle-Atlantic States Region, individuals rather than organized groups of citizens are often the source of opposition to mosquito control operations. It is often a case of "people are down on what they are not up on." It is easy for anyone to become an "instant ecologist," but ecology goes well beyond the stage of being descriptive biology. Ecologists not only name plants and animals but attempt to quantify their relationships in the many biotic communities. Actually, professional ecologists have often supported mosquito control measures. However, the viewpoint of dissenters is given full consideration and much effort is directed towards creating a better informed public.

It is evident that suppression of mosquitoes is considered in terms of the total environment in the Middle-Atlantic States Region. Resources, which include two of

the largest estuaries in the world, are our concern. Although the future is bright, many problems may arise from increased human demands placed upon our wet-

lands. Most of us are under no illusion regarding the costs and the difficulties posed, or the tremendous opportunities for contributing to human welfare.

NORTH CENTRAL REGION

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The states within the North Central Region of AMCA are deeply involved in many aspects of the national controversies concerning pesticides. The major issues in our area include all types of pesticide chemicals, not just those used in mosquito control operations. Mercury pollution in Lake St. Clair, and DDT and other persistent pesticide residues in the Great Lakes and their river tributaries are examples of the more widely publicized problems that have occurred in this area of the country. As a result of these and other more localized controversies the issues associated with protecting the quality of our environment have attracted many organized groups and individuals who are concerned, and sincerely interested in attempting to initiate and support programs designed to remedy these problems. Included in these groups are wildlife conservationists, student activists, private citizens' committees and state, local and national political figures.

Concurrent with the growing concern and awareness of pesticide pollution problems has been an increase in the needs for effective mosquito control programs throughout most of the North Central Region. Mosquito-borne diseases such as California encephalitis and dog heartworm appear to be increasing both in incidence and distribution throughout much of the area. The expanded development of recreational areas and the more intensive use of existing outdoor recreational facilities expose increasing numbers of people to the mosquito problems each year. The general movement from urban to suburban areas has markedly increased the numbers of people living in areas without adequate

control programs. There are relatively few organized mosquito control programs in our area of the country. Only Illinois, Ohio and Minnesota have State enabling laws for mosquito control. Indiana, Michigan, Minnesota and Ohio have some local vector control programs but none on the state level. Much of the control work in these states is done by individuals and locally hired pest control operators.

In our area we now have something of a paradox. On the one hand we have groups and individuals who, in the most extreme cases, are advocating complete cessation or drastic reductions in the use of nearly all pesticides. On the other hand we have an increasing clamor for the control of mosquitoes that are producing both pest and health problems throughout much of the North Central Region. Needless to say, there are many activities associated with both viewpoints but one example will illustrate some of the more positive results produced thus far.

In 1969 the governors of the states bordering the Great Lakes formed the Five State Interdisciplinary Pesticide Committee. Each state delegation consists of four individuals representing Agriculture, Public Health, Natural Resources and Water Quality, and the specific charge of this committee is that it coordinate pest control activities of the five member states. Their accomplishments to date are both impressive and significant: Collecting of firm information on the extent of pesticide use in the Great Lakes area with plans to update this information annually; encouraging the governors of their states to establish and *fund* monitoring programs to

determine pesticide levels, including polychlorinated biphenyls, in the stream tributaries of the Upper Great Lakes; and sponsoring a pesticide symposium, "Background for Decision," to provide the officials in their states with factual information concerning pesticide problems. Perhaps most significant is that they have proven that disciplines with divergent viewpoints can deal objectively with environmental issues related to pesticide use in their areas of professional interest.

In looking to the future it appears quite likely that there will be a continuation of efforts to curtail the use of certain pesticides in our area and that formal legislation will be passed to achieve this. Michi-

gan, for example, has drastically curtailed the legal uses of DDT and it seems quite certain that this type of action will be repeated in other states. Legislation almost certainly will be forthcoming to establish or extend the licensing requirements for pesticide applicators in some of the states. Bills for this purpose have been passed or are being considered by a number of our state legislatures. Increasing disease and pest problems will stimulate public support for mosquito control programs. The best interests of the public will be served if these programs are directed and conducted by well organized and efficiently operated control organizations, either governmental or locally organized.

LATIN AMERICA-CARIBBEAN REGION

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In this region, where the populations are still threatened by such vector-borne diseases as malaria, yellow fever, Chagas disease and encephalitides, public health and other government authorities have opted for direct, positive protection against these known health hazards while still weighing the possible long-term consequences of environmental contamination by residual insecticides. According to data kindly provided by the Pan American Regional Office of the World Health Organization (W.H.O.), selective and limited application (principally intradomestic) of residual insecticides is continuing in the already-established programs.

In 21 countries of the region, formal anti-malaria programs are still in operation, and most of them apply residual insecticides to the inner surfaces of houses at 6-month or shorter intervals to interrupt transmission by potentially infective mosquitoes. As early as July, 1970, the Ministry of Health and Welfare of the Government of Mexico announced its decision to continue the use of DDT as the insecticide of choice in its malaria program,

and cited the report of the W.H.O.'s Executive Council to the effect that DDT's advantages far outweighed its hazards. In Nicaragua, where anopheline resistance to DDT has proved serious, extensive substitution of malathion has occurred; propoxur has been used or programmed for El Salvador, Guatemala, Honduras, Nicaragua and Venezuela. Mass drug administration is used as an alternative or supplement to intradomestic mosquito adulticiding in Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Haiti (in the past), Honduras, Panama and Venezuela. The malaria programs of Guayana, French Guayana and Surinam have made extensive use of chloroquinized or amodiaquinized salt. Limited larviciding has been accomplished in Nicaragua and Haiti, and small swampy areas in Haiti have been drained.

In the campaigns in the region against *Aedes aegypti*, only Mexico, Cuba and El Salvador are still using chlorinated hydrocarbons for intradomestic spraying or perifocal or focal treatment. Programs in 20 other countries have changed to malathion, Baytex or Abate, based on evidence

of resistance of *Aedes aegypti* to the chlorinated hydrocarbons.

Several countries with serious Chagas disease problems carry out spraying campaigns against Triatomidae in houses and some outbuildings. The residual insecticides used are dieldrin and/or BHC.

The only extensive aerial application of a residual insecticide as a public health measure was the ultra low volume spraying of malathion (3-6 ounces per acre) in Ecuador in 1968 as an anti-mosquito

measure during an outbreak of equine encephalitis.

From the above it is evident that the general regional reactions to the rare instances of any environmental contamination clamor have followed the policy postulated by the World Health Organization: the minimal hazards which might be attributable to the highly selective (mainly intradomiciliary surface) applications of residual insecticides are far outweighed by the important and documentable public health benefits derived from such use.

NORTH PACIFIC REGION

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There is no doubt in the minds of pest control personnel of the North Pacific Region of AMCA, that the ecological pressure is being applied more heavily every day. In too many instances this pressure is being applied by self appointed experts with ecological knowledge and background perhaps obtained by reading the definition in Webster's *Collegiate Dictionary*.

Attempts by legislation to control the application of the persistent insecticides such as DDT, have in most instances resulted in a watered-down descriptive list of the uses for same, and allowing use of DDT in vector control at the discretion of the local health officer. Both Oregon and Washington now have legislation suggestive of the foregoing statements. In most instances throughout this region, however, vector control and mosquito control officials have taken it upon themselves either to eliminate entirely the use of DDT and other persistent chlorinated hydrocarbons or limit their use to emergency applications only.

Inasmuch as "DDT" has become a common household word and most readily thought of by those with either limited or no expertise in the field of pest control, it is the one chemical upon which most attention is focused. We have observed

with horror the indiscriminate use of the rodenticide 1080 on thousands of acres of burned over land without so much as warning the public of the dangers of the poison, or consideration given to ecological damages that could be created in the particular watershed where applied.

In many instances throughout the region, control operators have introduced natural predators of the mosquito. *Gambusia* are now accepted and used extensively throughout the state of Oregon in all areas where they can survive temperatures and pollution in millponds. British Columbia has been attempting for the past year to introduce them within the Province for natural control but they still have not received the sanction of the Fish and Wildlife Branch. They are, however, still pursuing their introduction and acceptance.

Legislative controls have been put into effect in Oregon and Washington aimed at controlling the application of pesticides. This legislation is requiring the licensing of pesticide dealers and applicators. This license requirement includes licensing of various governmental subdivisions active in the field of application, and requires training in the application and formulation of pesticide compounds. We feel this

legislation will reduce the many instances of misapplication and mistakes which have occurred in the past, resulting in drastic ecological changes within some of our communities.

We here in this region feel the outlook for the future is good. Already the pressures brought about by our large population of budding "ecologists" have allowed us to seek and obtain the support necessary from the public for the expenditure of larger sums of money for the permanent control work (drainage etc.) that we have always known was necessary to eliminate mosquitoes permanently, rather

than for efforts to control them season after season with increasingly toxic pesticides necessitated by development of resistance in the insects.

We, in the North Pacific Region, like to feel that we took the lead, before the "Ecology Era" began, in seeking better methods of controlling pests without changing the ecology of the area.

We also feel the "newly discovered" thing, ecology, can help us in creating a better environment in which to live, if we use, train, and educate these ecologists to do their share physically rather than just verbally.

CANADA REGION

A. S. WEST

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In general, the impact of the current ecological era on biting fly control has been much the same in Canada as in the United States. We have had our share of emotional pronouncements, hastily enacted legislation (which perhaps fortunately in some cases has not been rapidly implemented), and formation of "instant ecologist" groups which would denounce all use of pesticides.

Knowledgeable authorities recognize that for the present we must continue to depend upon insecticides for the control of biting flies. This dependence in the face of mounting opposition has posed a problem. As in the United States we have until now neglected our responsibility, to stand up and be counted, to provide a clear, unbiased statement of the pesticide-environment situation.

Very recently the Entomological Society of Canada has published¹ an objective

appraisal of the pesticides-environment situation which "analyzes the problem, places it in perspective and proposes short-term palliatives and long-term solutions to it."

Currently, biting fly control in Canada suffers from the fact that no federal government agency has a responsibility for research and development in this area. Such studies as are being carried on are done by a few individuals scattered across the country in government laboratories and in universities.

A fair assessment of this scattered effort is that collectively it seeks to improve chemical control techniques so as to limit the impact on the environment to the extent possible. More attention is being paid to the effects of pesticides on non-target organisms. The potential of alternatives to chemical control is recognized, but from a practical standpoint it is realized that the extensive replacement of chemical control methods is a long way off.

Looking to the future it can be predicted that demands for biting fly control

¹ Copies may be obtained by writing to D. G. Peterson, Secretary, Entomological Society of Canada, K. W. Neatby Bldg., Central Experimental Farm, Ottawa, Ontario.

will increase as the development of the Canadian north continues. It is expected that regulation of control will become more strict, that probably proof of the need of control may be required, and that some monitoring of the effects of chem-

icals on the environment may become an integral part of control operations.

The awakening public response to the current ecological era has been a sudden education for entomologists. It is now our responsibility to educate the public.

THE RELATIVE EFFECTIVENESS OF MALATHION THERMAL AEROSOLS AND GROUND-APPLIED ULV AGAINST THREE SPECIES OF MOSQUITOES¹

R. T. TAYLOR AND H. F. SCHOOF

Recent studies by Mount *et al.* (1968, 1970) indicated that ground-applied ULV aerosols were at least as effective as high volume thermal aerosols against *Aedes taeniorhynchus* (Wiedemann). A particle size of from 11 to 16 microns, mass median diameter, was important in obtaining effective kills. Anderson and Schulte (1970) reported that an air pressure of 3.0 to 3.5 psi at flow rates of 2.85 to 3.0 fl. oz./min. would produce this optimum particle size. In Savannah, Georgia, in 1970 tests were conducted with comparable equipment against three mosquito species in open and wooded areas.

METHODS AND MATERIALS. The test area was previously described by Taylor and Schoof (1968). The thermal aerosol applications were made with a Leco 120² fog generator; a Curtis 55,000 cold aerosol generator modified with a Leco ULV nozzle head was used for the ULV treat-

ments. Malathion thermal fogs were dispersed at 85 fl. oz./min. (6 fl. oz. malathion/gal. No. 2 fuel oil) at a vehicle speed of 5 mph and 170 fl. oz./min. at 10 mph. ULV aerosols of 95 percent malathion were dispersed at 1.7 to 10.0 fl. oz./min. at the same vehicle speeds. The nozzle of the thermal fogger was set at a slight angle down and away from the vehicle, but the ULV nozzle was directed at a 45° angle up and away from the vehicle.

Treatments were made in the evenings just after sundown. The line of travel of the vehicle was 1,300 feet, with a running time of 1.5 min. at 10 mph and 3.0 min. at 5 mph. Prevailing southwest winds of from 0 to 5 mph allowed the aerosols to drift over the test area. During the test period, average temperatures and relative humidities were 82° F and 80 percent. Caged *Anopheles albimanus* (Wiedemann), *Aedes taeniorhynchus* (Wiedemann) and *Culex pipiens quinquefasciatus* (Say) (approximately 100 females/cage) were suspended 6 feet above the ground along three blocks 270 feet apart. Cages in the open area were 150, 300, 450 and 600 feet from the line of discharge. Cages also were placed in wooded areas (fairly dense) at the same height at the 150- and 300-foot stations for the 5 mph

¹ From the Biology Section, Technical Development Laboratories, Laboratory Division, Center for Disease Control, Health Services and Mental Health Administration, Public Health Service, U.S. Department of Health, Education, and Welfare, Savannah, Georgia 31402.

² Use of trade names is for identification purposes only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health, Education, and Welfare.