tions into the biology and ecology of pest mosquitoes as well as disease vectors. For the time being, control districts must direct their attention to the more practical matters at hand, providing the greatest possible protection from mosquitoes with the limited funds available. Fortunately, the problem of insecticide resistance does not appear to have reached significant proportions in Texas. This is a matter which will undoubtedly be encountered as more and more of the state comes under control. In the meantime, we are looking forward to continued growth and progress towards the distant goal of state-wide mosquito control.—DON W. MICKS, Laboratory of Medical Entomology, The University of Texas Medical Branch, Galveston.

CALIFORNIA

California, comprising most of the western coast, is one of the fastest growing areas in the United States. Its population of 14 million is increasing by one every 50 seconds or 600,000 new residents every year. To provide living space for this rapidly increasing population, the established communities, having burst their seams are spreading widely into the adjacent farming areas, in which new communities are also mushrooming. Industry, striving to keep pace, is also encroaching upon farm and marginal land.

To feed this huge, growing population and to replace lost acreage, agriculture is of necessity expanding into new areas. Today, 7 million acres are under irrigation, and plans are in the making to provide irrigation water to an additional 13 million acres of farm land, as well as water service to an additional 2½ million acres of urban, suburban and industrial areas. This current expansion and continuing increase in the use of water is in turn increasing the magnitude and complexity of the mosquito control problem. Last year, California's 45 mosquito abatement districts and 8 pest abatement districts required nearly 4 million dollars to carry on their programs.

This second largest state which stretches north and south as far as from Boston to Charleston may be divided into six major mosquito problem areas:—mountainous, coastal, northern central valley, southern central valley, southern and semi-tropical. Each of these areas has some species, habitat and problem differences. Therefore in order to give you a brief overall picture of mosquito control in California it is necessary to generalize.

The level of control in most districts is steadily improving as shown by light trap records, service requests and by the sensitivity of the population to fewer numbers of mosquitoes.

During 1957 mosquito-borne encephalitis and malaria were minimal. This past winter's abundance of rain and relatively mild weather, may provide the necessary conditions and stimuli for increased mosquito production, and this may in turn result in an increase of encephalitis.

Last year the northern portion of the Central Valley experienced the heaviest production of *Anopheles freeborni* in many years. The numerous overwintering adults, mild weather and abundance of rain may easily result in a difficult control problem during 1958.

As a result of a greater acceptance of parathion, most of the districts used some parathion during 1957; a number of these districts used it exclusively for general field spraying, both by air and ground application, and used malathion and DDT for urban and suburban control. Other districts are still using DDT, malathion and other insecticides successfully for field control. To date no mosquito resistance to parathion has been noted. Resistance to other insecticides is variable from district to district. One district which has reported some resistance by *Culex tarsalis* to malathion in 1956 subsequently reported no significant resistance during 1957.

There is a growing interest in herbicides based on the experience that adequate larval control cannot be obtained unless the

weed cover is at a minimum. During 1957 Dalapon and amino triazole were used quite extensively, and the new material Simazin is currently attracting interest for use during 1958.

There has been little if any increase in the use of legal procedures to enforce control or to require the mosquito producer to pay part of the costs of control, other than his normal tax. In the past several of the Central Valley Districts have attempted to use legal procedures but the agricultural influence in this region, greatly surpassing that of the urban and suburban population, necessitates calculated caution.

Source reduction, recognized as the ultimate solution to the mosquito control problem, is receiving increasing emphasis. A number of the districts are employing specialized technical and professional personnel for this purpose with somewhat slow but gratifying results. Other districts are using various members of their personnel for this educational and persuasive method which through the improvement of agricultural methods and industrial practices reduces and eliminates mosquito habitats.

The ingenuity, experimentation, and research by the districts individually and in cooperation with Bureau of Vector Control of the California State Health Department, the universities and colleges, the U. S. Department of Agriculture, and the U. S. Public Health Service, during the last decade has provided new concepts, methods and insecticides. The acceptance and use of many of these concepts, methods and insecticides has resulted in the present high level of mosquito control in California. Today the increasing magnitude and complexity of the problem and the constant striving for its more efficient and economical solution is resulting in an increased demand for more basic and applied research.—ROBERT F. PORTMAN, President, California Mosquito Control Association, Inc.

OREGON

Prior to 1950 the only mosquito control work carried on in Oregon was by the City of Portland in the Columbia River area. From 1950 to the present time, twenty-one programs have been set up throughout the state. These vary from large programs, such as the one existing in the City of Portland areas, to smaller programs with an annual expenditure of $50 to $75.

At the present time there are only three methods under which control programs can be set up under Oregon law. The first would be the mosquito control districts, which are limited by law to counties having a population of 100,000 or over. This law would limit mosquito control districts to three counties in the State of Oregon. The second law authorizes county courts to set up mosquito control districts if the necessity should arise. This would allow the creation of organized mosquito control within any county in the state. The third law, enacted by the 1957 legislature, gives the power to sanitary districts formed under the Metropolitan Sewage District Law to carry on mosquito control activities. As noted by the above laws, the only way a continued budget can be assured is under the Sanitary District Law and the Mosquito Control District Law. The law allowing county courts to set up mosquito control programs varies from year to year according to the amount of money budgeted to support such programs, as these moneys are derived from the general budget. Thus, hardship is enacted on those working in programs that are established under county statutes.

Oregon has four climate and geographical regions with distinctive species of mosquitoes as the main pest mosquitoes. The four districts can be divided into the Coastal; the Willamette-Umpqua-Rogue River Valleys; the mountain areas; and, the irrigated areas in eastern and central Oregon. Breaking these down into species

and problem mosquitoes in these areas are as follows:

(1) Coastal Area—In the coastal area, climate is moist with a high rainfall and moderate temperature. The most troublesome mosquito is *Aedes dorsalis,* a salt-marsh mosquito prevalent in all of the salt marshes along the coast. *Anopheles occidentalis,* and *Anopheles punctipennis* are also prevalent in this area. Among the permanent water mosquitoes are *Culex tarsalis, Culex pipiens, Culex stigmatosoma, Culiseta incidens,* and *Culiseta maccrackenae.* These occur in numbers to be of local importance. Other species that may be found in the coastal area are *Aedes aboriginis* and *Culex territans.* The population increase along the coastal area of Oregon has brought about settlement of areas where mosquito problems have existed in the past, but were not of economic importance. By the result of economic and population pressures, mosquitoes have become a serious public health problem. The location of log ponds adjacent to the city center population has brought about a problem in mosquito control which has been and will be difficult to solve.

(2) Willamette-Umpqua-Rogue River Valleys—The western river valley areas are mainly concerned with permanent water mosquitoes. *Culex tarsalis, Culex pipiens, Culex territans,* and *Anopheles freeborni* are present in sufficient numbers to be of economic importance. *Aedes sticticus, Aedes varipalpus* and *Aedes increpitus* are serious pests in some localities. The main mosquito problem is the control of mosquitoes in the log ponds and polluted drainage waters.

(3) Mountain Area — The mountain area of Oregon has tremendous numbers of snow water *Aedes* which hamper the development of recreational facilities within the national forests. Control methods other than on a localized basis are not economically feasible.

(4) Irrigated Areas—The irrigated areas of eastern Oregon have a predominance of *Aedes dorsalis, Aedes nigromaculis, Aedes fitchi, Aedes intrudens, Anopheles freeborni, Culex tarsalis,* and *Culiseta incidens.* All of the above species are at times prevalent enough to be of serious economic importance. *Aedes dorsalis* and *Aedes nigromaculis* are prevalent to the extent that the social, recreation, and work patterns of many of the small communities have been seriously changed or hampered.

Other problem areas within the state which are not considered universal enough to be a state-wide problem are the Columbia River flood plain areas where *Aedes sticticus, Aedes vexans,* and *Aedes sierrensis* are the most prevalent and troublesome of the species.

In Oregon, two mosquito-borne diseases that have in the past been considered endemic are encephalitis and malaria. In the Willamette Valley malaria has historically been a mosquito-borne disease of considerable importance. Records at the Oregon State Board of Health show that the average annual morbidity for the years 1932 through 1943 was 38 cases with a high of 67 cases occurring in 1936. Occasional cases of malaria have been reported in recent years, but a true picture of local transmission is not available because of the high influx of migratory labor during the season of greatest mosquito activities. Since *Anopheles freeborni* is present throughout the state in both the irrigated eastern section and the Willamette Valley there is a potential for the recurrence of malaria within these areas. The change of environment and humidity in the irrigated areas represents a potential threat for the establishment of malaria. Thirty-three percent of all adult mosquitoes taken in resting collections from irrigated areas were *Anopheles freeborni.*

Encephalitis, which is endemic throughout the state but is concentrated in the eastern irrigated sections, can explode to the position of a serious epidemic at any time. *Culex tarsalis* is present throughout the state and the reservoir is established as indicated from sera samples taken from horses and chickens throughout eastern Oregon. In 1956 there were 54 horse

cases of western equine encephalitis in two counties in the endemic area. No reported human cases occurred, which is a mystery to us. As the population increases in these areas, susceptibles coming into the area will be exposed to the disease and a rise in encephalitis should be considered imminent. Until proper irrigation methods are practiced as well as the control of log pond mosquitoes, encephalitis will be a potential hazard in the endemic areas.

Another problem that exists within Oregon as more land comes under irrigation and as the population increases, is *Culicoides*. We have a problem at present in some of our coastal recreation areas, as well as in the irrigated areas of eastern Oregon. The development of sewage lagooning in the more arid part of the state will tend to increase the *Culicoides* problem if proper maintenance is not carried out in sewage lagoons. A reported outbreak of blue tongue among sheep in one of our counties has shown that the potential vector is present in the eastern Oregon area.

To date, resistance to DDT among the mosquitoes has been reported from only one locality—this being in a heavily polluted log pond. An interesting sidelight to this occurs in the Portland area during July and August when the water temperatures are up in the smaller ponds. DDT applied during midday has been failing to provide control of mosquito larvae, whereas re-treatment or treatment during the early morning hours when the water temperature is lower, has resulted in excellent control of larvae. Reported occurrences of insecticide resistance have been investigated and in most cases improper application of the insecticides has been responsible for the decrease in mortality of the larvae rather than resistance to the insecticide.—L. S. MILLER.

WASHINGTON

We hope the year 1957 will pass as an important transition period in the history of mosquito control activities in the State of Washington. At least three outstanding developments occurred during the year which should give renewed interest in fighting mosquitoes within the state.

The control of mosquitoes in various counties of the State is not new. In fact, there have been mosquito control programs to a greater or lesser extent in several of the counties for the past 30 years. There have been several attempts also to obtain enabling legislation during the past 20 years but not until March, 1957 was the Act passed by the Washington State Legislature. The Enabling Act now authorizes the organization of mosquito control districts, when favorably voted by the counties, in seven counties of the Columbia Basin, in eastern Washington. These are Adams, Benton, Franklin, Grant, Kittitas, Yakima, and Walla Walla counties. Undoubtedly the periodic epidemics of encephalitis are responsible for accelerating this interest in fighting the mosquito pest and also promoted the concerted effort of the State Department of Health and interested citizens in going to the State Legislature for the needed law.

The State Department of Health employed a full-time entomologist for the first time on July 25, 1957, to assist the counties in implementing the enabling legislation. The usual pros and cons for mosquito control were heard in the seven counties, and in at least one county bitter opposition was observed. Meanwhile one of our most important courses of action is to acquaint the public with mosquito biology and economics.

Three of the seven counties, Adams, Benton, and Franklin, voted on the organization of districts and on the levying of taxes to finance their work. Unfortunately, in each instance too few votes were cast to provide the necessary funds. The Benton County Mosquito Control District Board of Trustees met in Pasco, December 3. This was the first meeting of a Mosquito Control District Board of Trustees to be held in the state. (Only about one third of the county was included in the