

SALT MARSH RESTORATION IN ALAMEDA COUNTY AND ITS IMPACT ON MOSQUITO CONTROL

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Mosquito control in Alameda County offers many challenges, perhaps none so interesting and ironic as those posed by the salt marshes. Indeed, the District owes its existence to the salt marshes. The District was formed on the basis of a petition by some 30,000 residents submitted to the Alameda County Board of Supervisors in 1930. The petition was stimulated by hordes of viciously biting mosquitoes that made outdoor living very uncomfortable at times. The mosquitoes were primarily two species, *Aedes dorsalis*, the salt marsh mosquito and *Aedes squamiger* the winter salt marsh mosquito. It is not surprising then that the District's original view of the salt marsh was as an enemy. For the first 40 years of the District, open marshes were simply to be ditched, drained or diked. Reclamation of the marsh, as diking was called at that time, was supported by the District as conducive to mosquito control practices. Open marshes that became land fill sites, salt ponds, or dry farm lands were not only beneficial to the local economy, but also beneficial to mosquito control efforts. Of approximately 12,000 acres of salt marsh that existed in Alameda County in 1930, only about 2300 acres remain. (U. S. Fish and Wildlife Service, 1976; Hayward Shoreline Planning Agency, 1973). Much of the remaining marsh is scattered throughout the county in strips and patches on the outside of levees. Salt ponds have now replaced about 5,600 acres of open salt marsh and dry-diked areas comprise another 4,100 acres.

RETURN OF THE SALT MARSH.—The salt marsh in the San Francisco Bay Area has recently been defined by the public and various public agencies as valuable and worthy of preservation. The public has become aware of the variety of plants and animals, especially bird life, that inhabit the salt marsh. The following quote is illustrative of the public's "modern view" of salt marshes: ". . . salt marsh along the Hayward Shoreline occupy a prominent place in the overall environmental picture. . . ." "They support a wealth of interrelated - - and sometimes specially adapted - - organisms that range from inconspicuous algae growing on pickleweed stems to graceful Marsh Hawks soaring overhead." "They have served as a part of a special 'evolutionary laboratory' that today provides sanctuary for several rare and endangered species." "And their luxuriant swaths of cordgrass have helped earn the salt marsh their position as the most productive type of natural vegetation in North America." "For the ecological reasons outlined above, salt marshes should be given very high environmental priority in any plan for the use of bay shore lands". (Hayward Area Shoreline Planning Agency, 1973).

"CREATIVE" ECOLOGY.—In 1973 the trend toward elimination of salt marshes was reversed in Alameda County with the advent of a pioneer project to create a salt marsh by the United States Corps of Engineers. The corps, in conjunction with a dredging operation at the mouth of Alameda Creek, created a salt marsh of 150 acres. The material from the dredge operation was piped to an old salt

pond that lay parallel to the creek. Unfortunately, the District was not contacted by the corps to provide recommendations to prevent mosquito problems. The local flood district asked us to contact the corps during the project, however, and the District was able to provide hurried and partially effective recommendations. The result was a series of mistakes that could have been avoided in the planning stages:

- 1) More dredge material was placed on the site than anticipated. One hundred and twelve acres of the 150 acre site turned out to be above mean high water. The result was 112 acres of potential mosquito producing area with very little of the highly desired cordgrass that grows in the lower elevation of the marsh.
- 2) The inboard levee system was not upgraded to withstand tidal inundation. When the outboard levee adjacent to the bay was breached to allow tidal inundations, the inboard levee leaked and flooded an adjacent reclaimed marsh thereby creating additional mosquito problems.
- 3) The dredge material was allowed to subside and crack in the upper elevations of the marsh. When the levee was breached tidal water was trapped in the cracks, and with the expected invasion of pickleweed, the cracked ground may be expected to provide an ideal larval habitat for salt marsh mosquitoes.
- 4) A topographical survey was not made to detect low spots that would trap and hold high tidal waters. Therefore no ditches were planned to promote circulation and thereby prevent mosquito production.
- 5) The final mistake was caused by the corps breaching the outboard levee before needed corrections could be made. Unfortunately, our District was not contacted before the levee was breached.

"CORRECTIVE" Ecology.—The marsh restoration project, from the point of view of our District, had tremendous potential for the production of salt marsh mosquitoes. The District contacted the Coastal Region of the California Mosquito Control Association and the State Vector and Waste Management Section to ask for their assistance in the matter. With their technical assistance, the District recommended remedial action to the corps. Fortunately the corps had equipment available on the site for their cordgrass planting program. The corps disked the cracked ground and, based upon an engineering survey by Reuben Junkert of the State Vector and Waste Management Section, the corps also excavated ditches from the main slough to low areas in the upper reaches of the marsh. The ditches serve to increase water circulation and allow the entrance of predator fish.

Subsequent to the marsh restoration project the Coastal Region of the California Mosquito Control Association has prepared a document titled "Standard Recommendations to Prevent Mosquito Problems with Salt Marsh Restoration Projects in the San Francisco Bay Area" (Coastal Region, California Mosquito Control Association, 1976). The recommendations were considered necessary since many agencies have plans for the restoration of salt marshes in the Bay Area.

THE FUTURE.—Salt marshes will be returning to Alameda County over the next decade. Specific and general plans have been made for the creation of some 2,000 acres of salt marsh within the county, increasing the total acreage from the current 2,300 acres of open marsh to as much as 4,300 acres. The marshes, for the most part would be created by reverting dry-diked land back to marsh land. The marshes are planned by the San Francisco Bay National Wildlife Refuge, and the Hayward Area Shoreline Planning Agency. They are fostered by the policies of regulatory agencies including the Corps of Engineers, the California Department of Fish and Game, the Bay Conservation and Development Commission and possibly the San Francisco Bay Region Water Quality Control Board. The requirement by regulatory agencies of "mitigation measures" before permitting development appears to be a catalyst to the creation of salt marshes as mitigation in shoreline development.

It is essential that our agency provide input early in the planning stages of marsh restoration projects. The staff of the planning agencies should recognize that marsh restoration is not simply breaching levees, but requires sophisticated planning, site preparation and long-term maintenance to avoid mosquito problems. The alternative to proper planning is expensive remedial action for mosquito control pur-

poses after the marsh has been created. The methods available to remedy the problem at that time may well be limited and inimical to the goals of the planners.

The District has involved itself whenever possible in the planning of marshes. We believe the planning agencies have found the expertise of the staff valuable beyond that of just mosquito prevention. The District makes recommendations based upon open marsh "recirculation systems" as described in the Coastal Region's Recommendations. Field observations by vector biologists suggest the recirculation method of mosquito control is not only compatible with the marsh wildlife, but may even enhance the productivity of the marsh. The District needs solid scientific evidence, however. For this reason, the District is in support of a research project proposed by the Coastal Region to study the impact of recirculation ditches in the salt marshes. We believe the research would provide data to support the compatibility of recirculation ditches with desirable ecological objectives and would provide our agency with a strong position in the planning process.

REFERENCES CITED

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