THE IMPLICATIONS OF A FRESHWATER SIMULATION MODEL ON THE ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT

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The use of computers has already had a profound impact on the programs of the Alameda County Mosquito Abatement District. Computers now store and process operational data in the District, and generate timely reports for decision makers. It is now generally accepted that the automated system processes more data, more quickly and accurately than was accomplished by the previous manual system.

As presented in the previous paper, the District is in the early stages of developing a simulation model of a freshwater system. The computer in this case is doing more than simply providing information to decision makers, the Coyote Hills Model is designed to predict the consequences of alternative control approaches. Here the computer is encroaching into the decision-making-process, a revolutionary change in the District's approach to mosquito control. There is no doubt in my mind that we are entering a new and exiting era in vector control with both negative and positive implications.

POSITIVE IMPLICATIONS.—The ultimate objective of the Coyote Hills Model is to increase the effectiveness and efficiency of mosquito control. The previous presentation by Dr. Schooley has shown you the way the model operates. If the model can be validated, it will assist park district personnel and our district personnel is finding a management scheme that would maximize wildlife and recreational benefits while adequately controlling mosquito populations. The model provides the opportunity to try out various management strategies and to select an optimum approach. In a very short period of time, the model enables us to test various water depths, fish stocking rates and thresholds for pesticide applications, all by simulation rather than by costly and time consuming field trials.

The model also provides a tool with which to communicate with individuals in disciplines other than vector control. In the process of building the model, we created a multidisciplinary team including a naturalist from the park. As we developed the model it became quite apparent that each participant had gained an appreciation for the perspective of the other participants. A significant problem that we encounter in our preventive planning efforts is the inability of individuals in different disciplines to effectively communicate. Modelling may well be a means to bridge the problem if the process is accepted and used in land-use-planning.

The model is also useful in that it points out what we know, what we do not know, and the assumptions we have about the way the marsh operates. In the process of building the model, a great number of assumptions had to be made. For example, we had to make an assumption about the carrying capacity of the marsh for *Anopheles freeborni*, and the area searched in a given unit of time by mosquito fish, just to name two of the many assumptions. The process has provided a clear view of where we neea additional information. Also, because the model is mathematical, it makes the kind of imformation required very specific. The model has therefore specifically defined the research that is required.

The model has also provided the benefit of showing clearly the logic involved in control decisions. The process of modelling has forced us to clearly document the logic which allows it to be evaluated and restructured as necessary.

Finally the modelling approach promises to dramatically change the role of the mosquito control technician. In the recent past in our district, the control technician was assigned a zone within which he or she had total responsibility for mosquito control, including making immediate treatment decisions involving extremely complex aquatic systems. The model will assist the technician in making these decisions and at the same time requiring more sophisticated and accurate sampling of the technician.

NEGATIVE IMPLICATIONS.—Although we foresee major benefits to be accrued from the model, there are also some problems that may arise and should be avoided where possible. Some of these problems are simply the other side of the coin of some of the benefits.

We are concerned that the model may actually block communication. Some people suffer from math and computer fear. For them the modelling process and the use of the model is not acceptable. If these individuals are in key positions the model has failed as a communication device.

Another problem is that the model tends to develop an aura of validity based upon the esoteric nature of diagrams, mathematics and computers rather than any actual reliability of the model in simulating the marsh. We must continually be testing the validity of the model and restructuring it as required. The logic and assumptions of the model should be available to all users for critical review.

The model also creates a problem in that its development requires the coordination and cooperation of a number of experts outside the district. Because we need help in the modelling process and because we are including more elements of the marsh in our considerations, we find ourselves dependent upon experts in modelling or in specific areas of aquatic systems.

Finally, the model requires that we upgrade our field sampling techniques. We must now find or develop effective methods to determine the number of mosquito fish that are present in the marsh at any given time. Standard dipping techniques will also probably have to be replaced by a more reliable system of sampling mosquito larvae.

CONCLUSIONS.–The use of the Coyote Hills Marsh Model promises to have a profound impact on the Alameda County Mosquito Abatement District. There is potential for many benefits that will be accrued during the development and use of the model. We are also concerned about possible pitfalls. We hope to enlist the help of others involved in similar endeavors to help us maximize the benefits and avoid the pitfalls.

ASSOCIATION OF *AEDES TRISERIATUS* AND *CULEX RESTUANS* IN WATER-FILLED TIRES

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ABSTRACT

Mosquito larvae were sampled in water-filled tires located within the New Jersey Pine Barrens in 1976 and 1977. Two types of tires were sampled–"AGED" tires (sampling period: 7/76-11/76, 5/77-9/77) which had been undisturbed for a number of years and "COLONIZING" tires (7/77-9/77) which were tires cleaned out and filled with litter and tap water.

The most common mosquitoes, *Aedes triseriatus* and *Culex restuans*, were found to be negatively associated (chi square = 36.5, $p < 0.001$, coefficient of association = -0.42) in the 1976 "AGED" tires. Commonly, a decline of *Ae. triseriatus* in a given tire was associated with the occurrence of *Cx. restuans* in the same tire. This species replacement in the "AGED tires was not observed in 1977; most of the "AGED" tires remained 100% or nearly 100% *Ae. triseriatus*. However, in the "COLONIZING" tires, there was a species succession of *Cx. restuans* to *Ae. triseriatus*.

Whether the negative association between these two species results from competitive interference or merely environmental heterogeneity is undetermined.

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