diazinon concentration of 0.14 micrograms per liter. It is assumed that the diazinon concentration was less than 0.7 micrograms per liter at peak discharge because most of the flow at that point was uncontaminated water from the Coast Ranges. More limited data from Del Puerto Creek and the Spanish Grant Drain indicated similar patterns of decrease in diazinon concentration. The diazinon concentration was 5.3 micrograms per liter at Del Puerto Creek on February 8, which decreased to 0.3 micrograms per liter on February 9. The concentration at the Spanish Grant Drain was 1.5 micrograms per liter on February 8, which decreased to 0.3 micrograms per liter on February 9.

The next significant rainfall was February 18 to 20, when almost an inch of rain was recorded. The discharge was higher following this storm (figs. 2 and 3) because of near-saturated soil conditions. The highest diazinon concentration detected was only 0.2 micrograms per liter at Orestimba Creek on February 18 (fig. 3). All other concentrations were lower, indicating that most of the available diazinon had been transported during the previous storm.

DISCUSSION

Orestimba Creek, typical of drainage basins of the western San Joaquin Valley, responds rapidly to heavy rainfall, with the flow reaching peak discharge within a few hours. Diazinon concentration increased more rapidly than discharge during the storm of February 7-9. Peak diazinon concentration, 3.8 micrograms per liter, was measured 9 hours before peak discharge.

Runoff in the drainage basins of the westside tributaries comes from two very different areas: the intensely farmed San Joaquin Valley and the steeply sloped, naturally vegetated Coast Ranges. An explanation consistent with the data is that agricultural runoff from orchards in close proximity to Orestimba Creek transports diazinon, and it is that runoff that causes the initial rise is discharge and concentration. The rapid decrease in diazinon concentration is attributed to two factors: (1) decrease of diazinon concentration in agricultural runoff, with time, and (2) dilution of agricultural runoff with pesticide-free water from the non-agricultural Coast Ranges. No quantitative evaluation of the relative importance of these two factors is possible from available data; however, streamflow data from the gage on Orestimba Creek at the valley margin, upstream from the sampling site, indicate that little runoff from the Coast Ranges was reaching the water-quality monitoring station at Orestimba Creek while the diazinon concentration was high. This information, along with the extremely rapid decrease in diazinon concentration with only a modest increase in discharge, indicates that decreasing diazinon concentration in the agricultural runoff may be the predominant factor.

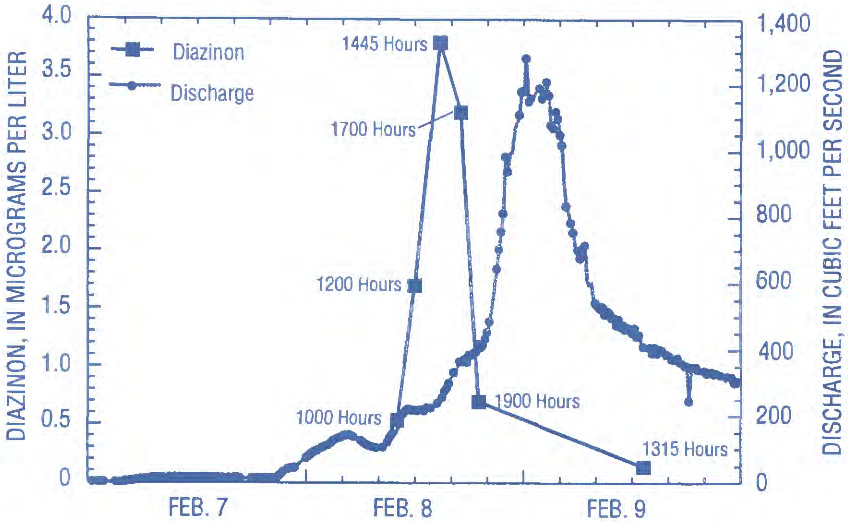

Figure 2. Diazinon concentrations and discharge, Orestimba Creek, February 7, 8, 9, 1993.

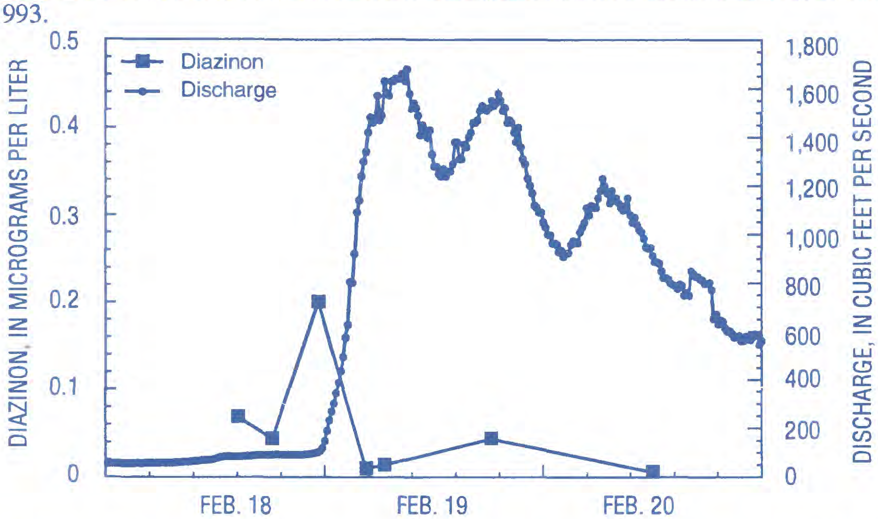

Figure 3. Diazinon concentrations and discharge at Orestimba Creek, February 18, 19, 20, 1993.

Information on technical reports and hydrologic data related to the NAWQA program can be obtained from:
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INPUTS OF THE DORMANT-SPRAY PESTICIDE, DIAZINON, TO THE SAN JOAQUIN RIVER, CALIFORNIA, FEBRUARY 1993

NAWQA
Fact Sheet

INTRODUCTION

The objective of the National Water Quality Assessment (NAWQA) Program of the U.S. Geological Survey is to describe the status and trends of the Nation's water quality with respect to natural features of the environment and human activities or land-use. Pesticides are a major water-quality issue in the San Joaquin Valley of California (fig. 1), and pesticide residues may be transported to rivers and streams in agricultural runoff following winter storms. Three sites in the western San Joaquin Valley were monitored during and after two February 1993 storms. The storms occurred after extensive spraying of organophosphate insecticides, mostly diazinon, on almond and other stone-fruit orchards.

PESTICIDE USE AND SELECTION OF SAMPLING SITES

Organophosphate insecticides are applied to almond and other stone-fruit orchards in the San Joaquin Valley during December and January. Locations of diazinon applications on almond orchards are shown in figure 1. There is extensive spraying throughout the eastern valley, but surface-water runoff is limited because of relatively coarse-grained soils, which facilitate the infiltration of water to the soil. In contrast, the soils of the western valley are relatively fine-grained and facilitate surface runoff, which can enter the tributary streams of the San Joaquin River through drainage canals. Pesticide transport was thought to occur primarily in the western valley; therefore, that region was selected for the storm sampling. Orestimba Creek was chosen as the primary sampling site (fig. 1) because the nearby land use is representative of western valley orchards, and the largest volume of drainage from orchards of the western valley flows to Orestimba Creek. Sites at Del Puerto Creek and Spanish Grant Drain were sampled at lower frequency to determine if the response to storm drainage was similar for Orestimba Creek and other small drainages of the western San Joaquin Valley.

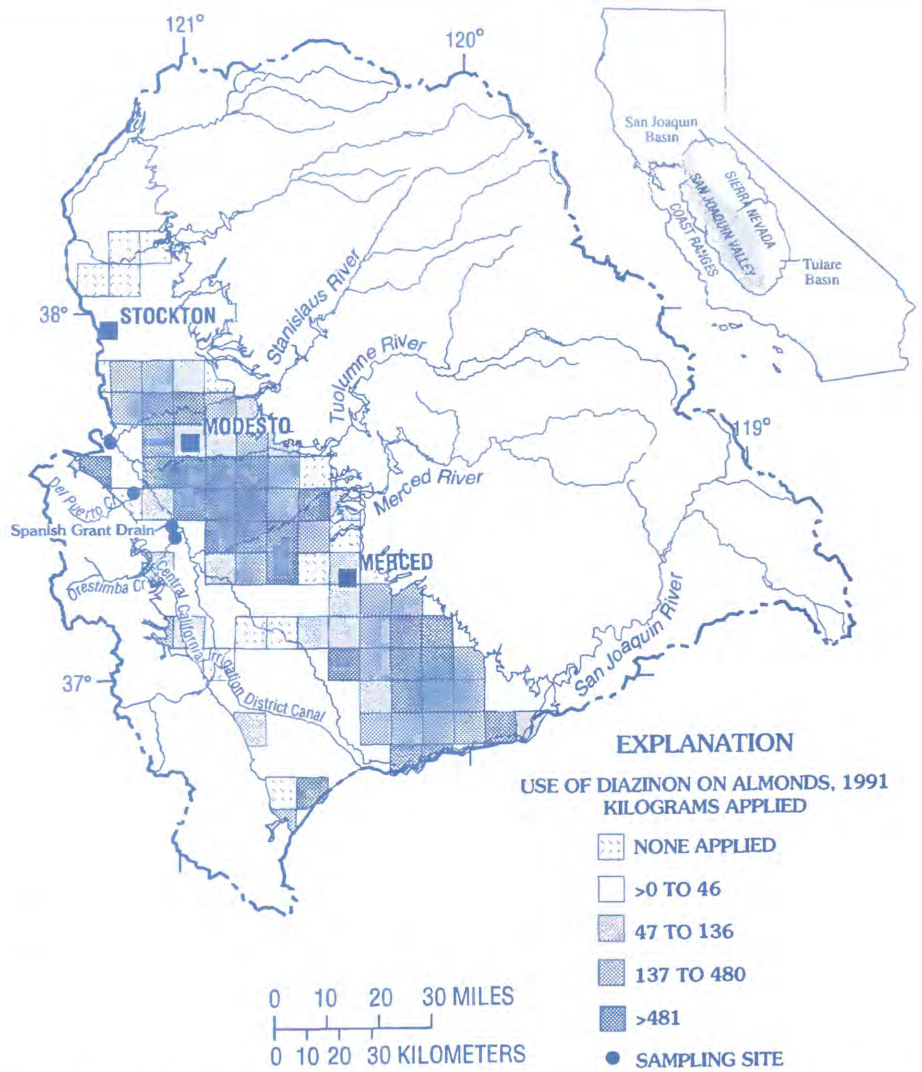

Figure 1. Study area map and diazinon use on almonds, 1992, (California Department of Pesticide Regulation).

DIAZINON OCCURRENCE DURING STORMS

Frequent rainfall during December 1992 and early January 1993 prevented pesticide spraying until late January or early February. Accordingly, six samples collected during January at Orestimba Creek had relatively low diazinon concentrations, less than 0.4 micrograms per liter.

Nearly two inches of rain fell during the storm of February 7-9, 1993. The first sample, collected at 1000 hours on February 8, had a concentration of 0.54 micrograms per liter at a discharge of 170 cubic feet per second (fig. 2). As discharge increased, the diazinon concentration also increased, reaching 3.8 micrograms per liter within 5 hours, at a discharge of 249 cubic feet per second. By 1900 hours, the diazinon concentration dropped to 0.7 micrograms per liter at a discharge of 418 cubic feet per second. The discharge then increased rapidly and peaked at 1,280 cubic feet per second, shortly after midnight. Although no samples were collected during the most rapid rise in discharge, a sample collected at 1315 hours on February 9, as the discharge was declining, had a