

GIS AND META-ANALYSIS: TECHNIQUES FOR THE SITE SUITABILITY ANALYSIS OF AGRICULTURAL BEST MANAGEMENT PRACTICES

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Organophosphate insecticides, notably chlorpyrifos and diazinon, are used to maintain high levels of agricultural production in West Stanislaus County, California. Irrigation and storm water runoff carries some of the applied pesticides into surface waters, where water quality in the San Joaquin River and Delta can be impaired. Previous studies focused largely on pesticide loads from dormant orchard spraying coupled with winter rain events. Results from these studies suggested that pesticide loads to the San Joaquin River and Delta from eastern tributaries occurred mostly in the winter.

In this meta-analysis we combined twelve years of water monitoring, pesticide application, agricultural land use, rainfall, and stream discharge data to characterize seasonal trends and identify “hotspots” where Best Management Practices (BMPs) could have the greatest impact on non-point source pollution. BMPs have demonstrated the ability to remediate agricultural runoff; the greatest net effect on watersheds will be achieved when BMPs are optimally sited to intercept non-point source pollution. Meta-analysis results were incorporated with traditional cartographic modeling techniques and GIS site suitability analysis to identify sites most suited for new BMPs.

Nearly 4000 individual chlorpyrifos and diazinon measurements were compiled from five sites on the San Joaquin River and six sites on tributary creeks. Pesticide application data was spatially processed and analyzed using GIS software. Year-round chlorpyrifos and diazinon stream concentration and loading was compared with pesticide applications within one mile of Orestimba Creek. At Orestimba Creek at River Road, of the 191 samples which exceeded the California Department of Fish and Game Criterion Continuous Concentration of 0.014 µg/L chlorpyrifos, 67% were in the dry summer season. Contrary to previous studies on eastern tributaries of the San Joaquin River, western tributaries are more affected by summer growing season pesticide applications than winter applications. Westside summer flows are made up almost entirely of irrigation return flows. Four one-square-mile sections adjacent to Orestimba Creek in extreme southwest Stanislaus County were identified as the most promising candidates for future BMP construction. Future focused studies and enhanced spatial data will improve resolution for BMP site selection.

KEYWORDS: BMPs, GIS, Pesticide, San Joaquin River, Central Valley California