ABSTRACT

HYDROLOGIC ALTERATIONS TO THE SACRAMENTO RIVER AND THE EFFECTS ON COTTONWOOD SEEDLINGS

by

Vicky Lynn Snowden

Master of Science in Geosciences

California State University, Chico

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The Sacramento River supports one of the most diverse habitats in California, but urbanization and agricultural expansion have reduced its riparian habitats by eighty-nine percent. A widespread effort to conserve and restore the Sacramento River ecosystem requires information regarding what factors affect the maintenance and replenishment of the riparian forests. Several studies have shown that regulation of rivers can inhibit regeneration of riparian forests, particularly cottonwood species. The natural flow regime of the Sacramento River has been significantly altered by human activities including, diversions, bank stabilization, and the operation of Shasta Dam. In this study the Indicators of Hydrologic Alteration (IHA) model was applied to determine how regulation of the Sacramento River has altered the hydrologic regime, and to predict what effects these hydrologic alterations may have on cottonwood recruitment. The IHA model uses daily flow data to produce statistics that show the change in several ecologically
important hydrologic parameters since the date of impact to the system. The results of the IHA analysis showed that some of the most significant alterations to the hydrograph include a 104% increase in mean August flow, a 78% increase in the number of hydrologic reversals, and a 49% decrease in the magnitude of peak flows. Overall, regulation of the river has resulted in reduced peak flows and a flattening of the hydrograph whereby summer flows have increased and spring flows have decreased. One site was chosen on the Sacramento River as a case study to observe the effects of hydrologic alteration on cottonwood recruitment. Comparison of the hydrology between sites was used to predict how the hydrologic alterations characterized by the IHA model are translated through the Sacramento River system and are reflected at the study site. River stage at the study site was gaged to observe local hydrology, and cross-sections were surveyed to determine stage of seedling recruitment during the growing season of 2000. Observation of seedling recruitment and survival showed that an estimate of less than ten percent of the seedlings that germinated at the study site survived the growing season of 2000, and that all the seedlings were scoured away during the following winter. The data indicate that seedling recruitment failed due to 1) recruitment at a low position on the point bar due to the lack of spring peak flows 2) the flat hydrograph during the period of seed release limited the area available for recruitment and resulted in only a very narrow band of seedlings at the water’s edge 3) the proximity of the seedlings to the water resulted in repeated inundation and limited growth of the seedlings due to hydrologic reversals. This study indicates that the alterations to the natural flow regime of the Sacramento River most likely are significant to the establishment of riparian vegetation.