



Longitudinal and Temporal Evolution of the Sacramento River between Red Bluff and Colusa, California (1942-1999)

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Aerial photographs have long been employed in fluvial geomorphic research to document changes in channel form and meander migration. The 160-km reach of the Sacramento River between Red Bluff and Colusa, California, was well-suited for application of this approach because of its history of relatively active channel migration (Larsen, 1995; Greco and Larsen, 2002; Constantine, 2006), an excellent record of historical aerial photography at frequent intervals carefully compiled (Greco and Alford, 2003; Greco and Plant, 2003), and some key questions about channel response to construction of a major dam that were still unresolved (Greco et al. 2007). The objectives of this study were to measure channel changes over a 160-km reach over five decades from analysis of sequential aerial photos to ascertain temporal and spatial patterns of change in the mainstem channel and in off-channel water bodies, and to analyze these in relation to hydrologic changes induced by operation of Shasta Dam (since 1943) and other land-use changes. The study is based on a synchronic and diachronic analysis of the active channel and the floodplain lakes using aerial photographs (1942,

1962, 1985, 1999). All data were integrated in a GIS database. From 1942 to 1999, the total active channel area decreased from 4562 ha to 3465 ha. The rate of decrease was 3.34 m.yr^{-1} from 1942-1962, 4.05 m.yr^{-1} from 1962-1985, and 3.51 m.yr^{-1} from 1985-1999.

Through the analysis of the aerial photographs, 87 floodplain lakes have been identified in 1942, 64 lakes in 1962, 75 in 1985 and 101 in 1999. The average size is 29.8 ha varying between 363 m^2 and 277 ha. Three main types of lakes were observed according to spatial geometry, their plug length but also their connection to the main channel. Oxbow lakes are the wide and sinuous lakes. Straight channel backwaters are characterised by the occurrence in the convex side of the meander. Straight secondary channels are formed near active channel, elongated, without jut out parts. The area of disappeared lakes was the most important between the 1942-1962, so it means that the lakes have been disappeared in this period immediately after the construction of the Shasta Dam. The interval and intensity of floods has been eliminated and this fact has been influenced also the apparition of the new lakes. Better understanding of historic channel migration rates and former channels' evolution is necessary to manage the present river channel landscapes.

Keywords: former channel, oxbow lake, straight channel backwaters, straight secondary channels.