Temporal Patterns of Channel Migration, Fluvial Events, and Associated Vegetation Along the Upper Yellowstone River, Montana[AFS]

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As part of the Governor's Upper Yellowstone River Task Force and the U.S. Army Corps of Engineers Cumulative Effects study along the upper Yellowstone River, we examined the vegetation along the river from Gardiner to Springdale, Montana. The study goal was to gain an understanding of fluvial geomorphic processes and its relation to flood plain vegetation. We used repeat photography and mapped cottonwood (*Populus angustifolia*) tree ages to quantify flood plain and vegetation dynamics in several geomorphic settings. The reference model for flood plain dynamics was exponential decay, which provides a rate of erosion and deposition at steady state. Flood plain dynamics and vegetation composition along the upper Yellowstone River flood plain varied by geomorphic setting, which in turn varied from broad, un-confined braided channel systems to single-thread channels with narrow flood plains confined by glacial terraces and bedrock. Although the general appearance of the vegetation and river system is similar to that of 100 years ago, retrospective age distributions and real-time trend analysis reveal a reduction in fluvial activity, cottonwood recruitment on an area basis, and cottonwood forest area. The flood plain turnover period for the braided reaches is between 550 and 1700 years. Dated flood plain area was positively correlated with flood size, and cottonwood area decay curves indicate that most flood plain erosion and deposition occurs during large floods. Agriculture caused a net reduction in forest area in the last 50 years, but loss to natural succession was about twice the loss due to agricultural conversion.