Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09208, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09208
EGU General Assembly 2008

Interactions between braiding and vegetation leading to the formation of single-thread channels in a laboratory experiment and the importance of competing time scales in how such systems organize

M. Tal (1,2), C. Paola (2)

(1) National Center for Earth-surface Dynamics, St. Anthony Falls Laboratory, Minneapolis, Minnesota, USA, (2) Now at the Institut de Physique du Globe de Paris, France, (michaltal8@gmail.com)

We present results from a series of physical experiments performed at the St Anthony Falls Laboratory from 2001 – 2007 which pioneered a method for studying the effects of riparian vegetation on channel morphology in the laboratory. The key elements of our experimental strategy were fluctuating discharge and alfalfa plants. The experiments demonstrate how a repeated cycle of short periods of high water discharge alternating with longer periods of low discharge accompanied by plant seeding and growth, convert a braided morphology with a non-cohesive bed to a dynamic self-maintaining single-thread channel with well-defined banks and a vegetated floodplain. The experiments reproduced many of the dynamics of field scale river systems including bend growth, pointbar formation, avulsions, and head-cutting floodplain channels. The extent to which simplified, unscaled laboratory experiments such as these reproduce key elements of complex natural river behavior suggests a high degree of scale independence in the relevant dynamics. Our methodology provides a basis for experimental development of self-sustaining high-amplitude meanders and has applications for river management and basic research purposes.

The experiments highlight that a key parameter in how channels and vegetation self-organize is the ratio of the channel mobility time to the time required for plants to become stable and resistant to erosion. Managed river systems are typically character-

ized by long periods of low flow and reduced and/or infrequent floods. Stable conditions over long time periods allow vegetation to grow and become more resistant to erosion, necessitating higher and longer flows to rework the bed. Dramatic examples of rapid expansion of riparian vegetation on managed rivers world-wide and the significant consequences for riverine habitat are evidence of systems in which the balance of time scales of vegetation growth and channel mobility has shifted due to management practices. Laboratory experiments in which the time scale of vegetation growth was short relative to the channel migration time developed into single-thread channels, while an experiment in which channel migration time was more rapid maintained multiple active channels.