

Episodic Stream Channels: Imperatives for Assessment and Environmental Planning in California - Proceedings of a Special Technical Workshop

Eric D. Stein, Kris Vyverberg, G. Mathias Kondolf and Kelly Janes

INTRODUCTION AND WORKSHOP OVERVIEW

The majority of streams in the arid regions of the Southwestern United States are not perennial; however, the perceptions of how rivers should look and behave are dominated by representations of perennial streams found in humid climates or snowfall regimes. Unlike perennial systems, which tend to reach climax/stable states, the essential quality of rivers in dryland landscapes is the *episodic* nature of flow and sediment transport and the associated dynamism of channel form. A historical focus on perennial systems as preferable, high quality habitat has led to ephemeral and intermittent streams often being characterized as “degraded” and the habitat they provide has been undervalued. However, the health of the entire watershed depends on the health of all its stream reaches. Although these streams function differently than their perennial counterparts, they also provide essential ecosystem services. Recognizing the inherent ecological functions of episodic streams is the first step towards developing and applying conservation and management strategies suited to dryland landscapes.

As the semi-arid landscapes of California face rapid urbanization and initiatives to fast-track construction of renewable energy projects on more than three million acres, there is now an urgent need to incorporate an understanding of the distinctive physical, hydrologic and ecological processes of arid streams to ensure that future developments are sustainable, cost-effective and durable, and include appropriate mitigation measures to offset impacts. In response, the University of California Berkeley, California Department of Fish & Game, and the Southern California Coastal Water Research Project launched an initiative to increase understanding of the physical processes, ecological adaptations, and management/conservations challenges of episodic channels in California, as a basis for delineating and assessing dryland streams and articulating design considerations for future projects. As a first step, the initiative convened a workshop in November 2010 featuring experts on episodic channels and their management. The workshop is followed by publication of these conference proceedings and development of curriculum for agency staff, NGOs, developers, and consultants on identification, assessment, and management episodic channels.

Key Attributes of Episodic Channels

While most of the examples presented are from the Mojave, the symposium also addressed such processes occurring on alluvial fans in more humid regions (such as, Napa Valley), which share many characteristics of dryland streams. Important hydrologic and geomorphic attributes include:

- Highly localized and extremely variable ephemeral and intermittent flow,
- Flood magnitudes much larger (as a multiple of average flow) than conventional humid-climate streams,
- Strong interactions with shallow groundwater, notably rapid infiltration which results in decreasing flow downstream,
- High-volume episodic movement of sediment,
- Unsuitability for application of most hydraulic modeling, and
- Transient forms that confound determinations of active versus relict stream processes and conventional notions of stable and unstable channel form.

The concepts and tools commonly used to evaluate stream behavior were developed in humid and temperate regions, and their transfer to episodic streams in dryland environs can be problematic. For example, hydraulic models commonly assume that channel boundaries will remain relatively fixed, that bedload and suspended sediment will occur in substantially lesser amounts than the volume of water present, that water and sediment move along a channel at a more or less a steady rate, and that water losses along a channel may be considered insignificant – conditions rarely the norm in episodic stream channels. Thus hydraulic models based on such characteristics are problematic as predictive tools for the behavior and evolution of dryland streams over time.

Modification or elimination of ephemeral, episodic dryland streams can severely affect baseflows, groundwater recharge, and the biological communities adapted to the natural hydrology and distributary stream networks. Perennialization of intermittent and ephemeral streams can occur as a result of dams impounding flood flows and releasing steady baseflows, from discharge of treated wastewater effluent or irrigation return flow, or ‘urban slobber’ from overwatering of landscapes – all contributing to the replacement of a diverse community of dryland species with exotics. Hydrological modifications to such channels can concentrate flows, increase flood intensities, and increase sediment transport and erosion, although the effects of such modifications may not manifest for years or even decades until the next flash flood.

The Symposium

On November 8-10, 2010, 22 speakers and approximately 120 participants from government agencies, academia, and the private sector (see Appendices A and B) gathered in Costa Mesa, California to discuss challenges associated with mapping, assessing and managing episodic streams in the dryland regions of California. The goal of this workshop was to introduce forms, processes, and ecological resources found in episodic stream channels and to provide managers and decision makers with a list of recommended priorities for future work in terms of both technical and management products that will develop our capacity to analyze ecological condition and potential environmental effects of land use decisions.

The workshop consisted of a series of presentations, breakout sessions and a field trip. The presentations began with a discussion of the physical process, landscape influences, and ecology of episodic streams and included discussions of development pressures, regulatory context, and mapping and assessment. This technical foundation was used as a basis to discuss key challenges associated with mapping, assessing and managing these systems.

The participants spent a majority of day two in breakout sessions discussing the following questions and concluded with recommendations for further collaborations, initiatives, and research needs:

- What linkages between the physical processes that sustain or contribute to the integrity of an ecosystem should be preserved by project developments?
- What key field indicators should be used to assess the biological or physical condition of dryland environments?
- What key field indicators can be used to delineate the boundaries of the functional ecosystem in episodic systems?
- What parameters should be included in regional or project-specific monitoring programs to promote improved understanding of the function of episodic systems over time?
- What key limitations of existing assessment tools must be addressed to make them appropriate for use in dryland environments?
- What priority research should be funded to address the limitations or knowledge gaps identified by the questions above?

The third day was devoted to a field trip to the Day Canyon alluvial fan system in San Bernardino County, California where participants were able to observe the principles presented at the symposium plus debate on the ground, the issues highlighted in the workshops.

This document provides a summary of the major topics discussed and the key conclusions and recommendations of the workshop. Detailed summaries of the presentations and additional workshop materials are provided in the appendices. This information, along with complete powerpoint presentations, on the workshops can also be found at www.sccwrp.org, <http://episodic.ced.berkeley.edu/> and www.waterboards.ca.gov/water_issues/programs/academy/

We are hopeful that this workshop will serve as launching point for ongoing research and collaboration that will lead to improved tools and capacity to manage episodic streams in an environmentally sensitive manner.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/645_EpisodicStreamsWorkshop.pdf