

## **Time series analysis of riverine ecosystems**

Robert T Milhous<sup>1</sup>

US Geological Survey, Fort Collins, Colorado

**Abstract.** Time series analysis of physical instream habitat and the riparian zone is not done as frequently as would be beneficial in understanding the aquatic ecosystem. The key activity in habitat time series analysis is the exploration of links between the ecology and the hydrology of the system. Three case studies demonstrate the development of a time series that can be useful in habitat analysis: 1) the transformation of a streamflow time series using a physical habitat versus discharge relation to a time series of physical habitat, 2) the transformation of streamflows to an index of the stress on an ecosystem caused by high streamflows, and 3) the transformation of streamflows to an establishment index for the establishment of cottonwood seedlings in the riparian zone of rivers. The first case study demonstrates how to transform a time series of streamflows to a time series of physical habitat indices using a relation between streamflow and the quality of the habitat in a stream. A river in Oklahoma was used in the transformation. The objective of making the transformation is to study the impact the frequency and characteristics of droughts on the quality of instream habitat in rivers. Periodic droughts occur in the Great Plains that cause streamflows to be very close to zero and the fish habitat requiring flowing water to be zero. The length of very low flows and the survival of fish in rivers with near zero streamflows is an important water management consideration. The second case study shows an example of where high streamflows should be considered in the study of an aquatic ecosystem. High streamflows can limit the fishery because of high velocities and the length of the high flow period. Both the magnitude and duration of the high flows are elements of a fish stress index. The third case study shows how an index to the establishment of cottonwood can be developed from the streamflows and knowledge of the habitat requirements for cottonwood establishment. Cottonwood establishment requires a substrate cleaned by high flow followed by streamflows that do not destroy the cottonwood seedlings once they are established. Both of these considerations are included in the establishment index.

---

<sup>1</sup> Hydrologist and Hydraulic Engineer. US Geological Survey, 2150 Centre Avenue, Building C. Fort Collins, Colorado 80526