Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11173, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11173
EGU General Assembly 2008

Pushing back the frontiers of Aqua Incognita: A strategy for assessing headwaters

K. Bishop (1), I. Buffam (2), J. Fölster (1), H. Laudon (3) J. Seibert (4) and J. Temnerud (1)

(1) Department of Environmental Assessment, Swedish University of Agricultural Sciences, Sweden, (2) University of Wisconsin, Madison, USA, (3) Umeå University, Sweden, (4) Stockholm University, Sweden

(kevin.bishop@ma.slu.se / Fax: +46-18-673156 / Phone: +46-18-673131)

The overwhelming majority of stream length, lies beyond the frontiers of any systematic documentation and would have to be represented as a blank space on the map. Thus for most of stream length that supports aquatic life, a systematic understanding is lacking on water quality, habitat, biota, or even how many kilometers of such habitat there are. This blank space is so vast and so important, that it deserves a name to help us at least remember that it is there. We propose calling it “Aqua Incognita”.

There is, however a long way to go from recognizing the problem of unassessed streams, to solving it. A fundamental question is whether it is even possible to make a meaningful assessment of something so vast and transient. In addition to the great spatial variability of water chemistry, every stream also has a temporal dimension, hour by hour, day by day, as flow and season change. And the spatial and temporal dimensions of individual headwaters are linked in networks that have myriad possible permutations and combinations with significance for the aquatic biota navigating these networks. So the task of defining Aqua Incognita is not to be underestimated.

But science is full of success stories, once an issue recognized. We see potential in combining monitoring information from downstream sites with map data on headwater catchments to aid in assessment of headwaters. In this paper, we demonstrate the concept using a regionally stratified survey of water chemistry in ca 750 streams with

catchments over 10 km^2 that was collected in both 2000 and 2005. To characterize the 90% of channel length upstream from the sample points, we analyzed data on the chemistry of headwaters from a dozen synoptic surveys. Here, the tributaries to most all confluences within 60-100 km^2 catchments were sampled in the course of a few days.

Using pH as an example, systematic patterns were found in the standard deviation as a function of catchment area, as well as the mean of headwater pH as a function of downstream pH. The skewness of the pH distribution in headwaters was also found to change systematically, with more acid downstream pH being associated with headwaters skewed to the low pH end of the range, while higher pH downstream had a headwater pH distribution skewed to the higher end of the pH range. With that information, an estimate of the pH in streams with catchment size classes between 1 km^2 to 25 km^2 was made. We believe our results suggest that data on downstream sites can be exploited to develop a stochastic description of headwaters.

The unknown has always beckoned explorers. Headwaters have retained their mystery despite being so nearby to everywhere. Others can make a case for going to Pluto and beyond. We believe it is high time that catchment science embarked on a new age of exploration to the unknown headwaters lurking in the landscape we know so much else about. Exploring Aqua Incognita will reveal the patterns of interaction between life and landscape in the upper reaches of river basins. Understanding these patterns will improve society's ability to effectively manage and steward water resources and aquatic biodiversity, benefiting all who depend so much on the headwaters we know so little about.