

Biological Samples Require Context for Interpretation (Newsletter)*

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Natural resource and energy industry operators invest in biological baseline sampling to support operating permit applications and environmental impact assessments. Water quality permits often require biological as well as chemical monitoring. Peak and ecological flow requirements are becoming more frequent requirements for all water users who desire to store water for use during low flow periods, to divert water from a stream or river channel, to discharge ground water withdrawals into surface waters, and to operate dams for hydroelectric generation, flood control, irrigation, or recreation.

Many measures, indicators, and indices have been applied to collections of aquatic biota, particularly the benthic macroinvertebrates (those insects and other invertebrates that are large enough to see with the unaided eye and live on and in the bed of the stream or river). While all these biotic summaries have assumptions that cannot be met, cannot be compared to each other, and provide no useful insights that are applicable to all geographic regions they are often required to be reported to regulatory agencies. More practical and technically sound is the attempt to identify a so-called "reference" stream and use biotic collections from it for comparison to the biotic collections from the system of interest. All these efforts to interpret biotic structure out of their geomorphic context fail to explain why we observe what we do at various locations. Analyzing the processes that function to produce the biologic collections provides insights and useful information not provided by the collections themselves.

Recently a state agency planner asked why 4 streams draining from waste rock disposal areas had water chemistry not in compliance with secondary drinking water standards while 14 others did not. Another reasonable question is why there are fish populations in one of these 4 non-compliant streams and not in another with similar water chemistry. Dams are disallowed to be constructed because the regulatory agency cannot predict what might happen to actual or potential populations of fish downstream of the dam.

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The tools used to answer questions like these and to put the presence of aquatic biota in their geomorphic context are spatial analyses, models, and statistics. In addition to explaining the structures observed they can be used predictably for project planning and regulatory decisions. When both industry and regulators understand the relationships among terrain (topography), hydrology, stream network configuration, landscape attributes, and biota decisions are more realistic and less time and money is invested in reaching those decisions.

Another setting in which spatial analyses, modeling, and statistics provide the geomorphic setting for decisions is chemically contaminated sediments from historic (and sometimes current) industrial activities. A white paper describing the issues involved in sampling and analyzing aquatic sediments so the results are technically sound and legally defensible can be downloaded from our Web site (<http://www.appl-ecosys.com/publications/sediment-sampling.pdf>).

These analytic tools were not available as recently as 20 years ago. They are available now and there is every reason to use them for your benefit.