EDITORIAL

Hydro-geomorphology as a central theme in environmental studies

As the hyphen separating its name reveals, hydro-geomorphology is inherently interdisciplinary. The first formal recognition of its existence was in 1973 by AE Scheidegger (Technical Univ. of Vienna), who defined it as the study of landforms created by the action of water. The author's enthusiasm about its relevance was evident when he stated "*…almost all of geomorphology is 'hydro'-geomorphology…*", and attributed its development to North American and European scientists. A parallel hydro-geomorphological school focused on natural hazard applications emerged in Japan in the 1960s, but that scientific tradition still remains inaccessible to most western scientists due to the language barrier.

The chronology of hydro-geomorphology as a field of study was revisited by KJ Gregory (Univ . of Southampton) in 1979 and he attributed its emergence during the 1960s to the sudden prevalence of analytical tools and equipment. Gregory acknowledged the emergence of two distinct sub-disciplines within hydro-geomorphology including the *'chronological approach'* which was invested in developing an understanding of long-term landscape evolution. The second, the *'systems approach'*, was concerned with developing a quantitative understanding of system change. A formal scientific curiosity to draw linkages between hydrology, geomorphological processes, and landforms can be traced back to the origins of modern geomorphology when, at the turn of the 20th century, GK Gilbert (US Geological Survey) armed himself with field and laboratory evidence and explicitly laid out procedural hydrologic and fluvial landform linkages. Gilbert's legacy on hydro-geomorphology goes beyond its integration of quantitative, hypotheses-driven analyses and both field and lab experimentation. It also influenced future scientists to be concerned with issues related to human impacts on hydrologic processes, erosion and sediment production, and the immediate and practical relevance on landform evolution.

The legacy of Gilbert was later executed in the form of studies such as those by S Schumm (Colorado State Univ.) and L Leopold (US Geological Survey) in which the concepts of *'geomorphic thresholds'*, *'complex response'*, *'geomorphic work'*, and *'effective discharge'* were explicitly formulated. These basic tenets of geomorphology helped describe the dynamism of landscapes, their resilience and vulnerability, and their dependency of numerous biotic, abiotic, and human variables. Many of these concepts are still used to guide environmental studies related to soil erosion, water resources, and the effects of river dams, among others.

At the turn of the 21st century, hydro-geomorphology has grown concerned with the effects of climate and land use changes on the ecological services the landscape provides. Several names have been suggested for this emerging trans-disciplinary field including *'stream hydrogeomorphology'*, *'river hydrogeography'*, *'geo-eco-hydrology'*, and *'unified Earth surface science'*. All of these terms recognize the central and inseparable

role of hydro-geomorphologic understanding in assessing the condition of ecological systems such as rivers, wetlands, and marine habitats. Many solidly argue that humans are currently a premier geomorphic agent given our ability to drastically modify the Earth's landscape. This is likely true particularly in emerging economies like those that currently characterize China and Brazil. These economies are enforcing a land intervention phase that might surpass the one that characterized North America from the second half of the 19th century to the Great Depression and which resulted in the widespread and irreversible degradation of many natural resources.

Therefore, it is imperative for a nation such as Brazil to embrace its educational and research programs in fields such as hydro-geomorphology. An environmentally literate population that encompasses scientists, government employees, the media, and community members is one that is aware, concerned, and most importantly capable of foreseeing and reacting not only to present dangers, but also to those lurking not too far ahead.

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