Annotated Bibliography for:
From the Geographical Cycle to Chaos Theory:
A Century of Geomorphic Concepts


Chorley advocates the use of general systems theory in studying geomorphology. He equates the Davisian concept of cyclic erosion to a closed system and as such it is inflexible. An open systems approach to studying landforms examines the relationship between process and form, which Chorley claims is the heart of geomorphology. He delineates the virtues of this open system approach but includes no diagrams or case studies.


The authors delve into the details of a systems approach to physical geography. Morphological systems, cascading systems, process-response systems, and control systems are particularly important and receive individual chapters. They also explore input and output as well as systems equilibrium, listing eight different types of equilibrium. The book contains a plethora of diagrams, figures and charts to help explain the concepts.


This is the paper that so heavily influenced geomorphology for half a century. Davis details his cycle and its dependence upon structure, processes, and time. He explains his cycle and then goes on to apply it to stream development, grade, divides, meanders, and peneplains. Davis also allows for the interruption of the cycle by episodes of uplift, and departures from the cycle by changes in climate or volcanism. But he notes that the cycle continues despite the interruptions and departures.


Hack suggests the abandonment of the Davisian cycle and suggests the concept of dynamic equilibrium as a better explanation of landform development. In his study of the Piedmont region of the Appalachians, Hack notes that a continuing series of uplifts prevents the geographical cycle from its completion, and as such there is no evidence for it. Borrowing the term "dynamic equilibrium" from Gilbert, Hack explains that "every slope and every channel in an erosional system is adjusted to every other" (p. 80), and that relief and form can be explained in terms of spatial relations rather than in historical terms.

Hack continues to elaborate on the virtues of using the concept of dynamic equilibrium, rather than the geographical cycle, to explain landform development. He makes the point that dynamic equilibrium is a principle used for explanation rather than an evolutionary model. He again uses the Appalachians as a study area. Basically, he reiterates and clarifies what he said before.


Higgins explores the virtues of Davis' geographical cycle to help explain its long-lasting popularity, listing twelve reasons. He also notes recent challenges to the Davisian cycle. Higgins concludes by saying any theory replacing the geographical cycle "must include simple terms for describing topography, must conform to current geologic and geomorphic thought, and must provide a basis for historical interpretations and future predictions of landscape changes, preferably in terms of evolutionary and cyclic rational models (p. 23).


Kennedy analyzes concepts of change, progression, and equilibrium in the works of J. Hutton, C. Lyell, C. Darwin, J. D. Dana, G. K. Gilbert, and R. E. Horton. She feels that geomorphologists searching for equilibria tend to view high-magnitude/low-frequency events as catastrophes. Since Hutton, Darwin and Gilbert did not consider the present state of the earth as some sort of normal or optimum, but rather considered an entire scope of phenomena producing change at any time or place, we might follow their example. She concludes that Strahler's (1952) and Chorley's (1962) distinction between "dynamic" and "historical" geomorphology to be unhelpful.


A very good explanation as to how chaos theory might be useful in physical geography. They list three tenets central to chaos theory. The authors also suggest its use in biogeography and geomorphology. They surmise that it will not really be applicable until data accumulation methods improve and computer systems are developed and refined.

This is an overview of the proceedings of the 1992 Geomorphology symposium on Geomorphic Systems. Many of the articles I found to help explain current thoughts on equilibria, nonlinear dynamical systems, and chaos were produced at this symposium and are contained in the resultant book. Phillips provides a good analysis of current directions and a fine overview of the other articles.


Phillips provides a good explanation as to what nonlinear dynamical systems are all about and how they apply to geomorphology. He infers that NDS is not revolutionary but rather is based on existing theoretical concepts. He includes some formulas but no figures of diagrams.


With a generous use of figures, formulas and diagrams, Renwick explores the differences in equilibrium, disequilibrium, and nonequilibrium in a clear and concise manner. Time is an essential factor. Equilibrium is brief and periods following perturbations can last for thousands of years. Systems in disequilibrium are in this long adjustment period as the system tends toward equilibrium. High-magnitude thresholds, positive feedback and deterministic chaos may prevent some systems from tending toward equilibrium. In this case they are said to be exhibiting nonequilibrium behavior. Renwick also notes that most landscapes contain a complex of landforms exhibiting all three types of behavior.


The authors employ some excellent tables and figures, as well as lucid prose to help reconcile historic and equilibrium theories of landscape development. They attribute the factors influencing landform development as functions of time and space. Variables of a system can be independent or dependent, it just depends on the temporal and spatial dimensions of the system being studied.


This is Strahler’s call for geographers to incorporate the fundamental principles of engineering science and mathematics into their work in order to give geomorphology its proper role as a science. Quantitative analysis, a systems approach, and mathematical models were part of his attempt to get geomorphologists to study the relationship between process and form.