

STATICS AND DYNAMICS OF NATURAL SYSTEMS—A GENETIC BASIS FOR ASSESSING ENVIRONMENTAL IMPACTS¹

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ABSTRACT

Land resources consist of a spectrum of static and dynamic components; it is important that both be considered in order to correctly assess interactions among human and natural systems. Methods for addressing static and dynamic elements are derived from various disciplines: areal geology, process-oriented geomorphology, and applied ecology. These methods involve recognizing and mapping functional (genetic) systems as well as charting the sustaining flows of materials and energy among these systems. Thus, depending on the scale of view (in both geographic extent and in a time context), one can construct a qualitative model that depicts predominantly static elements on maps while showing dynamic interchanges by means of ecological systems diagrams. Simply stated, bedrock is the most typical static component, whereas climate is the fundamental dynamic facet. These two "end members" adapt to each other through the energetics and transfers associated with the water cycle; this long-term adaptation is expressed in the morphology and size of drainage basins containing two major regimes—upland and fluvial systems. These are, in turn, linked by water-related processes resulting in distinctive slope, soil, and biotic characteristics on the uplands as well as a range of hydrodynamic conditions in the fluvial systems. If one assumes an overall state of dynamic equilibrium between the more "static" uplands and the more "dynamic" fluvial systems, Le Chatelier's principle can be applied to prejudge man's effects on the land. Measurable and mappable facets of the land such as bedrock and soil properties, ground slope, biotic assemblages, and water regimes all provide clues to the way in which natural systems react to disturbances. Only through an evaluation of the specific systems involved (including their static and dynamic properties) can local effects imposed by humans be consistently predicted and effectively mitigated.

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