Ecological Sites: Their History, Status, and Future

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By Joel R. Brown

A Short History of Sites

The concept of "site" has been one of the central tenets of modern natural resource management. Grouping portions of a landscape based on their climatic, geomorphic, and edaphic similarities to predict the dynamics of soil, vegetation, and related resources, especially in response to conservation practices, has provided a universally applicable management technology. In addition, the site concept provides a transparent and testable basis for 1) monitoring and assessment, 2) decision–support, and 3) communication. Even while readily acknowledging that "sites" are not natural bodies within a landscape, resource scientists and managers rely on a logical grouping of the many factors controlling ecological processes to organize information. Most importantly, these groupings have been a means to define the varying ecological potential (i.e., the biological resources that a site can support) across a landscape. By defining distinct potentials, regardless of the basis for that definition, resource managers could develop metrics for measuring the current condition relative to potential and for evaluating the trend, or change over time relative to each site's potential, in the status of resources. All phases of modern resource management have relied on the site concept to make and communicate decisions.

Historically, the site concept always has been valued for several functions. Planners could use the finely resolved specification of potential to develop site-specific actions intended to either maintain current conditions (avoid degradation) or alter the trend toward a more desirable condition (restoration). On-the-ground managers used site-specific information to prioritize management practices and to evaluate the success of management actions. Policy makers and program designers have been able to use site-based potential to identify ubiquitous resource problems, secure and allocate financial and technical resources, and communicate the outcomes of programs to legislators and the public.

During the twentieth century, the site concept became increasingly sophisticated and complex as we learned more about landscapes, culminating in the "ecological site" concept. As more supporting information (soil survey maps, plant community dynamics) became available, site descriptions were increasingly effective in communicating the effects of management. Over the past century, there have been three major phases of development of the site concept.

The first phase was rooted in the formal definition of site as proposed by Korstian[1] for estimating forest timber production and guidance for species mixes for reseeding sites. Korstian was a graduate of the University of Nebraska and Yale University in the early 1910s, a time period in which the influence of Frederick Clements was pervasive. In an interview late in his career, Korstian acknowledged the influence of C. E. Bessey on his education. Bessey is widely regarded as the father of modern plant taxonomy and was a colleague of Clements at the University of Nebraska. The dominant ecological theory of the time was proposed by Clements[2] and described a "climax" vegetation in equilibrium with the climate: the climatic climax. Climax theory also formed the basis for subdivisions of the landscape to predict vegetation patterns. One of the founders of the profession of range management, A. W. Sampson, wrote at length on the use of indicator plants to define landscape subunits for predicting successional patterns.[3] The presence of particular species or groups of species was used to define which elements of the landscape (combinations of soils, climate, landform) could be grouped together for systematic classification and description.

The second phase of the development of the site concept continued to adhere closely to the original ideas of the climatic climax and indicator species, but was reinterpreted to account for new theories. In large part, climax theory and its linkage to indicator plants remained intact as a means of predicting the endpoint of vegetation development, but a more nuanced interpretation of landscape variability provided the basis for grouping soil properties together. Tansley[4] proposed the "polyclimax" theory that predicted a climax plant community controlled by soil attributes (moisture and nutrients), topography, exposure, and disturbance. A further extension of this concept was proposed by Whittaker[5] with the "climax pattern" theory. This theory introduced the use of multiple drivers (seed dispersal, random disturbance agents such as fire) to predict climax communities. It was within this context that Dyksterhuis[6] first developed and proposed the range site concept. In this application, an edaphic climax community, as defined by indicator species composition and