

# Reconceptualization of Carrying Capacity Based on Landscape Ecology: Paradigm shifts and new approaches

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## **Expanded Abstract**

With the rising awareness and concern for environmental degradations and the need to understand how to maintain sustainable development under carrying capacity, it is more important than ever to develop theories and methodologies for understanding carrying capacity through natural and human processes as complex dynamic systems (Shi et al, 2016). There is a growing understanding that carrying capacity is not a static but rather an emerging, albeit complex, process with new notions coming along as people discuss possible solutions and new ways to apply and evaluate them (Arrow et al, 1995., Lane, 2010). Analyzing carrying capacity as a complex dynamic systems requires a systems approach, that is, a holistic approach that does not focus on a detailed understanding of parts, but on how links between key components contribute to the dynamics of the whole system. In these system, interactions cannot be comprehended merely by analysis, but only by synthesis within the context of the organization of the whole and its implications for resolving the pressing problems of our present ecological and cultural crisis (Palang et al, 2000) to better understanding the dynamics and patterns of ecosystem services production and benefits (Costanza, 2010).

Nowadays, landscape ecology is an interdisciplinary, integrative science, which is geared toward the holistic survey of landscape areas of various dimensions as towards certain problems in the landscape (Naveh, 2013). Landscape ecology has great potential to addressing urgent challenges facing society (Fu, 2013) and offers the capability to study and understand the scaling functions and the importance of pattern in maintaining a wide range of landscape services; so landscape ecology would be positioned as the scientific basis for carrying capacity.

Many of the greatest challenges in society have emerged as a result of humans acting within complex systems without fully understanding how they work (Thibodeau et al, 2016). To understand change mechanism in landscape, researchers must consider related issues such as the features and dynamic changes of landscape structure and function. The use of our world and its natural resources is based on a comprehensive consideration of all ecological, social and economic functions and without compromising the potential to deliver goods and services to future generations (Linehan and Gross, 1998). If we consider these principles to be valid for landscape development, then decisions on changes in landscapes have to be taken after consideration of economic, social and ecological functions and values (Termorshuizen and Opdam, 2009).

Shifting societal needs drive and shape landscapes and the provision of their services (Willemen et al, 2012). By changing landscape properties, human activities (i. e. policy and economy) can directly or indirectly affect the supply of landscape services. Therefore carrying capacity in integration to landscape ecology would consider the degree that a landscape can be changed without impairing or losing important functions or services. Accordingly, this research first reconstructs and assesses current concepts of the carrying capacity. Thereafter, it would propose a framework for transforming ecological carrying capacity to landscape carrying capacity in order to improve performance by integrating landscape ecology principals and carrying capacity. This would be possible through system dynamics to achieve social ecological interactions in a landscape carrying capacity.