Comment Paper

Viewpoint on objectives, boundaries, and rangeland carrying capacity

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Abstract

This paper *de-analyses* a recent paper by Roe (1997, *J. Range Manage.*, 50:467-472) entitled *Viewpoint: On Rangeland Carrying Capacity*. This response to that paper: (1) examines and demonstrates the importance of defining objectives and boundaries in management, science, *management science* and art, (2) reaffirms an earlier, objective-based concept of carrying capacity applicable to general systems and to models of them, and (3) implores minimal use of unnecessary jargon in range management science.

Key Words: grazing capacity, stocking level, range management science

Some science involves analysis, some involves synthesis, and some involves what might be termed *de-analysis*. The purpose of this brief viewpoint is to de-analyse the recent paper by Roe (1997, *J. Range Manage.*, 50:467-472) entitled *Viewpoint: On Rangeland Carrying Capacity*. Specific objectives of this response paper are to: (1) examine and demonstrate the importance of defining objectives and boundaries in science, management science, and art, (2) reaffirm an earlier, objective-based concept of carrying capacity applicable to general systems and to models of them (Scarnecchia 1990), and (3) implore minimal use of unnecessary jargon in range management science.

Objectives and boundaries are essential in management, in science, in management science, and in art. To paraphrase G.K. Chesterton, (Reader's Digest Association 1996) management, and management science, like art, consists of drawing the line somewhere. The absence of clearly stated objectives in Roe's paper is consistent with the absence of clear objectives, and boundaries, of the concept of carrying capacity in the paper's analyses. Specifically, Roe: (1) initially distinguishes among past concepts of carrying capacity but, lacking the direction of rigorous objectives of application, "constellates" them into a vague notion for the paper's analyses, (2) is unwilling to attach any boundaries to the "range" or its "environment", so that his concept of carrying capacity inevitably explodes into an unbounded, infinite environment of uncertainty where carrying capacity is related to everything, and (3) because of (1) and (2), inevitably uses the terms "conception," "notion," "theory," and "meta-theory" loosely in the absence of any scientific structure in this uncertain environment (universe). The author's elementary philosophy lacks objectives, and his needlessly complex, if fashionable, socioeconomic and *uncertainty* analyses leave the concept of carrying capacity technically vague, philosophically infinite, and, more or less, useless.

With respect to (1) above, Roe asserts that "If carrying capacity is necessarily a constellation of different cases and conventions over just what carrying capacity is a case or instance of, then it should come as no surprise that managing carrying capacity is more likely to be effective when it legitimates these differing understandings rather than obscures, avoids, or forces us to choose among them." Such an accommodating approach better meets the objectives of conflict resolution in social science than concept design in range management science. Sociological applications notwithstanding, the only way such differing concepts can technically be "legitimated" is by examining the objectives behind each distinct concept's origins and applications separately, and if possible, abstracting a general concept for application to specific objectives within specified boundaries. They cannot be "legitimated" by "constellating" them into a vague "notion" that can be neither clearly applied, nor be clearly communicated, because it has no clear conceptual boundaries to give it a single identity. This aspect of Roe's *uncertainty* surrounding the definition and communication of carrying capacity can be eliminated by rigorous, objective-based concept design, and in fact *must* be eliminated for meaningful, technical applications to be possible.

Roe's conclusion is that carrying capacity is generated in "this model by the range manager's forging a pathway across a 3-dimensional terrain of urgent decisions, uncertain knowledge, and obsolescent information relevant to what he or she takes to be the carrying capacity (and stocking rate) issues of interest." This picturesque description is as close as the paper comes to an application in range management science. But what can be the application of Roe's expansion "notion" of carrying capacity, when he concludes that: "If the notion of rangeland carrying capacity is to make any sense under conditions of high environmental uncertainty, it has to be at this meta-equilibrium level, where the notion of rangeland carrying capacity is, in effect, a meta-theory about how the capacity of a rangeland to carry a population changes over time, without however being able to predict what that carrying capacity will be in any specific instance or at any specific time. If this is so, then carrying capacity is really a theory of knowledge generation and change over a rangeland population and area."

Such lofty jargonizing propounds the trivial, even while obscuring it. We need to take a deep breath and remember that the concept of carrying capacity is a human concept, not a universal truth. An earlier paper defined carrying capacity *generally* as "the optimum number of individuals or units to achieve specific objectives given specified management options." (Scarnecchia 1990). The heuristic advantages of such a definition were dis-

cussed, e.g., that as we more clearly define objectives and more thoroughly understand a modeled system, the more accurate and meaningful our estimates of carrying capacities become. Carrying capacities can be conceptualized for real systems, but to *use* the conceptual tool, carrying capacity must be a model of limited complexity based on specified objectives, because we may visualize, but cannot otherwise apply a concept of infinite complexity in an environment of infinite uncertainty. The objectives, variables and boundaries of application of functional models are designed to meet the objectives of the modeler or user. The adequacy of these model objectives, relevant variables and model boundaries determine the adequacy of a model in simulating or adequately predicting a system carrying capacity. A model is validated if it meets defined standards as determined by experience and/or the indicators either measured or estimated. The inherent uncertainty of natural systems *per se* (the other major aspect of Roe's *uncertainty*) is just an element of model validation.

But without *certain, defined* boundaries to a model or system, *the concept of carrying capacity itself* expands to fill the universe as a function of an infinite number of variables, replete with uncertainty of several dimensions. Roe fills 5 pages with dense, varied jargon, including a topology analysis by Ragin (1992), and an equilibrium analysis of Hahn (1984), to show that an integrative concept, (i.e., carrying capacity, but also, for example, *rangeland health*), without defined boundaries can involve the universe and become a theory of knowledge generation and change. Four pages might have been saved by remembering that the trip from the *back 40* to the edge of the universe is mostly empty space.

In fact, without specified objectives and limited boundaries, any object, any variable, any model **explodes** into a useless, amorphous theory of knowledge generation and change, and any unbounded "notion" (further abstracted concept) of them becomes a *meta-theory* of how that theory changes over time.

Why not the average cow, for example? The average cow has a certain vague inscrutability. Like Roe's carrying capacity, a cow on planet Earth "is always—repeat—always moving several ways at once." (It is moving even more ways if it's actually *moving*.) In fact, a cow, in the abstract, and in the absence of **objectives of description**, is a veritable **infinite** mass of uncertainty, in an uncertain environment. Adopting the reasoning of Roe, it seems that "if the notion of a [a cow] is to make any sense under conditions of high environmental uncertainty, it has to be at this *meta-equilibrium level*, where the notion of [a cow] is, in effect, a *meta-theory about how [the cow] changes over time, without however being able to predict what [the cow] will be in any specific instance or at any specific time. If this is so, the [a cow] is really a theory of knowledge generation and change over a rangeland population and area.*

Of course, since the "real system in question is never just the range," (Roe, Pg. 468), uncertainty remains as to exactly what "rangeland population and area" *carrying capacity*, or *the cow*, is a theory of knowledge generation and change *over*. In an inevitably uncertain environment devoid of specific objectives, defined boundaries, and simplifying models, the concept of carrying capacity is a functionally infinite, and infinitely unmanageable part of range management science.

Still, intuitively, I like the creative aspects of the abstract "notion" of a cow as a meta-theory of how the cow changes over time, and of a cow as a theory of knowledge generation and change. But I hope other authors will resist the temptation to

develop a *meta-meta-theory* about the meta-theories and theories of such knowledge generation and change in uncertain environments. Even though such a *meta-meta theory* would have no obvious applications in range management science, certainly it can be developed, and adorned with some superfluous, extra-disciplinary analyses. Then it could be sent to a *jargonophilous* refereed journal. It's a matter of finding the right one.

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