Relinquishing Boundaries: Metaphors for conceptualizing institutional systems

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Abstract

Planning for parks and protected areas is characterized by 'messy' and 'wicked' situations. Due to the complexity of these situations, we need sense-making devices–models and metaphors–that can aid in their conceptualization. Conventional approaches rely on delineating boundaries–boundaries between ecosystem types, political jurisdictions, disciplinary considerations, and more. Although such boundaries have been developed to reduce the complexity of intractable systems, they fail by excluding many critical factors. Such failures are indicated by many threats to ecological integrity, including fragmentation, invasion of exotic species, increased intensity of stressors, and loss of biodiversity. In order to cope, we need alternate models and metaphors that can help identify and inter-relate the wide range of factors influencing the systems of concern, including, bio-physical and *socio-cultural factors. Drawing on complex and self-organizing systems concepts, this paper presents alternate metaphors. In particular, it briefly describes a different conceptualization of ecosystems as complex, collectively-producing, boundaryless systems. In consequence, a distinction between 'organisms' and 'ecosystems' is made that provides a tool for understanding bio-physical* and *socio-cultural systems. This metaphor also can be applied to understanding park planning and management systems.*

Introduction

My background, both personally and academically, is illustrated by the photo in Figure 1. Concern for such areas continues to provide the motivation for my research, with a particular focus on three interconnected challenges:

1) In planning for the conservation of natural areas, research focused exclusively on biological and ecological considerations is naive and inadequate. Salient concerns include social, economic, political and cultural influences. In order to cope with the subsequent difficulties and uncertainties, we must incorporate recognition of the complexities that arise from such wide-ranging and ever-changing influences.
2) This complexity requires that we use sense-making devices such as models and metaphors to simplify the world into an accessible form. The difficulty lies in finding appropriate devices. Two common metaphors, mechanical systems and organisms, are inappropriate for most complex situations relevant to planning and management for parks and protected areas. In my earlier research I found this especially true for ecosystems, most notably with respect to our apparent insistence on delineating boundaries. When considering the increasingly common extension of 'ecosystem' to include human social systems, the lack of appropriate metaphors is especially apparent.
3) Appropriate metaphors can help generate understanding about the ecosystems and social systems of concern to park and protected area planning and

Figure 1: Carmanah Valley Provincial Park, British Columbia

management. However, it is also critical to consider the dynamics, influences and behaviours of the planning and management institutions themselves and those factors that influence them. In this case, both the lack of appropriate metaphors, and the will to apply them reflexively, are issues of concern.

To address these challenges, I apply concepts from complex systems thinking (e.g. Lewin 1992, Kay and Schneider 1994, Dempster 1998b, Mainzer 1998). These emerging concepts – which have been applied to both bio-physical and socio-cultural systems – suggest different metaphors that are useful for understanding. I focus, in particular, on their potential for relinquishing the need to define boundaries. The resulting perspective enables a distinction between organisms and ecosystems, based on a variety of different characteristics. This distinction can then be applied as a metaphor for understanding social systems.

My intent here is to briefly describe this distinction, which primarily relies on a new characterization of ecosystems. I believe this encourages a more appropriate understanding of ecosystems and social systems. In addition, I believe it is useful for understanding the institutions responsible for the planning and management of parks and protected areas. The purpose of introducing these ideas is to offer *you*, the reader, a different perspective for looking at, and thinking about, the systems you work with, and within.

Systems

Organism-Ecosystem metaphor

Figure 2 symbolically represents the distinction between organisms and ecosystems that I describe. The 'organism' is easy to delineate and measure due to its clearly distinguishable boundary. In contrast, the lack of a clear boundary makes the 'ecosystem' difficult to delineate, describe or measure. Although the former representation is often applied to ecosystems, I believe the fading circle is more

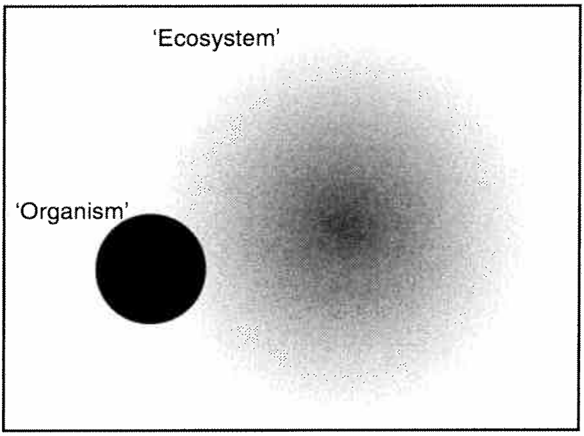

Figure 2: Symbolic representation of 'organism' and 'ecosystem'.

accurate. Building on this difference by incorporating common organism and ecosystem descriptions and complex systems concepts, I have developed a set of characteristics associated with each representation (Table 1).

I portray these as two different types of system, yet I note a few cautions. These are sense-making devices – lenses for looking at the world through – they are not descriptions of reality. Each system type is a caricature that emphasizes particular characteristics. Each should be considered as the end of a continuum. Interpretations of 'real' systems will best fit a description at some intermediate point in between the caricatures. More detailed description of these caricatures, which I refer to as autopoietic (Maturana and Varela 1980) and sympoietic systems (Dempster 1995), respectively, can be found elsewhere (Dempster 1998a, 1998b).

Examples fitting the two sets of characteristics can be found in both bio-physical and socio-cultural domains (Table 2). For example, 'group-think' is the label attached to small groups of people that become internally focused to an extreme, excluding input of people and information (Janis 1982). Such groups make decisions that are often recognized as inappropriate, in retrospect, as illustrated by decisions about the Vietnam War and the design of the Challenger Space Shuttle. Characteristics of these groups reflect the bound, centrally controlled, self-contained, 'organism' description. By comparison, an open group, allowing inclusion

Organism-like	Ecosystem-like
tree	forest
individual human	community
clique or group-think	open group
technical jargon	common english
expert driven task force	participatory process
rational-comprehensive planning and management	ecosystem and/or adaptive management

Table 1: Examples of organism-like and ecosystem-like entities.

Orgamisms	Ecosystems
boundaries	lack of boundaries
autonomous units	complex, amorphous entities
centrally controlled	distributed control
self-contained information	distributed infroation
relatively predictable	relatively unpredictable
self-producing	collectively-producing
developmental	evolutionary
finite	potentially infinite
homeostatic balance	balance by dynamic tension
require certainty	ok with surprise
efficient	adaptable, flexible
accumulate specific information	open to new and different information

Table 2: Comparison of organism and ecosystem charactersitics (after Dempster 1998).

of new members and information, illustrates the set of ecosystem characteristics. Similar differences between jargon and common language illustrate advantages of the two system types in different situations. While technical jargon is valuable for sharing ideas among 'experts,' it is inappropriate for communication among people with different backgrounds. The latter situation requires the more open common language – a concern relevant to communicating with the public about parks and protected areas.

In addition, the currently common appeal for more open and participatory approaches to planning and management reflects a move from 'organism' characteristics toward 'ecosystem' characteristics – from the standard rational-comprehensive planning approach toward participatory adaptive management (e.g. Lee 1993, Gunderson *et al.* 1995, Agee 1996, Jope and Dunstan 1996). In this sense, the 'ecosystem' characteristics may provide design criteria for appropriate planning and management systems – a consideration noted below. It is essential, however, to recognize that this description of ecosystem does not match the standard representation, but reflects complex systems concepts.

Complex systems thinking

Research into complex systems offers a wide range of concepts and applications. Many of these concepts have been applied to ecosystems (e.g. Allen *et al.* 1993, Schneider and Kay 1994, Kay and Schneider 1994, Patten and Jorgensen 1996, Regier and Kay 1996), but they can also be applied for understanding social systems(e.g. Lewin 1992, Dempster 1998b, Mainzer 1998), in particular, for understanding planning and management institutions themselves. I draw attention to lessons relevant to parks and protected areas.

1) Be wary of positive feedback – such as exponential population growth – which occurs when system outputs have a reinforcing or augmenting influence on inputs. The QWERTY keyboard (named after the top left keys) is an example. This familiar key arrangement was *designed* to slow typists down because manual typewriter mechanisms jammed if key strokes occurred too quickly. People bought typewriters with this arrangement, so more people

learned this arrangement, and then more people bought typewriters with this arrangement, and so on. In consequence, despite overcoming the technological barrier, we continue to use an inefficient arrangement of keys.

2) Information about a system's own pattern of organization is important. The simplest illustration is genes for an organism. Biodiversity also provides critical instructional information for ecosystems and policies, rules and regulations provide a similar function for social systems and institutions. In addition, underlying cultural norms and 'unwritten rules' that instruct our behaviour inform the organization of our cultural systems.
3) History has momentum, since the information contained in any given system develops over time but also has a critical influence on future directions. As noted with positive feedback, ingrained patterns of behaviour can be significant barriers to change.
4) Systems are greater that the sum of their parts. 1+2=3, but 1 oxygen atom and 2 hydrogen atoms equals a water molecule that is distinctly different and interesting because of the properties it carries when these atoms are together. These emergent properties result from the parts relating as a functioning *whole* – if the system is taken apart, the properties or qualities no longer exist. Life is a classic example.
5) We should learn to expect surprise – disasters, drought, and pestilence as 'natural' examples, climate change and lake acidification as human induced examples. The latter example illustrates 'catastrophic' change, when a system suddenly 'flips' into a new or different state. In this case, a dramatic increase in pH occurred 'overnight' when the buffering capacity of the lake system was finally overcome. Revolutions, stock-market crashes, and the fall of the Berlin wall are social examples. Note that learning to *expect* surprise, is *not* the same as learning to *eliminate* surprises. In many cases, further research aimed at making predictions is futile. 'Surprises' often happen *because* of – rather than *in spite* of – our plans and actions.
6) Nature is balanc*ing* not balanc*ed*. Figure 3 illustrates the conventional representation of 'natural equilibrium' – a ball resting in a bowl – and an alternative representation – a ball *balancing on* a bowl. Although nothing more than a shift in perception, the most frequent response to the second illustration is a puzzled look and the question: "But what *keeps* it there?" Surely this is exactly the question we *should* be asking! Systems must spend energy and resources to maintain or regain balance. By leading to different questions, the alternate representation may lead to different approaches. These two representations reflect the organism' and 'ecosystem' characteristics described above.
7) Tradeoffs are inescapable – a lesson learned by any decision-maker! The organism–ecosystem comparison provides an illustration: one cannot simultaneously carry characteristics from *both* sets. For example, efficiency and

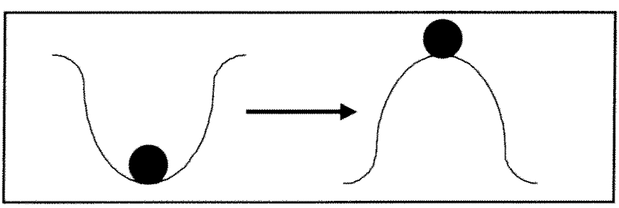

Figure 3: Nature-balanc**ed** to nature-balanc**ing**

flexibility are tradeoffs – a high degree of one, leads to a low degree of the other. Since the characteristics in each set are linked to each other, the tradeoffs are also relevant with respect to the less 'obviously' oppositional characteristics. For example, centralized control and self-contained information also tend to be tradeoffs against flexibility.

These lessons from complex systems thinking are reflected in the ecosystem characteristics listed above (Table 1). They have potential value for understanding biophysical and social systems that are of concern for the planning and management of parks and protected areas. For example, consider, designing a planning and management system appropriate for each set of characteristics. Two different approaches would be essential: one that could rely on predicting and controlling organism-type systems, the other that would have to cope with the surprise and change inherent in ecosystem-type systems. Given recognition of these differences, the value of using the two sets of characteristics and the forgoing lessons to help understand planning and management systems can also be noted. A control-oriented, efficient organism-type institution, with self-contained information and a need for certainty may be appropriate for coping with organism-type systems, but will not be appropriate for ecosystem-type systems. The latter would require the open adaptable characteristics of an ecosystem-type institution.

Boundaryless Systems

There are two key questions that arise with respect to the boundaryless characterization of ecosystems described here. 1) Since boundaries perform a useful function as regulators of system inputs and outputs, what mechanisms perform this function in boundaryless systems? 2) Since boundary delineation is a common means of systems identification, what alternate means are available? Considering resolutions to these questions is helpful for further understanding.

'Boundary' mechanisms

The concept of structural coupling (Maturana and Varela 1980) – the degree of fit between the structural characteristics of system, inputs, and environment (Figure 4) – illustrates the input regulating mechanism of ecosystems. For example, whether or not an exotic species can be integrated into an ecosystem, depends on whether the exotic can fulfill its energy and material requirements. Without an appropriate food source (structural inputs), the exotic will not survive. Due to such factors, only inputs that can structurally couple will be integrated into an ecosystem.

This example provides a tool for considering social mechanisms, although the 'structures' will not be physical entities. Consider, for example, the difficulty of integrating qualitative information into a planning and management institution geared for dealing with quantitative 'scientific' information. The descriptive 'structure' of local ecological knowledge or value preferences may not fit into a system that relies on the statistical analysis of numerical 'structures' or another established procedure for validating the 'accuracy' of scientific information. Even though committed to including ideas through participatory processes, a planning and management system may inadvertently restrict inputs due to inappropriate structural coupling.

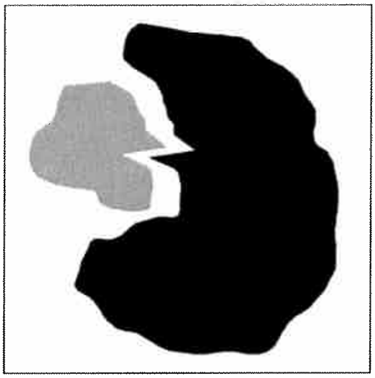

Figure 4: Structural coupling and fit.

System identification

By relinquishing boundaries, a different method for system identification is required. I suggest using the factors involved in system self-organization. A complex, self-organizing system can be identified by the various influences that generate it, rather than by delineating boundaries around it. One of these – positive feedback – was described above. Another factor is the presence of, and interaction between, global and local influences such as those generating river patterns.

In this example, the underlying global influence is gravity, which provides a general direction to all water. The water, however, is interrupted by local influences from soil particles to large geologic features. The resulting interaction generates the river pattern (Figure 5). Different patterns will emerge from interactions with different local landscape influences (Figure 6).

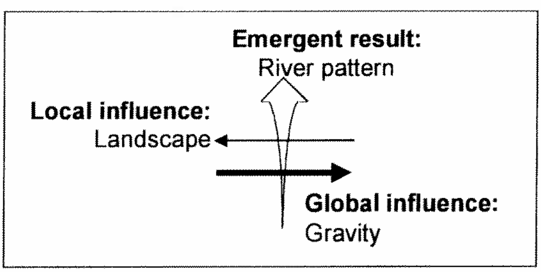

Figure 5: Interactions generating river pattern.

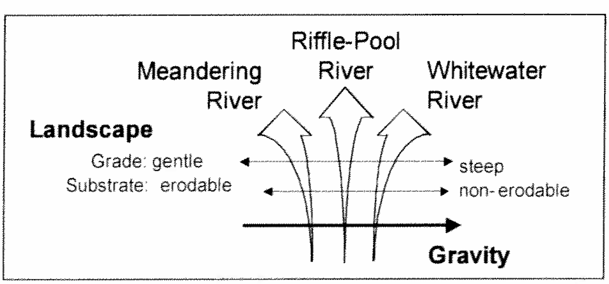

Figure 6: Different interactions generating different patterns.

These ideas can also be applied to social systems. For example, small group effectiveness depends on balancing a variety of different influences (Larson and LaFasto 1989, Barker *et al.* 1995). As with river patterns, different types of small groups emerge from different interactions. Figure 7 illustrates factors relevant to group maturity and decision-making. This example emphasizes the dynamic nature of such interactions. As goals become clearer and in-group interactions increase, the group matures, increasing its potential for shared decision-making.

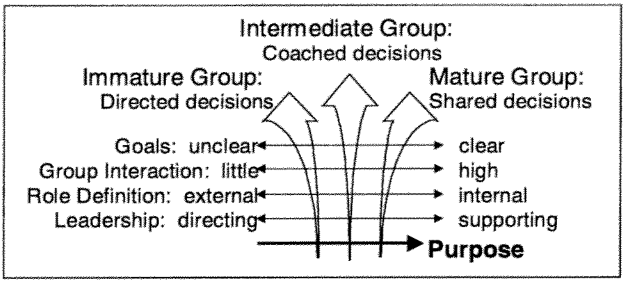

Figure 7: Interations generating different types of small groups.

Conclusion

My intent in this paper was to briefly introduce ways of looking at, and thinking about, systems relevant to park and protected area planning and management that differ from conventional approaches. Further discussion can be found in Dempster (1998a, 1998b). There are several key points to consider.

Organisms and ecosystems can be considered as two contrasting system types with different sets of characteristics. Of particular note is the characterization of ecosystems as complex, collectively-producing, boundaryless systems. Augmented by concepts from complex systems theory, this characterization more accurately represents ecosystems than other representations that are commonly applied. Due to the significantly different characteristics of the two systems types, this distinction between organisms and ecosystems emphasizes the need for different planning and management approaches. The latter point is critical for park and protected area planning and management and is useful with respect to three different aspects.

First, the two system types, and especially the different characterization of ecosystems, can be applied as an aid to understanding biophysical systems. Second, the metaphors and lessons described above can be applied to the social, economic, political and cultural systems that must also be considered in the planning and management of parks and protected areas. Third, they can be applied to the planning and management systems themselves, a notion I believe to be particularly important. For example, the current calls for more open participatory processes parallel a shift from using organism-type planning systems to using ecosystem-type planning systems. Recognizing the two sets of characteristics and their subsequent tradeoffs may help planners and managers understand the dynamics of the systems they work with and within. By characterizing what types of planning and management systems exist, and what *should* exist, advantageous changes can be considered. In addition, understanding system dynamics may highlight barriers to change – factors preventing implementation of even the very best ideas.

Of particular importance in considering such dynamics are structural coupling and self-organizing factors. Recognizing that inputs need to fit, or couple appropriately, in order to be incorporated into a system is a useful consideration. Identifying self-organizing factors such as positive feedback and global local interactions, can provide a means for identifying such complex systems. In addition, recognizing the underlying influence of global directions such as gravity may also point to previously unrecognized influences.

While application of these metaphors does not (and cannot) provide precise descriptions or predictions of future behaviour, they do provide useful tools for thinking about the world in a different manner. As an example, Table 3 provides a list of questions that arise from applying these metaphors and lessons to planning and management institutions.

Regarding the organism-ecosystem metaphor:

- Is this institution best charactersized as an organism or an ecosystem? Does it have clear or distinct boundaries?
- Given the range and type of systems this institution is responsible for, what type of system—'organism' or 'ecosystem'—*should* the institution be?
- To make this institution more representative of the appropriate set of characteristics, what should be altered? What should be encouraged?

Regarding the complex systems lessons:

- What positive feedbacks influence this institution?
- What performs the role equivalent to genes for an organism? What provides instructional information?
- What ingrained patterns of behaviour restrict desirable change?
- What makes it greater than the sum of its parts?
- What aspects are lost if the parts are analysed isolation?
- Does this institution rely on eliminating surprise by attempting to learn 'everything' and predict future outcomes? How can it become more flexible?
- What kind of balance does—and/or should—occur in this institution? What are the factors maintaining the position?
- What oppositional characteristics has this institution been trying, unsuccessfully, to capitalize upon? Given institutional priorities, what tradeoffs are most appropriate?

Regarding structural coupling as a boundary:

- What are the 'structures' of the institution? What is the equivalent to the biosphysical linkages and requirements of an exotic species?
- What will enable or 'disallow' a new species to be incorporated into this institution?
- How can the institution ensure that there is a nurturing environment for new ideas and information to couple to? What ideas and information are excluded by the institution?

Regarding self-organizing factors for identification:

- What factors play a role similar to gravity by providing a general direction to all components in this institution?
- What factors play the role of landscape by interrupting the flow on a localized level?
- What is the pattern that develops?
- How might the pattern change if the direction of 'gravity' changed? Or if the landscape influences were removed?

Table 3: Questions relevant to understanding institutions

The complexity of the systems involved in planning and management of parks and protected areas defies accurate representation. The ideas presented here illustrate one possible means for conceptualizing such systems, including biophysical systems, social systems, and planning and management systems. Since they differ from conventional means of conceptualization, they may provide useful insights regarding the dynamics, behaviour, and potential for change in such systems.

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