Ecological Integrity Discourses: Linking Ecology with Cultural Transformation

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Abstract

Scientific discourses are rhetorical constructs for interpreting, articulating, and coordinating the bits of information and knowledge produced by science. Discourses also help scientific communities promote and advocate particular strategies for action. A review of the literature on ecological integrity has led us to identify four scientific discourses: (1) Wilderness-Normative, (2) Systemic-Normative, (3) Ecosystemic-Pluralistic, and (4) Transpersonal-Collaborative. Each of these discourses differs in the conceptual definition of ecological integrity, the role of science, and the assumptions regarding human-ecosystem relationships. The Transpersonal-Collaborative differs from the others in that it embraces the construction of personal and cultural meanings for ecological integrity. Each of the four discourses emphasizes different beliefs and worldviews, which, in turn, promote specific conservation practices. Acknowledging a diversity of discourses and recognizing personal commitments to particular discourses would increase the transparency of contextual decisions regarding the alternative conservation strategies suggested by different scientific communities.

Keywords: *Ecological integrity, socio-ecological systems, global environmental crisis, collaborative learning, conservation discourses*

Introduction

Ecological integrity has been discussed in the environmental literature as a useful concept for addressing the global environmental crisis and as a guiding principle for the transition towards sustainability. A positivist approach is often assumed that conceives ecological integrity as something that can be objectively defined and achieved. We argue that this kind of conceptualization produces representations of ecological integrity that lack flexibility and reflexivity for dealing with the complex empirical dimensions (political, cultural, existential) of the global environmental crisis. We develop an alternative approach based on constructing a range of ecological integrity discourses. Each discourse is a set of reasoning patterns and rhetorical strategies produced by, and embedded in, particular scientific communities and networks of social relations. Each also entails particular worldviews, social practices and strategies for giving meaning to physical and social realities, and addressing the global environmental crisis.

The example of the Maya Biosphere Reserve in Guatemala illustrates the relevance of a discursive approach to ecological integrity. The reserve was established in 1990 by the Guatemalan Congress for preserving the integrity of the remaining rainforest that co-evolved with Mayan culture for centuries. The reserve was designed according to strictly biological criteria dictated by outside experts, and its imple-

mentation followed a top-down interventionist approach fuelled by international funds. One of the results of this approach was a violent response by people inhabiting and exploiting the resources from the areas declared now as "free of human influence." A decade of struggles between conservationists and local people has forced the development of new conservation strategies, especially strategies oriented to increase local participation in management. Despite these efforts, the integrity of the Mayan forest is still at stake: (1) the agricultural frontier expands even in the core areas of the reserve, (2) the participatory management schemes present serious limitations when put into practice, and (3) the national demographic and political dynamics threaten to increase the existing pressures in the area. This Mesoamerican story illustrates that any effort to overcome the global environmental crisis must not only consider humans, but, more importantly and particularly over the long term, must involve transformations at both personal and cultural levels. As Ehrlich (2002, 32) states in relation to the global environmental crisis: "what is desperately needed now is much better understanding of the ways in which culture evolves and determines most interesting human behaviour, including humanity's treatment of its life support systems."

The experience in the Maya Biosphere Reserve points to the need for a general move in conservation from "technical fixes" to a focus on social and cultural change. At the conceptual level, this shift is illustrated in this paper by the evolution of the scientific debate on ecological integrity. The main concern of ecological integrity is to confront the current global environmental crisis. What is at stake is either the integrity of ecosystems, the survival of human beings as a species, or both. In this paper we discuss four different ecological integrity discourses that are produced or, at least, supported by scientific knowledge: (1) Wilderness-Normative, (2) Systemic-Normative, (3) Ecosystemic-Pluralistic, and (4) Transpersonal-Collaborative. Each of these discourses to ecological integrity is based upon different perspectives of the human-environment relationship and entails different ways of doing research. At a conceptual level, they can be seen as co-created narratives. This co-creation implies that each discourse owes part of its existence (in the form presented here) to the others. As a consequence, there are no contextually independent (i.e. "objective") criteria for choosing between them. Each discourse has merits and limitations in specific situations, and its application may do more harm than good if it is carried out beyond its limits or in inappropriate circumstances. Even when used within their limitations, they cannot tell us about the right thing to do. Rather, each is a conceptual tool that aids better understanding of our relationship with the environment. As such, each provides alternative ways of engaging in conservation practices and, hence, informs us about what actions can be taken in particular situations.

Wilderness-Normative Discourse

The basic assumption of this discourse is that ecological integrity does not include human beings. Integrity is seen as a pristine, optimum state that ecosystems either have or have not: "the state of being whole, entire or undiminished, a sound unimpaired or perfect condition" (Miller and Rees 2000, 10). The degradation or loss of integrity comes from any human-induced divergence from a baseline condition. The divergence can be measured through changes in a variety of biological attributes (Karr and Chu 1995; Christensen et al. 1996; Brussard et al. 1998).

From an ethical standpoint, integrity is valued as the foundation of life on earth. This fundamentalist assumption places integrity as a central principle whose acknowledgement and fulfillment cannot be morally challenged (Westra and Lemons 1995; Callicott et al. 1999). To prevent the harm of ecosystems becomes an ultimate value; the basis for a new categorical imperative that follows from pure thought or reason. The principle of integrity is independent of personal wishes and cannot be subjected to negotiation (Westra 1994). It is also independent of whether upholding it leads to the "best" consequences in a given context. It represents a moral obligation rather than a moral choice. It embraces both biocentric (i.e. intrinsic value) and utilitarian (i.e. life-support functions) ethical imperatives that come before any other moral consideration. As a corollary, integrity encloses a prescribed, unalterable and unchanging end, toward which every living thing unfolds.

Biophysical reality is portrayed, in this discourse, as divided into three closed compartments that require different management regimes (Hunter and Calhoun 1996; Brussard et al. 1998): pristine ecosystems, buffer areas, and human areas (Figure 1A). A pristine central core area would receive the highest degree of protection, which decreases outward across a gradation of multiple-use buffer zones and corridors. Integrity applies only to pristine areas, while the concept of ecosystem health[4] is applied to buffer areas (e.g. agroecosystems). Ecological integrity is achieved by avoiding the "threats" human beings impose on natural areas. Human activities must be managed in order to ensure: (1) the isolation of a sufficient percentage of pristine areas from damaging human effects, and (2) the maintenance of healthy buffer areas (Westra and Lemons 1995).

Experts determine ecological integrity (Figure 1B) and inform legislators, courts, and managers who, in turn, executes command and control actions (legislation, policies, and regulations) to compel human actions with respect to ecosys-

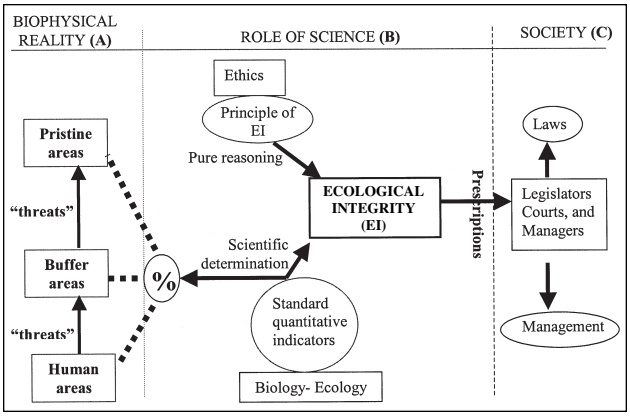

Figure 1. Wilderness-Normative Discourse. (EI = Ecological Integrity).

tems (Figure 1C). The worldview supporting these procedures is clearly modernist and positivist. That is, empirical observations through quantitative indicators appear as the only means to have access to objective reality and truth. Research methods involve the collection of quantitative data to "build up" ecological indicators (Grumbine 1997). Such indicators are used to compare a specific area with regions believed to represent undisturbed ecosystems. Standard indicators and baseline values are required in order to operationalise ecological integrity and formulate quantitative prescriptions that can be used in court. This entails a very pragmatic research practice. As stated by Miller and Rees (2000, 10), the challenge consists of "separating scientific wheat from mystical, speculative, or romantic chaff." Because of the human need for natural resources, the main task becomes determining the minimum percentage of land to preserve in order to ensure integrity at a global scale (Figure 1B) (Lemons 1995). Given the lack of precise ecological models that predict the consequences of human activities, the priorities are to: (1) discover the relevant properties of ecosystems associated with loss of integrity, (2) design appropriate indicators, and (3) identify levels of those indicators that can define integrity or lack thereof (Rapport 1990; Evans et al. 1990; Hellawell 1991; Karr 1991; Karr and Chu 1995). Finally, a (4) system of feedback for monitoring and modifying indicators and their values is also needed (Keddy et al. 1993; Christensen et al. 1996). A common strategy consists of looking at the threshold of spatial scales at which biotic processes may persist. These thresholds determine the extension or percentage of wild areas needed to maintain ecological integrity (e.g. spatial heterogeneity requirements of top-level carnivores).

Empirical research within this discourse has been developed for aquatic ecosystems and natural parks (Karr 1993; Woodley 1993; Parks Canada 2001). One problem found is the need to maximize the ratio of information provided to measurement costs (Lemons 1995). Another problem is the discontinuity of funding for long-term monitoring programs. The use of indicators is usually considered the only way to fully operationalise ecological integrity: "There is no other way to learn about the effects of human activities, (...) except through comprehensive monitoring programs using valid indicators" (Noss 1995, 71). The discourse strives towards holism in its effort to integrate measurements of diverse biological attributes such as: (1) biodiversity, (2) landscape characteristics, (3) connectivity, (4) disease vectors, and (5) migratory patterns (among others) (Miller 1995; see Noss (1990) for a comprehensive list of measurable indicators). Several indexes of ecological integrity have been proposed that fit into the logic of this discourse (Westra et al. 2000). The best-known example is Karr's multi-parameter Index of Biotic Integrity (IBI), which is used as the basis for regulation of aquatic ecosystems in several American states (Karr and Chu 1995).

The human dimension has been lately expanded in this discourse with the consideration of issues such as human population growth, equity, the consumption-oriented tendencies of Western society, ecosystem functions (defined in anthropocentric terms), or even the consideration of metaphors like that of natural capital (Rees 2000). This has brought the use of (1) new biophysical indicators devoted to assess the energy and material transformations imposed by our lifestyles on ecosystems (e.g. ecological footprint), and (2) the combination of ecological, social, and economic indicators as a more effective way of assessing and managing ecological integrity (Grumbine 1997; Brussard et al. 1998).

The underlying belief systems of this discourse assumes that ecological integrity requires "keeping people out of ecosystems," and that this can be accomplished through legislation and the implementation of "top-down" policies. The large amount of experiences amassed around the world regarding the establishment of protected areas offer important lessons about the suitability of this discourse in different contexts (see, for example, Brandon and Wells 1992; Lemons 1995; Gbadegesin and Ayileka 2000; Parks Canada 2001; Bruner et al. 2001).

Systemic-Normative Discourse

In this discourse, ecosystems are understood to be dynamic self-organizing systems. This understanding of ecosystems leads to the definition of their integrity as the ability to deal with an array of unforeseen circumstances (i.e. coping with stress, resiliency) (Kay 1991). Biophysical reality is portrayed, in this discourse, as divided into: (1) ecosystems, and (2) human areas (Figure 2A). Humans are still seen as

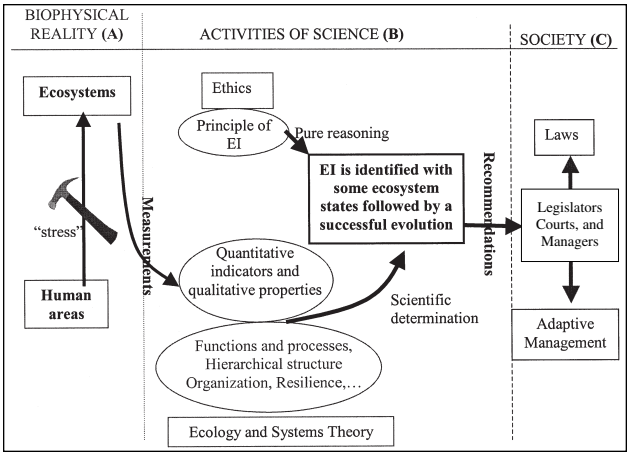

Figure 2. Systemic-Normative Discourse. (EI = Ecological Integrity).

'threatening', or 'stressing' natural systems. However, it is acknowledged that all ecosystems are, to some degree, influenced by human activities. Consequently, the idea of pristine or wild ecosystem is deemphasized.

The use of science in this discourse has still a modernist orientation, but it is more structuralist than positivist. Ecological integrity is still determined by experts, but empirical observations are not enough for unveiling Truth (Figure 2B). Ecosystems are the result of structural relations that must be understood and re-constructed. Owing to the complexity underlying these structures, a specific level of uncertainty will have to be generally acknowledged and considered as an epistemological limitation.

Ecosystems are understood as dynamic, instead of static, entities. Attention is focused on the rates at which changes occur. Natural changes are desirable, and acceptable. Efforts to constrain natural variability lead to homogenization and fragility. However, the existence of a "better" overall direction for ecosystem evolution and development is still assumed. There are different ways of getting there but there are definitely "right" destinations. Ecological integrity is about how much the ecosystem can deviate from a "good" direction without arriving at an irreversible change. This overall direction is assessed by looking at: (1) health, which applies to ecosystems that function successfully despite human impacts, (2) ability to regenerate themselves and withstand stress, and (3) ability to continue their ongoing development (Kay 1991). Scale-specific monitoring and adaptive management are needed in order to prevent destructive deviations from occurring.

From a systemic perspective an ecosystem's ecological integrity is about the state of its internal and external interrelations, processes, and functions (Figure 2B). In the previous discourse, the loss of even one species implies a loss of integrity, but according to this discourse, redundancies within functional groups make the biological composition less relevant (De Leo and Levin 1997). Ecosystems are seen as sets of highly interdependent entities evolving over time. Rules can be specified to describe how the system transitions from one state to another over time. However, the predictive capacity of these rules will be limited by the inherent uncertainties associated with the complexity of ecosystems. This conceptualization of ecosystems is enriched by the following notions (Kay 1991; Regier 1995; Jensen et al. 1996; Kay and Regier 2000; Holling 2001):

(a) Ecosystems are open self-organized and dissipative systems. Ecological integrity represents ecosystems ability to maintain their self-organized structures, which allow them to recover from external disturbances.

(b) Ecosystems evolve as their components evolve, and the maintenance of this evolutionary process is the key to achieving ecological integrity. As a middle point in the deterministic (i.e. succession leading to a state of climax) and stochastic (contingent) dichotomy, evolution involves complex interactions. Structure, pattern and a certain degree of predictability are still acknowledged (i.e. most combinations of coexisting life forms are not feasible).

(c) Ecological integrity becomes a scale-dependent concept. Ecosystems are conceived of as nested hierarchies, which are orderings of subsystems within systems, which themselves are parts of systems. The whole is emphasized as something more than the sum of its parts.

(d) Disturbances are explained as temporary disturbances from, or transitions between, attractors. Holling (2001) represents these disturbances through the concept of adaptive cycles where ecosystems develop phases of exploitation, conservation, release and reorganization, and can 'flip' into less or more organized cycles. The relevant question to be addressed when considering external disturbances is whether the natural dynamics can keep pace.

Research methods involve quantitative, scale-dependent indicators of functions and processes, rather than elements and components (King 1993; Westra et al. 2000). One example of an ecological indicator that would fit into the logic of this discourse is the measurement of "system ascendancy" (Ulanowicz 1997). This indicator merges notions from information theory and thermodynamics to assess an ecosystem's network for processing material and energy. Instead of linear degradation from a state of "pristiness," ecological integrity is assessed according to states of organization that are part of "normal" functioning. This kind of diagnosis may involve the integration of diverse information in order to make general arguments about ecosystem states (Lemons 1995). Comparative studies of similar areas with differential human impacts are fundamental for quantifying the functions and

processes that ensure an ecosystem's resilience. A methodological tension exists between the recognition of complexity and the technical tractability of information (Ascher 2001). The challenge is to pick up the most relevant aspects for every process in each situation. As suggested by Holling (2001, 391): "complexity ... emerges not from a random association of a large number of interacting factors, but rather from a smaller number of controlling processes." In this discourse the importance of monitoring is highlighted in order to (1) keep track of the consequences of managerial actions, (2) check their suitability, and (3) adapt to possible surprises (Figure 2C).

Although the tools used to measure and describe integrity are different, the ethical imperative and the implementation schemes remain largely the same as in the Wilderness-Normative discourse. One crucial change, however, is the promotion of adaptive management (Gunderson et al. 1995). Instead of blaming those "responsible," failure is turned into a learning experience at the institutional level. Adaptive management includes the modelling of social and institutional dynamics, and changes in human behaviour (Norton 1998). The idea is that we can achieve integrity, if we understand and manage human and ecological systems by accounting for: (1) the mechanisms of self-control (or self-organisation) supposedly existing in these two types of systems, (2) their resilience or adaptability to external changes, and (3) the interplay between them, represented as nested sets of adaptive cycles (or "panarchies"), that constitute the overall dynamics[5] (Holling 2001; Olson and Folke 2001). The implications for management are that we need more flexible institutional structures in order to attain more efficient control, and adapt to the inevitable changes occurring in both social systems and ecosystems.

This discourse has theoretical and conceptual links to most of the themes and applications of Ecosystem Management and the "Ecosystem Approach" (Christensen et al. 1996; Grumbine 1997; Slocombe 1998). In fact, maintaining ecological integrity is sometimes identified as a goal of ecosystem-based management (e.g. Jensen et al. 1996; Brunner and Clark 1997). Broadly speaking, ecosystem-based management reacts to past strategies based on static models of ecosystem functioning that might have had some catastrophic consequences (e.g. the fire suppression in Yellowstone Park). In this sense, its application can be valued as an alternative that, at the minimum, tries to offer a deeper and more realistic picture of ecosystems. However, its efficiency for improving management (understood as command-and-control) is less than evident. For instance, embracing of inherent uncertainties, or the difficulties of formulating easy-to-communicate statements of general application may represent important challenges for implementation. Despite these difficulties, the discourse has been broadly adopted in North America (Born and Sonzogni 1995).

Ecosystemic-Pluralistic Discourse

This discourse emphasizes: (1) complex systems theory as a fundamentally different perspective for knowing about the world (i.e. an ecological understanding of the world), (2) the incorporation of social values into the definition of ecological integrity and (3) the definition of a new role for science (i.e. from discovering universal laws to facilitating negotiation among conflicting values). Ecological integrity cannot be used to prescribe how things should (or should not) be. Instead, it can help to inform a participatory process for those decisions involving ecological issues (Figure 3B) (Funtowicz and Ravetz 1995; Policansky 1998).

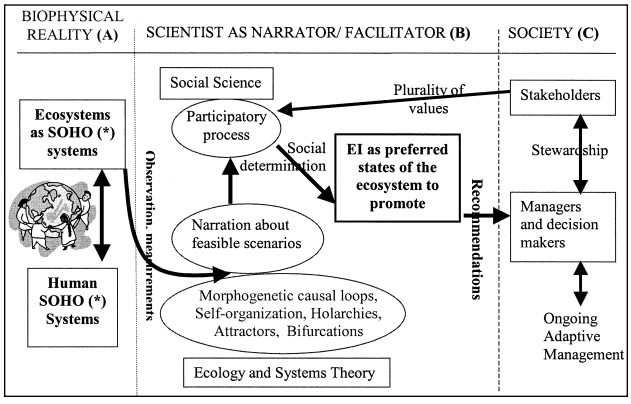

Figure 3. Ecosystemic-Pluralistic Discourse. (EI = Ecological Integrity).

This discourse recognizes the epistemological importance of the possibility, in a given situation, for several ecologically different regimes that have integrity. There may not be a unique, ecologically "correct" ecosystem to be preserved or maintained. Science has no basis for telling us which of the possible regimes is the correct one. It can only tell us, with an irreducible degree of uncertainty, what the different regimes might look like and how they might respond to human activity. Science can tell us about the tradeoffs involved in our actions. Which tradeoffs are acceptable and which regime should be promoted is a value laden choice, not something which can be dictated by experts.

Both ecological and human systems are described, in this discourse, as Self-Organising Holarchic[6] Open (SOHO) Systems (Figure 3A) (Kay and Regier 2000). To use the same framework of description for both systems facilitates the study of their interactions. Even though the emphasis is on natural ecosystems, human activities are considered to be the result of complex, self-organizing dynamics that interact, un-

avoidably, with ecological dynamics. Ecological integrity is determined by those states of an ecosystem that are biophysically feasible and compatible with the needs and wants of a society characterized by a plurality of conflicting values.

Research methods are basically the same as in the previous discourse. The Ecosystemic-Pluralistic discourse is modernist in that it still assumes a mind-nature divide, and the subsequent privilege of science's knowledge about nature. However, scientific knowledge is always obscured by irreducible uncertainties. Furthermore, observations of complex realities cannot ever be independent of the observer. This introduces the Hierarchy theory[7] notion of "criteria of observation" as the basis upon which one decides what relationships are important in an ecological observation (Norton 1995; Allen, T. et al. 2001). These criteria are not independent from the observer and are different from scale-defined levels (i.e. the same system at a specific scale can be observed according to different criteria of observation). As a consequence, no state of a system can be better in absolute terms (i.e. according to all the criteria of observation). "Facts" are always the product of selective perceptions, values, and interests. Scientific information is still considered non-biased (i.e. somehow validated and value-free), but when dealing with complex phenomena, knowledge necessarily lacks completeness and certainty.

Therefore, for all these reasons, this discourse recognizes that scientific information can never tell us what is the right thing to do. In addition, science depends on processes of communication that add more subjectivity to the production of knowledge. The ultimate consequence is that integrity cannot be equated with absolute "goodness." In other words, science provides information about the rules that govern ecosystems' overall evolution, but not an objective "good" direction (Kay 1993; Lemons 1995). It speaks about possibilities rather than about necessities. "Ecological integrity is rooted in certain ecological concepts combined with certain sets of human values. Integrity may be a property of 'well-organized' states that we find desirable, and 'disintegrity' with states, perhaps either organized or disorganised, that we do not prefer. Alternatively open systems which are strongly self-organized but in an unwanted or undesirable state may be considered to reflect 'pathological integrity' " (Regier 1995, 97). Accordingly, the contribution of science has more to do with a firm grasp of the problem than with prescriptions, and now the emphasis is on describing relationships, patterns, and tradeoffs (Harwell et al. 1999).

The three discourses presented so far share the assumption that ecological integrity is a problem with a policy solution. Society is portrayed in terms of conflicts where stakeholders struggle to influence decisions according to their own interests. The Ecosystemic-Pluralistic discourse suggests a formal process of negotiation where a large number of stakeholders' values are included and made explicit (Norton 1998; Policansky 1998). This breaks up the monopoly of experts in influencing managerial decisions. Ecological integrity must be discussed in political and social arenas as well as in legal or ethical ones. Therefore, scientific and managerial arenas are extended towards society through a democratic, informed and transparent process of decision-making. The idea is that we are all managers (Grey 1999; Ludwig 2001). The ethical problem becomes making explicit and integrating the existing values in society rather than seeking arguments for the sorts of norms, goals or standards that people ought to hold (Firth 1998; Goodwin 1998; Harwell et al. 1999).

A version of an ecosystem-pluralistic kind of discourse to ecological integrity was initially applied under the "umbrella" of ecosystem-based management in the Great Lakes Basin ecosystems (Francis and Regier 1995; Konisky and Beierle 2001). Ecosystem-based management acknowledges the role of human values, but formal community participation is not always embraced (Duane 1997). However more attention is paid to an empirical understanding of participation in Environmental Integrated Management (Born and Sonzogni 1995; Hofmann and Mitchell 1998; Margerum 2001). Besides the reconciliation of conflicting values, participation is proposed, in integrated management, because of the need to pragmatically "scale-down" the problem. Thus the public may help scientists to decide about the limits of a specific problem. The Ecosystemic-Pluralistic discourse adds to the rationale for participation, the need to face uncertainty, incompleteness, and the value-laden nature of any description of a complex system (Kay and Regier 2000; Allen, T. et al. 2001). It also incorporates the critique coming from the so-called Post-Normal Science perspective about the current lack of trust in governmental and scientific institutions (Funtowicz and Ravetz 1995).

Collaborative management is emerging as the next "logical" step beyond participatory, integrative, adaptive management, and ecosystem-based strategies (Daniels and Walker 1996; Allen, W. et al. 2001). Its insights support the participatory aspect of the Ecosystemic-Pluralistic discourse to ecological integrity (Blatner et al. 2001). Collaborative management can be understood as a response to the changing conditions in increasingly networked societies (Innes and Booher 1999). Some proponents of collaborative management are moving beyond the assumption of considering stakeholders' values and interests as fixed (Saarikoski 2000; Sinclair and Diduck 2001). They recognize the transformative potential of multi-stakeholder negotiation for individuals. Thus, an emphasis on learning among multiple stakeholders leads to constructive public deliberation by which "opinions can be revised, premises altered, and common interests discovered" (Daniels and Walker 1996, 74).

Towards a Transpersonal-Collaborative Discourse

This discourse seeks to transcend the condition of separateness and isolation in recognition of the interrelated unity of all existence[8] (Naess 1973; Fox 1990; Devall 1995). It is assumed that the environmental crisis demands a deep change in the way we understand ourselves as humans and how we interact with nature. The word "Transpersonal" is meant to signify transcending individuality into something that is more inclusive than the individual person (Maslow 1968). In this discourse learning about ecological integrity broadens our circle of identifications so that we include others' well-being as part of our own well-being. It requires replacing excessive attachment to egoistic achievements with an attitude prone to collaboration and being-in-respect for others as the central way of being. Eventually, the gradual introduction of a reward system based on self-development and co-dependence, in the place of one based on ego concerns and economic criteria, would synergistically bind up our own unfolding with the unfolding of other entities (Mansfield 1995; Hester et al. 2000). Care is supposed to flow naturally if the self is widened and deepened so that nature is felt and conceived as part of ourselves (Josselson 2000; Kalton 2000).

Biophysical reality is portrayed as individuals embedded into social systems[9], and these, in turn, into ecosystems[10] (Figure 4A). Upper levels are the context for lower levels and constrain their organizational capabilities (Kay et al. 1999; Giampietro and Mayumi 2000). In practice, this implies that any individual's biophysical living conditions (e.g. the amount of water that an individual can directly or indirectly consume) are seen as constrained by biophysical aspects of both social organization (e.g. artificial structures for water distribution), and ecological organisation (e.g. natural water reserves).

Once the criteria and scale of observation are chosen (deciding what constitutes relevance), the ensuing description

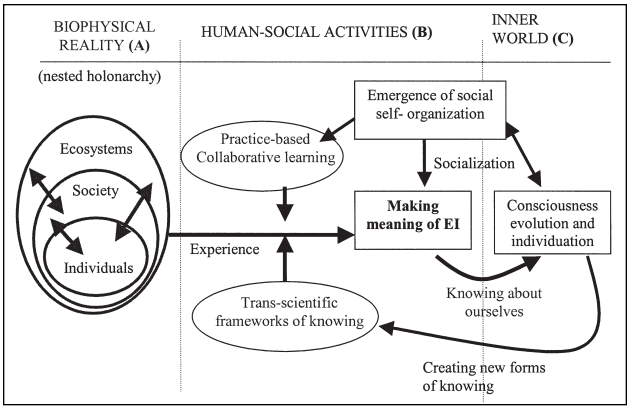

Figure 4. Transpersonal-Collaborative Discourse.

of a biophysical system can be pursued within a scientific knowledge production system. This description is a valuable input to the ecological integrity discussion, but then the attention shifts towards the issues of meaning, beliefs, power relations, and values. These issues require a dialogical stance rather than final analyses or syntheses about what constitutes reality. Modern science and complex systems theory have fundamental and unsolvable limitations to dealing, on their own, with these new issues. Now, the emphasis is on those non-material aspects that are more relevant for intra-personal development. A combination of knowledge production systems is required in order to foster a social practice based on collaborative learning (Figure 4B). The output is neither about deciding what outer reality to promote or about which managerial system is most appropriate for reaching it. Instead, it has to do with understanding how our values and worldviews affect our way of interacting with ecosystems and how this interaction, in turn, affects our own personal well being. It is not a matter of having better information for making better decisions, but of creating meaning about the relational matrix within which individuals, social systems, and ecosystems co-evolve (Duane 1997; Kalton 2000).

A trans-scientific framework of knowing embraces a variety of systems of knowledge, science being one among others (Figure 4B) (Brier 2000). No system of knowledge can be deemed, a priori, as the most appropriate for making sense of ecological integrity. Each one emphasizes a different dimension of the concept. Their use will depend on the context and, ultimately, on personal choices. What really matters is to: (1) make the choice in an informed and transparent way (i.e. understanding the implications), (2) promote constructive dialogue among different perspectives, and (3) foster knowers' positive feelings of identification with an ever-expanding sense of self (i.e. avoiding the treatment of nature only as abstracted objectified data).

Considering several systems of knowledge as equally relevant might be perceived as threatening the "enlightenment" which was reached through reductive mechanistic theories with cause and effect linearity. Science may have removed some obscure projections upon the outer world (i.e. unconsciously and affectively attributed qualities to external objects). The modernist agenda has replaced former worldviews based on literal interpretations of mythologies with the agreement on a common material ("natural") reality as a unifying cultural factor. However, scientific knowledge cannot enrich us beyond the limits imposed by rationality (Mansfield 1995; Wilber 1997).

The Transpersonal-Collaborative discourse defies the ontological common denominator imposed by "modernization" and "naturalization." The mind-nature divide is blurred by the negotiation and construction of meaning in a multicul-

tural context. In support of this move it is argued that the emphasis on the material aspects of reality underpins a consumerist society which is at odds with the ecological sustainability of human beings and whose linkage with enlightenment is, to say the least, dubious (Bowers 1993; Rees 2000). Additionally, the predominance of reductionistic formalisms within science promotes separateness from nature and a vision of control and domination (Berkes 1999). "For most modern people nature is no longer an exemplification of cosmic intelligence, a display of divinity, but something to be conquered and manipulated for our satisfaction. Domination and control overshadow reverence for nature and the powers it exemplifies" (Mansfield 1995, 4).

Constructing or making meaning of ecological integrity (Figure 4(b-c)) is not a simple acquisition of information or knowledge, but a living experience that touches the heart as much as the mind (Varela et al. 1991). It requires an ongoing understanding of the interdependence between inner world (e.g. dreams, fantasies, emotional responses) and outer world (e.g. social and biophysical phenomena). Meaning is the "substance" linking the intra-personal (e.g. a particular trajectory unique to a person) with other individual living beings and with some kind of "organic wholeness" (Bateson 1987; Devall 1995; Young-Eisendrath and Miller 2000; Thompson 2001). Persons are neither bounded, unique, cognitively integrated entities nor are they only constructed by social discourses. This alternative position suggests a permeable boundary between inner and outer which allows (1) the existence of an inner identity that gives rise to powerful internal thoughts, feelings, and tendencies to act a certain way, and (2) a continuous actualisation of such identity through the person's interaction of mutual co-creation with the extra-personal (Varela et al. 1991; Bragg 1996).

The emphasis on individuals should not be seen as a lack of consideration of culture and social organisation (Strauss and Quinn 1997). Focusing on the emergence of social structures from the bottom up does not deny the constraints on individuals imposed by those structures. On the one hand, the creation of meaning takes place "physically" at the individual level (i.e. within an individual person), but never as an isolated process. On the other hand, cultural meanings are the externalisation of a common interpretation of some type of object or event evoked in people as a result of their shared life experiences.

The most important implication of this position is that the agency of social transformation is not located in the actualisation of ideologies in the "outer social world," but in the dialogical process occurring among "selves." It is located in a true dialogue where we connect with our own inner needs, aspirations, and personal development, but in relation to another. Ideally, each voice incorporates its own evaluative position at the same time as it remains open to the potential truth of "the other." In this context, to be ethically sensitive and responsible is not only to have knowledge of abstract moral principles or to defend someone's own position in a coherent way. It has more to do with participating from one's unique position (as a situated individual) in a dialogue about what is important for each participant and trying to understand what is that each one might decide to do (Hester et al. 2000). Coercion aside (i.e. when free of differentials in status or power), we influence each other through the stories we tell. In collaborative learning, stories speak about experience and emancipation rather than about data and metaphors for fostering moral obligation (Michael 1995).

A collaborative learning practice requires a commitment to learning to learn, opening oneself to other perspectives, and thereby to co-learning as a unique human being (Wenger 1998). Thus each individual interprets reality in a unique way, but the process of interpretation is somehow co-created through interactions with others. This "opening up" makes people aware of the misplaced trust that they have given to dominant cultural worldviews of their time, worldviews that, eventually, have instilled into individuals a value system that is entirely out of line with any consideration for human-nature interdependence. For this process of transformative dialogue to occur, a social practice based on collaborative learning is required (Figure 4B). That is, a deep practice of universal consideration for all beings, which constitutes one's very perception of the world (Hester et al. 2000). In this sense, collaboration is associated with diversity, classless differentiation, trust, the transcendence of narrow sectarian loyalties, common interest, and the integration of combined natural/cultural systems (Regier 1993; Macnaghten and Jacobs 1997; Innes and Booher 1999).

To prescribe the structure society should have, or the path that leads to it, is not the point here. Every "society" has to figure this out for itself. However, an appropriate social contract is required for promoting curiosity, leaving space for creativity, and, ultimately, letting consciousness unfold (Goodwin 1998; Castro-Laszlo 2001). In addition, social organisation is expected to provide the material sustainability of the individuals embedded into it, but this must be achieved in the absence of exploitation. The alternative is to interlink power with responsibility and to be attentive to one's own life: "To survive in this world, and to live fully and well, one must be attentive. To impose agendas on the world — ethical, political, economic, scientific- is, to some extent, to cease to pay attention, it is to organize one's perception of the world according to the dictates of the mode of control" (Hester et al. 2000, 281).

The "implementation" of this discourse appears to be more problematic than the others. The normative discourses are purposefully designed so that they can be implemented

within the current social organisation (provided the necessary political will). The Ecosystemic-Pluralistic discourse requires a deepening democratic structure, and a change in the role that science plays in society. The Transpersonal-Collaborative discourse is not designed as a policy or scientific business in the first place, but as a means of fostering the evolution of human consciousness. This is not something that can be implemented by designing a plan and following it step by step until the objectives are reached. Ideas of control or management (even if it is adaptive) lose relevance here.

Collaborative learning demands an internally experienced imperative and a certain degree of tolerance for ambiguity and paradox. It cannot be initiated externally or as a rational imperative (Morito 1999). This brings up a very different concept of community than in the previous discourses. The pattern that connects people does not consist of deontological moral codes, coercive hierarchies, or conflicting interests. The emphasis is on being responsive to both one's own goals, and the needs of others to be responsive to their own goals (Fox 1990). In the present circumstances this concept of community can only have a global dimension.

Some experiences in the fields of eco-psychology, collaborative inquiry, and community-based participation could provide some preliminary empirical understandings related with the implementation of this discourse (e.g. councils of all beings (Macy 1995; Bragg 1996), environmental restoration based on reciprocity (Shapiro 1995), evolutionary learning communities (Castro-Laszlo 2001), cross-cultural collaborative research (Gibbs 2001), or appreciative inquiry (Hammond and Royal 1998)).

Variations on the Theme of Ecological Integrity

Each discourse assumes a set of beliefs and worldviews, which are usually tacit or unexamined. These worldviews, in turn, promote specific social practices and determine the way scientists engage in their research activities. Table 1 summarizes what is "behind" each discourse and the implications for how we approach our relationship with the biosphere.

The way to "look at the world" varies between the discourses, from nature in equilibrium (homeostatic), to nature

Table 1. Variations on a theme: Classification criteria for Ecological Integrity Discourses.

Criteria	WILDERNESS-NORMATIVE DISCOURSE	SYSTEMIC-NORMATIVE DISCOURSE	ECOSYSTEMIC-PLURALISTIC DISCOURSE	TRANSPERSONAL-COLLABORATIVE DISCOURSE
MINDSET	-Homeostatic	-Homeorhetic	-Self-organizing	-Co-evolutionary
DEFINITION OF INTEGRITY	-Pristine ecosystems HAVE integrity	-Certain states of ecosystems HAVE integrity	-Umbrella concept for discussing the ability to continue self-organization	-Metaphor for understanding ecological, social, and individual co-evolution
MAIN OBJECTIVE	-To preserve pristine areas and to be effective in current political and social contexts	-To preserve capacities of life to organize, reproduce, sustain, adapt, develop, and evolve	-To integrate human values and ecological realities into understanding for a decision making participatory process	-To integrate, meaningfully: personal growth, social organization, and human-environment interactions
ROLE OF SCIENCE	-Objective science informs about normative issues	-Objective science with descriptive and normative functions	-Articulate different perspectives with descriptive and explanatory power	-Contribute to individual's identity through making sense of biophysical constraints
ROLE OF SCIENTISTS	-"Measurer" and "prescription"	-"Assessor" and "prescription"	-"Narrator" and "facilitator"	-"Knower"
QUALITY ASSESSMENT	-External Truth	-External Truth but being explicit about uncertainties	-Expert opinion, self-consistency and transparency	-(negotiated criteria for) "well constructed" testimony
ROLE OF HUMANS	-Humans are apart from and threaten (pristine) ecosystems.	-Humans are apart, but ecosystems are always under anthropogenic stress	-Humans are part of ecosystems. Thus, they both influence and are influenced	- Ecosystems are part of humans and cannot be meaningfully separated
MAIN ETHICAL DISCOURSE	-Prescriptive Principle of Integrity (PI) -Absolute autonomy of nature -Integrity as a foundational value	-Prescriptive Principle of Integrity (PI) -Autonomy of nature in terms of self-organization processes -Integrity as a foundational value	-Post-Normal Science -Plurality of values in conflict leading to a participatory discussion	-Collaborative learning about ecological integrity as an evolutionary path in our being-towards-death
HOW TO DEAL WITH NATURE	-*Command-and-control* focused on human activities in buffer areas	-*Adaptative management* focused on human activities as they relate to ecosystems	-*Collaborative management* focused on human-ecosystem trade-offs	-*Collaborative learning* focused on respectful co-creation with our biophysical constituencies

following a specific trajectory or rate of change (homeorhetic), nature following different evolutionary paths as a result of the interplay among internal (including human) processes of organization (morphogenetic), and, finally, to the disappearance of any kind of both human autonomy from nature, and nature autonomy from humans (co-evolution through interdependent transformation). These mindsets lead to different definitions of ecological integrity and different objectives.

In the Normative discourses, integrity is a property that ecosystems may or not have and it is something that can be objectively measured. The main objective in these discourses is to maintain ecosystems in a state with integrity, either it be a pristine state or an evolutionary trajectory. The Ecosystem-Pluralistic discourse defines ecological integrity as a value-laden concept. Its main objective is to find ways to incorporate the values present in society into a decision-making process based on the discussion of alternatives and their associated trade-offs. In the Transpersonal-Collaborative discourse, ecological integrity is not defined either as an objective reality or as a socially negotiated construction, but rather as an integral part of each individual's process of co-evolution. The idea is that there cannot exist any kind of personal growth that is independent of cultural and ecological evolution. The objective of ecological integrity is to make explicit, to every single person, the interplay of personal, cultural and ecological evolutionary processes.

According to these different mindsets, definitions, and objectives, the role of both science and scientists change radically from one discourse to another. In the normative discourses science provides a privileged mode of observing reality. Scientists must use this privilege in order to advocate for the inclusion of a biocentric ethics in legislation and policy. Laws and policies, in turn, must be based on the available scientific "Truths." In the Ecosystemic-Pluralistic discourse science does not speak Truth, but it is still a privileged perspective; "the best game in town" (Allen, T. et al. 2001, 476). However, ecological integrity is not a purely scientific concept. It includes a political dimension. Whether an ecosystem has integrity will depend on the observations considered and the existing values in society. In this discourse scientists build narratives to illustrate the trade-offs between different potential futures. The quality of these narratives is not only related to their correspondence with the material world, but also with their transparency regarding the assumptions and decisions made by scientists to simplify, describe the situation and to communicate their understanding. In the Transpersonal-Collaborative discourse, science is no longer a privileged way of knowing about "Reality." It becomes one system of knowledge among others, perhaps one that is particularly appropriate for describing the material aspects of a situation. Science can surely provide valuable insights into human-nature relationships, but it must always be complemented with the consideration of other knowledge production systems (e.g. arts, or local knowledge) and their relationship to science. The flatland ontology, driven by the dominance of the universal scientific discourse, is replaced by a constructivist stance where reality is contextual and needs to be negotiated. Furthermore, scientists appear themselves as "knowers," rather than just professionals. This implies that anyone's research must be understood as framed within his/her own path of personal evolution.

Thus, the criteria to assess the quality of knowledge produced within each discourse differ notably. In the Wilderness-Normative discourse, the main quality criterion is that of compliance with external Truth (i.e. the universal nature observed through objective science). The Systemic-Normative discourse relies upon this same criterion, but includes the need to be explicit about uncertainties. This requirement improves the quality of scientific descriptions in that it improves its correspondence with a complex reality. The Ecosystemic-Pluralistic discourse suggests consistency as a quality criterion for the assessment of the synthesis of different perspectives and interpretations. As for its political dimension, it requires a great deal of transparency regarding the decisions scientist must take to simplify reality and to communicate their results. In the Transpersonal-Collaborative discourse, quality is assessed in the contextual negotiation of the criteria needed to verify that the different possible testimonies are "well constructed." This negotiation should occur through trans-cultural dialogue where good quality assures that no cultural perspective is privileged.

Another important difference between the four discourses is the way in which they frame human interaction with nature. The Wilderness-Normative discourse is based on management and control. This is supported by the belief that environmental problems have policy solutions. They respond to the pragmatic necessity of implementing assessment tools, communicating findings successfully, and persuading public bodies in order to promote the adoption of environmentally sound laws, regulations, policies, and actions. All that is needed are efficient mechanisms to transmit scientific information towards the centres of decision. In turn, political institutions must guarantee the funding of scientific research "in the right direction" (i.e. in order to fulfill new managerial needs).

The Systemic-Normative discourse emphasizes connectedness — interdependence-mutuality. Managerial practices are enriched with a new form of engagement: "learning by doing." The idea is that uncertainties and surprises demand flexibility to cope, innovate, and adapt. We can only partially know the consequences of our actions and, therefore, an adaptive approach is necessary. That is, we need ongoing

responses dealing appropriately with what is at hand and looking to the feedback from an always-evolving situation. Through experimentation, managers may learn to control more effectively.

In the Ecosystemic-Pluralistic discourse management is democratized. Collaborative management is proposed in order to involve everybody in a social practice that would normally be associated with a particular group (i.e. managers) and perceived as separated from that which is managed. Ecological integrity demands that people work together as responsible, multi-skilled partners towards common goals. This represents an overwhelming triumph of managerial ideology. Managing is considered as an intrinsic human activity (inherent historically), which was appropriated by a particular specialist group and now can be recovered by society (Grey 1999; Ludwig 2001).

From a transpersonal-collaborative perspective, management severely constrains the potential of human lives through collapsing human beings multidimensional reality into one-dimensional (flatland) of rationality and control (Wilber 1997). The alternative to managerial control is a collaborative learning practice. Because learning transforms who we are and what we can do, it is an experience of identity. Through experience, individuals internalize the ongoing dialogue from the world around them and this influences how they act. The Transpersonal-Collaborative discourse delves deeply into the implications of understanding humans and nature as inherently interdependent and co-constructed.

One key implication of the Transpersonal-Collaborative discourse is that human values and subjectivities must not only be included in decision-making, but must themselves be subjected to a discussion and re-consideration. In other words, human values are no longer perceived as givens that are fixed, and different perspectives are no longer considered completely relativistic and beyond judgment. Instead, the values and perspectives themselves must become part of the overall discussion and action towards integrity. This stems from a deep understanding of the reciprocal interconnections between two key systems: ecosystems and human systems, in particular human behaviours, values, and the individual's own level of awareness of the nature of the self-other relationship. Values are no longer seen as exogenous causes that motivate individual actions and preferences, but as expressions of human-nature relationships. Everything is now on the table, including the construction of human values in terms of their interactions with the entire ecological holonarchy. In other words, values will support the emergence of specific kinds of human-nature relationships, and thus, they should be examined and evaluated based on their contribution to the integrity of this human-nature relationship.

Which Discourse?

The discourses presented in this paper should be seen as complementary conceptual constructions. Rather than trying to determine which is the "best" discourse, the relevant question is: "In which situations or for what purposes is each discourse most useful?" To further answer this question it is useful to look at how each discourse is structurally coupled[11] with different types of societal institutions, culture, individual involvement, and academic settings. As we show in Figure 5, the normative discourses fit better with hierarchical bureaucratic institutions based on a command-and-control culture, where individuals engage in professional practices, and science provides very specific answers that form the basis for rules and regulations. At the other extreme of the continuum we find that the Transpersonal-Collaborative discourse fits better with community initiatives that are based on mutual understanding, and which require personal involvement and action. Although it may seem counter-intuitive, such a societal context allows for, and often requires, more sophistication in the description of complex self-organizing dynamics. This is something that the Transpersonal-Collaborative discourse provides for.[12] Because community initiatives embrace a broader spectrum of reality, the use of multiple "languages" to speak about the diverse aspects of that reality

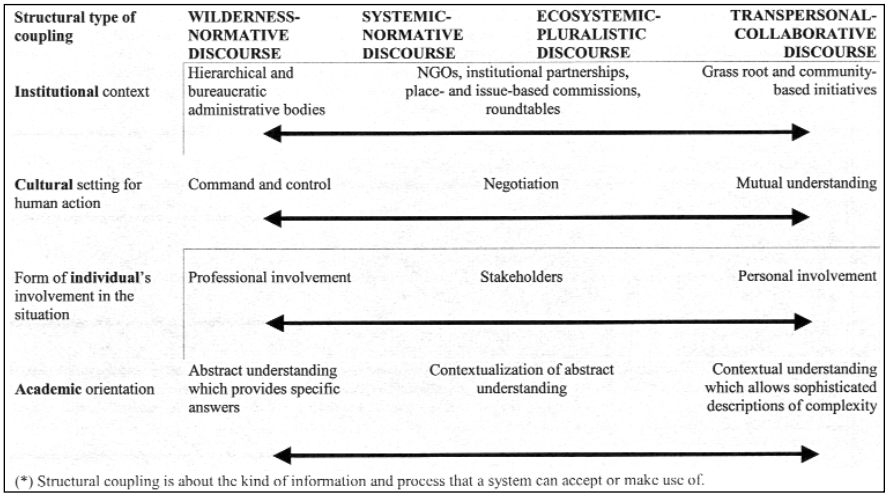

Figure 5. Structural coupling (*) of each discourse to ecological integrity.

must be accommodated, which again the Transpersonal-Collaborative discourse is well suited for. The main challenge is to integrate these languages in a coherent way. Finally, the Ecosystemic-Pluralistic discourse fits with conflictive political arenas that are based on processes of negotiation among stakeholders. Such situations require that abstract scientific knowledge be adapted or "translated" to the contextual circumstances so that stakeholders can understand their options and the tradeoffs between them.

More work should be done in exploring the implications of adopting each discourse within the present scientific and social settings. The normative discourses seem to be particularly useful in a context characterized by lobbying, legal enforcement and social negotiation through lawsuits as it is in the USA. Its application may balance the reductionistic perspective of economics whose "obsession" with "unbridled" economic growth is one of the main elements responsible for the current environmental crisis. In support of this, one could attribute to this strategy some of the "advances" achieved in conservation. For instance, increasing the extension and number of areas declared as protected, or accomplishing stricter legal standards for environmental protection.

However, the strategy of putting humans apart from ecosystems can be seen as effective only in situations of "emergency," that is in the short-term. Furthermore, as indicated at the beginning with the Maya Biosphere Reserve example, there are contextual situations were this discourse will be counter-productive and contribute to a further deterioration of the situation. The biosphere reserve model is based on western institutional contexts and might not be appropriate for South countries. Western democratic institutions are generally perceived to be in the service of their citizens. This is often not the case in the southern countries where institutions are often in the service of a ruling elite and not trusted by local people. Furthermore local people often do not have the resources, financial and otherwise, to participate in institutional decision-making processes. Thus they are alienated from the type of processes that fit with the normative discourses and this ultimately leads to conflict, as is the case in the Maya Biosphere Reserve example. A Transpersonal-Collaborative discourse seems far more appropriate for these types of situations as it is an evolutionary approach that inherently involves the local people directly. Regardless of the approach used, if ecological integrity is to be attained, the southern context requires changes, promoted by the creative energies of local people, in global social and economic structures (including those of the North).

Finally, from a long-term global perspective, an interventionist strategy might not be appropriate in any context, as it keeps the focus on "urgent problems," rather than restructuring the basic framework that led to the problems in the first place. The Ecosystemic-Pluralistic and Transpersonal-Collaborative discourses are based on transforming human structures and processes. They might serve to change the behaviours, lifestyles, and habits that contributed initially to creating our current "state of emergency." Only through transforming the consciousness of individuals can we integrate the, initially differentiated, and now completely dissociated, realms of mind (noosphere) and body (biosphere).

Endnotes

1. Author to whom correspondence should be directed:
E-mail: dmanuel@eclac.cl
2. James Kay's co-authors report with sadness that James died from cancer on 30 June 2004. Many of the basic ideas on which this article is based were conceived and developed by him.
3. E-mail: dolderman@psych.utoronto.ca
4. Ecosystem health is defined by two general criteria: (1) no degradation of the site that would impair its productive future use, and (2) no degradation of areas beyond the site (Karr 1996).
5. More about this framework can be found in the final report of the "Resilience Project" http://www.resalliance.org/reports.
6. Holons is a term coined by Koestler (1978) for describing entities that act as wholes (hol-) but also as parts (-on) of larger wholes within a form of organisation that may be termed holarchy.
7. Hierarchy theory is about issues of scale and type of observation. The issue of scale is part of the discussions of the Systemic-Normative discourse. The Ecosystemic-Pluralistic discourse adds the issue of "type" of observation to the discussion.
8. Some thinkers and practitioners whose perspectives are consistent with the Transpersonal-Collaborative notion of ecological integrity are not explicitly considered in the description of this discourse (e.g. feminists, post modernists, multicentrists, and indigenous people).
9. The biophysical aspects of social systems can be roughly reduced to the material outcomes and distribution of capital and technological activities.
10. Each one of these three nested systems is composed of interactive holarchies that are self-organizing open systems in which the elements (themselves holons at different levels and different scales) are also self-organizing open systems (Koestler 1978).
11. Structural coupling is about the kind of information and process that a system can accept or make use of. For example the description of a conservation project might be in quite different terms for an academic audience versus a community group. Similarly a bureaucratic institution and decision makers might only be interested in the physical size and cost of a conservation area and the political mileage that they can get out of it, while an NGO might be interested in the biodiversity that will be preserved and local citizens might be interested only in how their historical rights might be infringed upon.
12. In our work we have often been struck by the ability of a local community, particularly those which are still well connected to a local biophysical reality, to understand and develop a rich complex understanding of the ecological situation, which a traditional western bureaucracy would simply be unable to assimilate and cope with.

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