



## ENVIRONMENT IN THE COURTROOM

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# Ecosystem Management: It's Imperative ... Whatever It Is

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## 1. Introduction

Ecosystem management has fundamentally changed the field of environmental protection, from a narrow focus on individual sources of harm to a more holistic focus on entire ecosystems, the multiple human sources of harm within ecosystems, and the complex social context (including political boundaries and economic institutions) in which those sources exist. US legal scholar Oliver Houck described ecosystem management as a “whole new species of thought—half science and half religion—[that] has arisen in research, articles, books, management plans and litigation, a new field of conservation biology” that is “changing the language of the game.”<sup>1</sup>

This approach was not a new concept when Professor Houck commented on it in 1998, but it had gained an unprecedented level of acceptance in recent years leading up to his paper. According to another US writer, the ecosystem concept, together with the related concept of “sustainable development,” were “sweeping through international, national, state, and local policy and reshaping the appearance of environmental law at all levels.”<sup>2</sup> For another author, it is a “true paradigm shift.”<sup>3</sup>

In Canada, the call for ecosystem management has existed for at least four decades, but has gained considerable traction in recent years.<sup>4</sup> Canadian legislation is jumping on the ecosystem management bandwagon. At a basic level,

*\* Thanks to Mount Royal University Professor Michael S. Quinn for his recommendations on the voluminous ecosystem management literature and for his long-term input and advice on ecosystem thinking.*

several Canadian statutes now define the “environment” in holistic, ecosystem-like terms.<sup>5</sup> Others link the objectives of “environmental” and “ecosystem” protection.<sup>6</sup> Numerous other Canadian statutes now aim generally to protect “ecosystems” instead of or in addition to the “environment.”<sup>7</sup> Several statutes provide for ecosystem protection as a target or basis for government’s use of specific regulatory tools<sup>8</sup> and for the development of broad-brush “strategies.”<sup>9</sup> Two federal statutes provide general endorsement for the “ecosystem approach” for achieving the Acts’ objectives.<sup>10</sup>

Canadian environmental managers have also shared the enthusiasm for ecosystem management. For example, Environment Canada has been engaged in several “ecosystem initiatives,” including those relating to the Great Lakes, the St. Lawrence River, the Atlantic Coast, and the Georgia Basin.<sup>11</sup> Canada’s federal Department of Fisheries and Oceans (DFO) has adopted the “ecosystem approach” as a basis for fisheries management.<sup>12</sup> In addition, Canadian provinces and territories have made numerous gestures toward embracing the ecosystem approach.<sup>13</sup> And at least several Canadian post-secondary schools now have degree programs or faculties focused on ecosystem management.<sup>14</sup>

Although there is widespread support for ecosystem management, there remains considerable ambiguity over what it entails and what it is for. As one author stated: “If there is one thing about ecosystem management upon which people agree, it is that the term means different things to different people.”<sup>15</sup> This ambiguity is reflected in the lack of consensus over whether “ecosystem management” is even an appropriate name. While many people refer to ecosystem “management,” that term is often criticized as reflecting an overly techno- and homo-centric view of the environment as an object that is subject to human manipulation. Others refer to an ecosystem “approach” or ecosystem “protection,” both of which at least purport to reflect a more reverential or respectful view of humans’ relation to the environment. Another variation is the term “ecosystem-based,” in reference to either “management” or “approach” (or some other descriptor).<sup>16</sup> However, to some commentators, the debate over terminology detracts from the development of general principles or elements of the ecosystem concept.<sup>17</sup> This chapter uses the term “ecosystem management,” but solely for practical reasons; it does not purport to take a stand on the debate noted above.

The purpose of this chapter is to provide a broad, general outline of ecosystem management. The chapter first addresses the need or imperative for this approach and then discusses several of the approach’s principles or components, noting the areas of uncertainty and challenges.

## 2. The Ecosystem Management Imperative

Advocates for ecosystem management generally agree that it is needed because environmental problems often involve linkages among physical, biological, and social components within and among ecosystems.<sup>18</sup> For example, a watershed ecosystem includes four sets of complex physical linkages: vertical (surface to ground water), horizontal (up- and down-stream), lateral (river channel to riparian zone to flood plain), and temporal (changes in each of the above linkages over time). Those physical watershed components are linked, in turn, to biological and, in most cases, human, communities within watersheds. To make matters more complicated, there are physical, biological, and social linkages among watersheds and among watersheds and other kinds of ecosystems.<sup>19</sup>

These linkages show that environmental problems within a given watershed cannot be solved by focusing on one watershed component without considering how that component is linked to others.<sup>20</sup> For example, regulatory efforts to protect fish in a watershed must focus not only on the harm to fish from pollution discharged from a domestic sewage plant but also on the threats to fish from all other sources of water pollution, as well as sources of damage to riparian vegetation and reductions in stream flows. Moreover, those myriad threats must be evaluated in the context not only of the range of often disjointed laws available to reduce them but also the laws and other social factors that may be encouraging them. Ecosystem management provides a comprehensive analytical framework for assessing and addressing these interconnected physical and social factors. Advocates for ecosystem management also generally agree that it can promote the social values of equity and efficiency, as well as environmental protection, by simultaneously addressing all physical, biological, and social causes of environmental problems. Ecosystem management provides a flexible framework for fairly and efficiently allocating the social costs of environmental protection among all public and private interests.<sup>21</sup>

Advocates generally agree, not only on the imperatives for ecosystem management, but also that the holistic approach is difficult to define and implement because of the same complex physical, biological, and social linkages that necessitate the approach in the first place.<sup>22</sup> Professor Adler observes that the advantages and problems inherent in the ecosystem approach present a paradox: the larger the ecosystem unit and the more comprehensive the harms and social causes addressed, the more holistic the approach. Yet, the larger the scale and scope of the ecosystem approach, the more difficult it will be

to implement, in terms of scientifically modelling the complex physical and biological linkages and coordinating among all the interested bureaucrats, politicians, citizens, and commercial interests.<sup>23</sup>

### **3. Ecosystem Type and Scale**

“Ecosystem” is defined as an “assemblage of species plus the interacting physical and biological processes upon which the species depend.”<sup>24</sup> While this definition is intuitive and makes scientific sense, the concept is problematic in that there are no inherent or objective ecosystem “units.” While it is useful to define ecosystem scales or boundaries for management purposes, these line drawings are essentially arbitrary (i.e. non-natural) exercises.<sup>25</sup> They are also problematic because defining one type or scope of “assemblages” masks another or other “assemblages” relating to the same biophysical components. For example, a “watershed” is a type of ecosystem that is commonly defined as the geographic area of land drained by a particular body or segment of flowing water. A “basin” is the largest form of “watershed,” encompassing the land mass drained by an entire river system.<sup>26</sup> Watershed ecosystems like the Mackenzie, Columbia, South Saskatchewan, and Mississippi River basins may have numerous components, which can be broken up into multiple smaller watersheds based on each of the numerous tributaries that feed those large river systems.

It may be even more difficult to define the appropriate ecosystem scale using kinds of ecosystems other than watersheds. For example, an alpine meadow in the Canadian Rockies can be viewed as a local ecosystem providing habitat for local insects and rodents. But the meadow may also lie within a range for grizzly bears and migrating eagles. It may also contain wetlands adjacent to a creek which is part of a larger watershed that ultimately drains sub-alpine forests and prairies. Should the meadow be viewed as an isolated system, or as part of an alpine Rocky Mountain ecosystem, part of the watershed to which it belongs, or part of a “grizzly-shed” or “eagle-shed”?

Intuitively, watersheds are an appealing ecosystem “unit” for planning purposes because they can be used to cover an entire land mass without overlap, unlike other categories of ecosystems that may overlap and may not cover an entire land mass, such as bird and mammal migration corridors. However, watersheds are not the only ecosystem categories that can be used to cover an entire land mass.<sup>27</sup>

The wide variation among ecosystems arguably suggests that there is no “one size fits all” unit for ecosystem management. Thus, it is not surprising

that, while several Canadian statutes provide for the management of marine, forest, or freshwater ecosystems generally, none specifies an ecosystem unit of concern for management purposes.<sup>28</sup> A lack of consistency in the choice of unit or boundary among different ecosystem management programs may impede necessary efforts to coordinate or link these programs to achieve regional, national, or international goals.

#### **4. Governance**

Whatever ecosystem unit is used for management purposes, the unit's geographic boundaries are unlikely to coincide with the geographic boundaries of political jurisdictions. In addition, the complex interactions within ecosystems require interdisciplinary management perspectives that are arguably difficult to promote in agencies whose staff have been trained in specific disciplines and who may have historically been organized along lines that correspond to those disciplines. Both of these factors make it a challenge to design a governance system for ecosystem management.

Another challenge arises from choosing the roles of government staff and non-governmental parties, especially those living or working within the relevant ecosystem boundaries. Ecosystem management proponents generally favour a greater role for local stakeholders—typically, through their participation in watershed councils or other area-based planning organizations—than in more conventional or traditional environmental regulatory and natural resource management regimes.<sup>29</sup> No doubt this view stems, in part, from the notion that the people living and working in a given place are the most affected by place-based management decisions, and that locals may be best able to develop creative, effective solutions to problems occurring in their area.<sup>30</sup> This notion seems even more persuasive in an ecosystem management context where an array of local factors is on the table than in a management regime focused more narrowly on a single issue or natural resource.

Locally based decisions can also help take the political “heat” off a regional or national agency on controversial environmental issues and can lighten the agency's workload. In short, broad and strong local participation seems preferable in ecosystem management in order to provide the necessary expertise and power base to address the myriad harms to ecosystems.

On the other hand, there is concern that local citizen and government decision makers are more likely to be corrupted by powerful corporate interests. In addition, even geographically “local” ecosystems have aspects or components that may be of regional, national, or global importance. These facets

include the survival of plant and animal species (and arguably even populations) and the protection of publicly owned lands, waters, and other public resources. These non-local interests suggest that environmental regulators and land managers should not completely abdicate their decision-making roles to local bodies that may not see or at least share the non-local interests.

The challenges to defining an appropriate governance model are reflected not only in the lack of consensus on a *uniform* model but in uncertainties with respect to individual governance models. For example, Alberta has arguably sent mixed messages regarding the roles of its “watershed and planning advisory councils” in provincial watershed planning.<sup>31</sup>

Of course, the question of whether ecosystem management decision making should be made by local bodies need not be viewed in black and white. In reality, there exist a variety of decision-making roles, from establishing overall goals and objectives, performance and environmental quality standards, and plans for achieving those targets, to developing in-place solutions, monitoring, enforcement, and follow-up, among other functions. Strong regional or federal leadership may be appropriate for some of these roles but not for others, and other roles may require close coordination at two or more political levels.

As with the variability in types of ecosystem units, there is arguably a wide variability in socio-political circumstances among ecosystems. This socio-political variability suggests that ecosystem governance models themselves may need to vary. However, there is also arguably a need for consistency in governance models to ensure a high degree of coordination and cooperation among governance institutions and that regional, national, and international interests are met. Consistency may also be needed to promote fairness to, and ensure equivalent levels of rights and responsibilities among, all ecosystem management participants and citizens generally.

## **5. Ecosystem Management Objectives**

What is ecosystem management for? What are the ultimate aims or purposes of ecosystem management? To some, ecosystem management is just an analytical framework (holistic, place/system-based) for environmental decision making and a decision-making process (problem identification and goal setting, local decision making, adaptive management, planning, etc.). However, to many of its proponents, ecosystem management also includes an objective of achieving, maintaining, or restoring some level of ecosystem condition that is desired for all ecosystem management applications.<sup>32</sup> Many scientists now favour ecosystem “resilience” as the condition of concern.<sup>33</sup>

Varying expressions of the “optimum” ecosystem condition reflect an evolving scientific understanding of ecosystems, from the concept of an ideal ecosystem condition as a static or “equilibrium” state to the notion that ecosystems are inherently dynamic and evolving.<sup>34</sup> Of course, the moving nature of the target makes it even more challenging to define an “ideal” ecosystem condition.

Canadian legislation runs the gamut of these varying approaches. For example, some statutes require or enable watershed or water management planning but provide little or no detail on the target of such planning effort.<sup>35</sup> By contrast, several Canadian statutes focus on maintaining or restoring ecosystem “integrity.”<sup>36</sup> Several others aim for ecosystem “integrity” along with “health” or other co-conditions.<sup>37</sup> Other statutes aim to protect ecosystem “structure and function,” “productive capability” or “capacity” and “stability” or “diversity,” among other targets.<sup>38</sup> There can be a wide range of target conditions specified in different statutes within a single province.<sup>39</sup>

An ethical issue that underlies the debate about ecosystem management objectives is whether its purpose—and the expression of any desired ecosystem condition—should be driven solely by anthropocentric, utilitarian concerns, or by some non-anthropocentric, non-utilitarian notion of ecosystems in their “natural” or “undisturbed” state.<sup>40</sup> (A related conceptual conflict relates to whether ecosystem management views humans as part of or separate from ecosystems.) There is some common ground between these two ethical poles in the sense that an ecosystem approach is arguably necessary from a purely anthropocentric view, because humans themselves are ultimately better off living in healthy ecosystems.

Some question whether humans are really capable of constructing a non-anthropocentric ethic (and accompanying management framework), given that ethics itself is a human construct and human interests must still be considered in any method for implementing a non-anthropocentric ethic.<sup>41</sup>

This logic is supported by Aldo Leopold’s justification for his influential “land ethic,” which has been cited as providing the ethical justification for ecosystem management.<sup>42</sup> Under that ethic, the morality of various human actions is judged according to whether they preserve or destroy the “land,” a term Leopold defined broadly along ecosystem lines.<sup>43</sup> Although Leopold’s “land ethic” is commonly associated with a non-anthropocentric environmental ethic, much of his justification for his “land ethic” is based on humans’ physical or biological dependence on healthy ecosystems.<sup>44</sup> One could also argue that humans are psychologically or spiritually dependent on them as well.<sup>45</sup>



## 6. Tools for Ecosystem Management

Regardless of the lack of consensus about the objectives of ecosystem management, there is arguably a consensus that “planning” is the foundational tool for achieving its objectives. However, this consensus belies a debate as to whether plans should include or be based on quantitative thresholds or *limits* to define boundaries for permissible human activities across the entire ecosystem of focus. There are numerous proponents of ecosystem-based limits.<sup>46</sup> Limits provide a “bottom line” or system of accountability, but they can be scientifically or technically difficult to determine, especially at an ecosystem scale. A limits-based approach also requires the development of potentially complex systems for fairly and efficiently deciding the appropriate mix of present and future activities that collectively stay within the limits of choice.

Several Canadian statutes provide for ecosystem-based planning, for example, for public forests or other public lands, based on considerations of desired ecosystem conditions. For example, subsection 11(1) of the *Canada National Parks Act* requires the adoption of park management plans that include a “long-term ecological vision” and “ecological integrity objectives and indicators.”<sup>47</sup> Section 68 of Ontario’s *Crown Forest Sustainability Act* requires the adoption of a “Forest Management Planning Manual” that must, in turn, require that every “forest management plan” adopt objectives based on considerations of the “abundance and distribution of forest ecosystems” and a recognition that “healthy forest ecosystems are vital” to Ontarians’ “well-being.”<sup>48</sup>

Several Canadian endangered species statutes provide that species recovery strategies or management plans may be based generally on “ecosystem management principles” or other broad criteria.<sup>49</sup> Similarly, the *Canada National Marine Conservation Areas Act* calls for the development of marine conservation area management plans based in part on “principles of ecosystem management.”<sup>50</sup>

While Canadian statutes endorse ecosystem management or ecosystem-based planning, the author is unaware of any Canadian statutes that prescribe ecosystem-based limits, or that require the establishment of such limits, as a starting point or target for ecosystem management plans.

## 7. Adaptive Management

Because of the scientific and technical uncertainties inherent in a holistic, ecosystem perspective, there is general consensus among proponents of ecosystem approaches that they require adaptive management. This approach is essentially a circular process in which problems are identified and hypotheses

about cause and effect are made, followed by the adoption and implementation of management tools. The effectiveness of these tools is then studied and assessed, leading to reconsiderations of problems and appropriate solutions and adjustments of previously chosen tools, as necessary.<sup>51</sup>

Adaptive management is inherently sensible, but it is also problematic. Besides requiring the commitment of often scarce funds and personnel, it logically calls for a flexible approach that may conflict with the oft-stated need for certainty in regulatory and planning regimes, certainty that is needed, in turn, for effective business and land use decision making. There is also a risk that adaptive management may be used to avoid making controversial or difficult decisions in the first instance.

## Conclusion

Ecosystem management is not just a passing fad. For all of its uncertainties and challenges, its holistic, ecosystem focus makes sense. And the alternative—narrowly focusing on protecting or maximizing the yield of individual natural resources—is inherently flawed. As one textbook suggests, ecosystem management must be approached with “caution and humility,” but it is nevertheless “necessary and urgent.”<sup>52</sup> Another author similarly observed that “striving for some aspect of an ecosystem approach, as difficult as it might be, is better than what we are doing now.”<sup>53</sup>

The idea that ecosystem management is an approach to “striv[e] for” is particularly important. Like the principles of “equality” and “democracy,” ecosystem management may be impossible to achieve in its purest or absolute form, but it is nevertheless worth pursuing. In Yaffee’s words, “movement toward the ecosystem management end of the spectrum is good,” even if each step does not achieve a perfectly holistic result.<sup>54</sup>

### NOTES

- 1 Oliver A Houck, “Are Humans Part of Ecosystems?” (1998) 28 *Envtl L* 1 at 2.
- 2 JB Ruhl, “An Environmental Rights Amendment: Good Message, Bad Idea” (1997) 11 *Nat Res & Env't* 46 at 47.
- 3 Fred Van Dyke, *Conservation Biology: Foundations, Concepts, Applications*, 2d ed (Dordrecht: Springer, 2008) at 351 [Van Dyke].
- 4 Michael M Wenig, *The Fisheries Act as a Legal Framework for Watershed Management* (LLM Thesis, University of Calgary Faculty of Law, June 1999) at 4–5 [Wenig].
- 5 For example, several Alberta statutes define the “environment” broadly as the “components of the earth” including in turn “air, land and water,” the “layers of the atmosphere,” “organic and inorganic matter and living organisms,” and the “interacting natural systems that include” these other components. *Alberta Land*

*Stewardship Act*, SA 2009, c A-26.8, s 2(1)(j); *Environmental Protection and Enhancement Act (EPEA)*, RSA 2000, c E-12, s 1(t). The Yukon's *Environment Act* defines the "environment" in similarly broad terms but also specifically includes in its list of "environment" components "the ecosystem and ecological relationships." RSY 2002, c 76, s 2.

- 6 For example, the purpose statements of both Nova Scotia's *Environment Act* and Alberta's *Environmental Protection and Enhancement Act* include a recognition that environmental protection is "essential to the integrity of ecosystems." SNS 1994-95, c 1, s 2; *EPEA*, s 2.
- 7 For example, at the federal level, the *Auditor General Act* provides that the federal Sustainable Development Commissioner's role includes monitoring and reporting on federal departments' progress in achieving "sustainable development," which concept itself includes "protecting ecosystems." RSC 1985, c A-17, s 21.1(c). Similarly, the *Canada National Marine Conservation Areas Act* states that "[m]arine conservation areas [should] be managed and used in a sustainable manner that meets the needs of present and future generations without compromising the structure and function of the ecosystems, including the submerged lands and water column, with which they are associated." SC 2002, c 18, s 4(3). See also, e.g., *Species at Risk Act (SARA)*, SC 2002, c 29 (preamble "recognizing" that Canadian "ecosystems" are "part of the world's heritage"), and *Saguenay-St Lawrence Marine Park Act*, SC 1997, c 37, s 4 (Act's purposes include to "increase ... the level of protection of the ecosystems of a representative portion of the Saguenay River and the St. Lawrence estuary for conservation purposes"). Examples at the provincial or territorial level include Manitoba's *Provincial Parks Act*, whose purposes include "to conserve ecosystems." CCSM c P20, s 5. Manitoba's *Water Protection Act* states that its purpose is to "provide for the

protection and stewardship of Manitoba's water resources and aquatic ecosystems." CCSM c W65, s 2. Similarly, the preamble to British Columbia's *Muskwa-Kechika Management Area Act* states that the purpose of the legislatively created Muskwa-Kechika Management Area is to "maintain in perpetuity the wilderness quality, and the diversity and abundance of wildlife and the ecosystems on which it depends." SBC 1998, c 38. In the Northwest Territories, the *Environmental Rights Act* states that the people of the Northwest Territories have the "right to protect the integrity, biological diversity and productivity of the ecosystems in the Northwest Territories." RSNWT 1988, c 83, Preamble.

- 8 For example, the *Canadian Environmental Protection Act (CEPA)* authorizes the federal cabinet to adopt regulations for "preventing or reducing the growth of aquatic vegetation that is caused by the release of nutrients in waters and that can interfere with the functioning of an ecosystem or degrade or alter, or form part of a process of degrading or altering, an ecosystem to an extent that is detrimental to its use by humans, animals or plants." SC 1999, c 33, s 118(1). Similarly, Manitoba's *Water Rights Act* states that, in reviewing applications for licences issued under that Act, the relevant minister must consider "scientific and other information relating to the groundwater and water body levels, and the in-stream flows, that are necessary to ensure that aquatic ecosystems are protected and maintained." The Act then enables the minister to deny a licence application if the proposed activity would "negatively affect an aquatic ecosystem." CCSM c W80, ss 9.1(1) and (2). British Columbia's *Local Government Act* states that a "community plan" may include "policies" relating to the "preservation, protection, restoration and enhancement of the natural environment, [and] its ecosystems." RSBC 1996, c 323, s 474(1).

- 9 For example, the federal *Oceans Act* provides for the “development and implementation of a national strategy for the management of [Canada’s] estuarine, coastal and marine ecosystems.” SC 1996, c 31, s 29. Similarly, Alberta’s *Water Act* requires the Minister of Environment and Water to adopt “a strategy for the protection of the aquatic environment” that may include “matters relating to the protection of biological diversity,” which the Act defines as the “variability among living organisms and the ecological complexes of which they are a part, and includes diversity within and between species and ecosystems.” RSA 2000, c W-3, ss 8(1), (2) and (3)(c).
- 10 See *Oceans Act*, *ibid* (preamble stating that “[marine] conservation, based on an ecosystem approach, is of fundamental importance”); and *CEPA*, *supra* note 8 (preamble recognizing the “importance of an ecosystem approach” and stating that the Government of Canada will “continue to demonstrate national leadership in establishing ... ecosystem objectives ...”) and s 2(1)(c) (stating that the Government of Canada’s “duties” include “implement[ing] an ecosystem approach that considers the unique and fundamental characteristics of ecosystems”).
- 11 Government of Canada, “Ecosystem Initiatives” (accessed 12 December 2017), online: <<http://www.ec.gc.ca/nature/default.asp?lang=En&n=2C63408C-1>>.
- 12 Department of Fisheries and Oceans, “Principles of Ecosystem-based Fisheries Management” (accessed 12 December 2017), online: <<http://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/ecosys-back-fiche-eng.htm>>.
- 13 For example, Alberta’s 2003 *Water for Life Strategy* stated that its “focus” is to adopt a “watershed approach to management.” Accordingly, the landmark policy called for the development of “watershed plans” for setting water management objectives and priorities and for the support of watershed planning and advisory councils. Government of Alberta, *Water for Life – Alberta’s Strategy for Sustainability* (November 2003, accessed 14 December 2017), online: <<http://aep.alberta.ca/water/programs-and-services/water-for-life/strategy/documents/WaterForLife-Strategy-Nov2003.pdf>> at 7–8 and 15.
- 14 These are Lethbridge College (online: <<https://lethbridgecollege.ca/programs/ecosystem-management-bachelor-of-applied-science>>), University of Northern British Columbia (online: <<https://www.unbc.ca/ecosystem-science-management>>), and York University (online: <<https://futurestudents.yorku.ca/program/ecosystem-management>>).
- 15 Steven L Yaffee, “Three Faces of Ecosystem Management” (1999) 13 *Conservation Biology* 713 [Yaffee]. See also, e.g., Van Dyke, *supra* note 3 (stating that, of “all modern efforts in conservation, none has proven more elusive in definition ... than ‘ecosystem management.’”).
- 16 See Wenig, *supra* note 4 at 3.
- 17 See, e.g. Yaffee, *supra* note 15 at 723 (noting that the ecosystem management “term itself is not sacrosanct, but the direction it implies is”).
- 18 For a good discussion of the “ecological imperative” for ecosystem management, see Robert W Adler, “Addressing Barriers to Watershed Protection” (1995) 25 *Envntl L* 973 at 981–991 [Adler].
- 19 *Ibid* at 981–986.
- 20 *Ibid* at 982–983.
- 21 *Ibid* at 995–1000.
- 22 *Ibid* at 991–994.
- 23 *Ibid* at 1088–1104.
- 24 Peter F Brussard et al, “Ecosystem Management: What Is It Really?” (1998) 40 *Landscape and Urban Planning* 9.
- 25 Thus, Kennett rightly observed that ecosystems “are not self-defining as focal points for ... management. ... [T]hey are human constructs designed to capture ecological processes and relationships that are deemed to be important.” Steven

- A Kennett, *New Directions for Public Land Law*, CIRL Occasional Paper #4 (Calgary: Canadian Institute of Resources Law, 1998) at 18 [Kennett].
- 26 Adler, *supra* note 18 at 976.
- 27 The Government of Canada has divided the country into a hierarchy of 20 distinct, non-overlapping “ecozones.” The 15 terrestrial ecozones are broken down, in turn, into 53 “ecoprovinces” and in turn into 194 “ecoregions,” based on their physical and social characteristics. See Natural Resources Canada, “Forest Classification” (accessed 12 December 2017), online: <<http://www.nrcan.gc.ca/forests/measuring-reporting/classification/13179>>.
- 28 For example, s 4(4) of the *Canada National Marine Conservation Areas Act*, *supra* note 7, requires that each marine conservation area subject to the Act be divided into “zones,” at least one of which must “fully protect[t] special features or sensitive elements of ecosystems.” But the Act does not specify the ecosystem unit of concern. Similarly, both British Columbia’s *Ecological Reserves Act* and Alberta’s *Wilderness Areas, Ecological Reserves, Natural Areas and Heritage Rangelands Act* provide for the provinces’ adoption of “ecological reserves” that are representative examples of natural ecosystems in each of those provinces. RSBC 1996, c 103, s 2(b); RSA 2000, c W-9, s 4(1)(b).
- 29 E.g., Van Dyke, *supra* note 3 at 351.
- 30 See, e.g., Adler, *supra* note 18 at 1091–1092.
- 31 See Michael M Wenig, *Understanding Local Albertans’ Roles in Watershed Planning – Will the Real Blueprint Please Step Forward?*, CIRL Occasional Paper #28 (Calgary: Canadian Institute of Resources Law, 2010).
- 32 E.g., Van Dyke, *supra* note 3 at 350; Averil Lamont, “Policy Characterization of Ecosystem Management” (2006) 11 *Envtl Monitoring & Assessment* 5 at 6. For an interesting and enlightening debate on the objectives and ethics of ecosystem management, see Bruce Pardy, “Changing Nature: The Myth of the Inevitability of Ecosystem Management” (2003) 20 *Pace Env’tl L Rev* 675; JB Ruhl, “The Myth of What Is Inevitable under Ecosystem Management: A Response to Pardy” (2004) 21 *Pace Env’tl L Rev* 315; Bruce Pardy, “Ecosystem Management in Question: A Reply to Ruhl” (2005–2006) 23 *Pace Env’tl L Rev* 209; JB Ruhl, “The Pardy-Ruhl Dialogue on Ecosystem Management, Part IV: Narrowing and Sharpening the Questions” (2007) 24 *Pace Env’tl L Rev* 25; and Bruce Pardy, “The Pardy-Ruhl Dialogue on Ecosystem Management Part V: Discretion, Complex-Adaptive Problem Solving and the Rule of Law” (2007) 25 *Pace Env’tl L Rev* 341.
- 33 See, e.g., Brian Walker & David Salt, *Resilience Thinking: Sustaining Ecosystems and People in a Changing World* (Washington: Island Press, 2006). The authors define “resilience” as the “ability of a system to absorb disturbance and still retain its basic function and structure.” *Ibid* at 1.
- 34 *Ibid* at 8.
- 35 See *Water Protection Act*, *supra* note 7 (preamble committing the Manitoba government to “watershed planning as an effective means to address risks to water resources and aquatic ecosystems,” and stating the government’s belief that “residents of watersheds should be consulted when watershed plans are developed”); *Water Act* (Alberta), *supra* note 9, ss 9 and 11 (discussed in Wenig, *supra* note 31 at 3–6).
- 36 *Canada National Parks Act*, SC 2000, c 32, ss 2(1) and 8(2); *Species at Risk (NWT) Act*, SNWT 2009, c 16, s 1(1); *Provincial Parks and Conservation Reserves Act*, 2006, SO 2006, c 12, ss 2(1), 3(1) and 5(2)–(3).
- 37 See, e.g., *Environmental Rights Act* (NWT), *supra* note 7 (preamble referencing ecosystem “integrity, biological diversity and productivity”); *Crown Lands Act*, RSN 1989, c 114, ss 25(1) (forest ecosystem “productivity, diversity

- and stability”) and 25(2) (“integrity of water-supply watersheds”); *Environment Act*, SNS 1994–95, c 1, ss 2(a) (“integrity”) and 104(d) and 105(3)(d) (aquatic ecosystem “health and integrity”).
- 38 See *Canada National Marine Conservation Areas Act*, *supra* note 7, s 4(3) (ecosystem “structure and function”); *Sustainable Development Act*, CCSM c S270, Sched A, s 5(d) (ecosystem “long-term productive capability, quality and capacity”); *Crown Forest Sustainability Act*, 1994, SO 1994, c 25, s 68(5)(b)(i)–(ii) (“natural landscape patterns, forest structure and composition, habitat for animal life and the abundance and distribution of forest ecosystems ... healthy forest ecosystems”); and *Forests Act*, RSNS 1989, c 179, s 10 (forest ecosystem “long term diversity and stability”).
- 39 See *Sustainable Forest Development Act*, RSQ, c A-18.1, ss 2(2) and (4) (forest ecosystem “condition and productivity” and “contributions to major ecological cycles”) and 4(2) (ecosystem “biodiversity and viability”); *Sustainable Development Act*, RSQ, c D-8.1.1, s 6(m) (ecosystem “support capacity” and “perenniality”); *Environment Quality Act*, RSQ, c Q-2, s 31.9(b) (ecosystem “balance”).
- 40 For the latter perspective, see, e.g., Yaffee, *supra* note 15 at 715 and 719; and Van Dyke, *supra* note 3 at 351.
- 41 See Wenig, *supra* note 4 at 18–25.
- 42 See, e.g., Kennett, *supra* note 25 at 19 (referring to Leopold’s “land ethic” as providing the “normative basis of ecosystem management”); and Adler, *supra* note 18 at 1000–1003 (referring to ecosystem management as a means for “harnessing bioregionalism” in order to promote widespread public adoption of Leopold’s ethic).
- 43 Aldo Leopold, *A Sand County Almanac* (New York: Ballantine Books, 1968) at 262.
- 44 Wenig, *supra* note 4 at 19 and n. 58.
- 45 This view is reflected in the observation of a BC judge in deliberating on the appropriate sentence in a prosecution for violation of the federal *Fisheries Act*, RSC 1985, c F-14. According to the judge, the “ecological system that was threatened in this case is of such immense value that it is impossible to put a value and figure on it. It must be, above all, protected in this community, because it is, in fact, the basis and the soul of the community in so many aspects, and to pollute it would be a loss without and beyond measure.” *R v Island Industrial Chrome, Ltd* (1989) 5 FPR 163 at 185 (BC Prov Ct) (emphasis added).
- 46 See, e.g., Heather Tallis et al, “The Many Faces of Ecosystem-Based Management: Making the Process Work Today in Real Places” (2010) 34 *Marine Policy* at 340 at 347–48; Pardy (2007), *supra* note 32 at 10; Michael M Wenig, Arlene Kwasniak & Dr Michael S Quinn, “Water Under the Bridge? The Role of IFN Determinations in Alberta’s River Management” in H Epp, ed, *Water: Science & Politics*, Proceedings of the Alberta Society of Professional Biologists, Annual Conference and Workshop, 25–28 March 2006, Calgary, Alberta; Michael M Wenig & Dr Michael S Quinn, “Integrating the Alberta Oil and Gas Tenure Regime with Landscape Objectives: One Step Toward Managing Cumulative Effects” in H Epp, ed, *Access Management: Policy to Practice*, Proceedings of the Conference presented by the Alberta Society of Professional Biologists in Calgary, 18–19 March 2003 (Edmonton: ASPB, 2004); and Kennett, *supra* note 25 at 22.
- 47 *Supra* note 36.
- 48 *Supra* note 38 at ss 61(1)(1), (5)(i)–(ii).
- 49 See *SARA*, *supra* note 7, ss 41(3) and 67; *Species at Risk (NWT) Act*, *supra* note 36, s 61(8), *Endangered Species Act, 2007*, SO 2007, c 6, s 13; and *Endangered Species Act*, SNS 1998, c 11, s 15(5).
- 50 *Supra* note 7, s 9(1) and (3).
- 51 See, e.g., Van Dyke, *supra* note 3 at 351, 354–355; Lamont, *supra* note 32 at 7.
- 52 Van Dyke, *supra* note 3 at 378.
- 53 Yaffee, *supra* note 15 at 715.
- 54 *Ibid* at 721.