

THE LAW AND ECONOMICS OF ENVIRONMENTAL HARM: A PRIMER AND UPDATE FOR ENVIRONMENTAL SENTENCING (PARTS I & II)

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INTRODUCTION

Ever since Justice Stuart's landmark decision in *R. v. United Keno Hill Mines* (1980),¹ Canadian lawyers and judges have enjoyed a relatively stable list of factors to consider when determining the appropriate sentence to be imposed in the environmental law context. In at least one aspect, however, this longevity and stability can be misleading. I am referring here to the first couple of factors listed in the *United Keno Hill Mines* framework, namely, the nature and extent of environmental harm (both actual and potential).² As recently observed and despite over thirty years of sentencing jurisprudence, the "difficulty of proving an ascertainable and quantifiable harm is present in most environmental cases"³

The purpose of this paper, then, is to familiarize the judiciary and bar with the legal and economic dimensions of a relatively tried and tested approach to quantification that has yet to be successfully applied in the Canadian environmental sentencing context: environmental valuation, which can be described as simply economic valuation — "the valuation in monetary terms of items that people might care for" — applied to the natural environment.⁴

We begin by first providing some context; recent developments in both environmental economics and Canadian environmental law support a shift towards an economic approach to the quantification of environmental harm for the purposes of sentencing. Part II sets out the basic legal framework, while Part III sets out the basic economic concepts, principles and methodologies of environmental valuation. Part IV consists of a case study. Finally, in Part V, we conclude by assessing the prospects of taking an economic approach to the quantification of environmental harm at this stage in Canadian sentencing law and the field of environmental economics.

¹ 10 CELR 43 (Y Terr Ct) [*United Keno Hill Mines*].

² *Ibid* at paras 11-13. According to Westlaw, *United Keno Hill Mines* has been judicially considered 71 times.

³ *R v Northwest Territories Power Corporation*, 2011 NWTTC 03 at para 89 [*Northwest Territories Power Corporation*]. See also *R v Terroco Industries Limited*, 2005 ABCA 141 at para 47: "In many environmental offences, harm is not easily identified"; and *R v Zellstoff Celgar Limited Partnership*, 2012 BCPC 295 at paras 43-48 (CanLII) [*Zellstoff*].

⁴ WM Hanemann, "The economic conception of water" in Peter P Rogers, M Ramón Llamas & Luis Martinez-Cortina, eds, *Water Crisis: Myth or Reality?* (London: Taylor & Francis, 2006) 61 at 66.

PART I: RECENT DEVELOPMENTS IN ECONOMICS AND LAW⁵

A. Brief History of Environmental Valuation

Although often perceived as new, environmental valuation has actually been around since the 1950s.⁶ One of the earliest examples (though still highly relevant, as further discussed below) was an attempt to quantify the value of some national parks in the United States (admission to which was free) using the costs that individuals incurred to visit such parks (e.g. for gas, hotels, food, etc. ...) as a proxy. This marked the beginning of what University of Alberta environmental economist Wiktor L. Adamowicz has described as the “travel cost valuation era.”⁷

As is often the case in the environmental context, however,⁸ it took a relatively catastrophic event — the 1989 running aground of the *Exxon Valdez* and subsequent oil spill — to really spur developments in this area, especially on the methodological side.⁹ Indeed, one of the most well-known valuation studies to date is still the one done following the *Valdez* spill that, using a then relatively controversial technique — contingent valuation — estimated environmental losses at a minimum of \$2.8 billion (US).¹⁰

Another significant boost for environmental valuation came in the late 1990s with the emergence of the “ecosystem services” paradigm,¹¹ now most commonly associated with United Nations’ 2005 *Millennium Ecosystem Assessment Report* (MEA),¹² pursuant to which the natural environment is conceived as another form of capital (i.e. natural capital) that gives rise to the (largely free) flow of such goods and services as water purification, climate regulation, flood mitigation, etc.¹³ Although it would be difficult to

⁵ Portions of this part of the paper are adapted from Martin ZP Olszynski, “Environmental Damages after the Federal *Environmental Enforcement Act*: Bringing Ecosystem Services to Canadian Environmental Law?” (2012) 50:1 Osgoode Hall LJ 129.

⁶ Wiktor L Adamowicz, “What’s it worth? An examination of historical trends and future directions in environmental valuation” (2004) 48:3 *Austl J of Agric Resource Econ* 419 at 419.

⁷ *Ibid.*

⁸ See e.g. Keith H Hirokawa, “Disasters and Ecosystem Services Deprivation: From Cuyahoga to the Deepwater Horizon” (2011) 74:1 *Alb L Rev* 547: “The idea that disasters incentivize changes in environmental law is well-settled ... [D]isasters provide an important and continuing point of reference by compelling us to revise our perceptions on the value of nature and natural processes.”

⁹ Adamowicz, *supra* note 6 at 423.

¹⁰ Richard T Carson et al, “Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill” (2003) 25:3 *Envtl & Resource Econ* 257 at 278.

¹¹ Gretchen Daily, *Nature’s Services: Societal Dependence on Natural Ecosystems* (Washington, DC: Island Press, 1997) is widely regarded as the “breakthrough” work for ecosystem services theory and research.

¹² See online: MEA <<http://www.maweb.org/en/index.aspx>>.

¹³ The MEA adopted a broad definition of ecosystem services (“the benefits that humans derive from ecosystems”), which it divided into four categories: “Provisioning services are the products people obtain

overstate the uniqueness and unprecedented success of the ecosystem services concept in furthering societal understanding of the numerous contributions made by functioning ecosystems to human health and prosperity,¹⁴ the translation of those benefits into monetary terms is still very much an exercise in environmental valuation and has therefore further stimulated research in this area.

Table 1: Recent Valuation Studies in Canada

Focus of Study	For	Valuation (CDN)
Mackenzie Region, NWT	Boreal Forest Initiative (2009)	\$570.6 billion/year ¹⁵
Credit River, ON	Pembina Institute and Credit Valley Conservation (2009)	\$371 million/year ¹⁶
Lower Mainland, BC	The Pacific Parklands Foundation (2010)	\$5.4billion/year ¹⁷
Polar Bear	Environment Canada (2011)	\$6 billion/year ¹⁸
Marine Mammals (inc. Beluga Whale)	Fisheries and Oceans Canada (2012)	\$962 million/year ¹⁹
Thousand Islands National Park	Statistics Canada (2013)	\$12.5 million/year ²⁰

from ecosystems, such as food, fuel, fiber, fresh water, and genetic resources. Regulating services are the benefits people obtain from the regulation of ecosystem processes, including air quality maintenance ... and water purification. Cultural services are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. Supporting services are those that are necessary for the production of all other ecosystem services, such as primary production, production of oxygen and soil formation.” See MEA, *Ecosystems and Human Well-being: Current State and Trends Assessment*, vol 1 (Washington, DC: Island Press, 2005) at 29.

¹⁴ See Olszynski, *supra* 5 at 134-135 and footnote 38.

¹⁵ Mark Alnielski & Sara Wilson, *The Real Wealth of the Mackenzie Region* (Ottawa: Canadian Boreal Initiative, 2009), online: <<http://www.borealcanada.ca>>.

¹⁶ Mike Kennedy & Jeff Wilson, *Natural Credit: Estimating the Value of Natural Capital in the Credit River Watershed* (Drayton Valley: Pembina Institute & Credit Valley Conservation, 2009), online: Pembina Institute <<http://www.pembina.org>>.

¹⁷ Sara J Wilson, *Natural Capital in BC's Lower Mainland: Valuing the Benefits from Nature* (Vancouver: David Suzuki Foundation, November 2010), online: David Suzuki Foundation <<http://www.davidsuzuki.org/publications/reports/2010/natural-capital-in-bcs-lower-mainland/>>.

¹⁸ ÉcoRessources Consultants, *Evidence of the Socio-Economic Importance of Polar Bears for Canada* (Ottawa: Environment Canada, 2011), online: <<http://publications.gc.ca/site/eng/397569/publication.html>>.

¹⁹ PC Boxall et al, “Analysis of the economic benefits associated with the recovery of threatened marine mammal species in the Canadian St Lawrence Estuary” (2012) 36 Marine Policy 189-197.

²⁰ Statistics Canada, *Human Activity and the Environment: Measuring ecosystem goods and services in Canada* (Ottawa: Minister of Industry, 2013), available: <<http://www.statcan.gc.ca/pub/16-201-x/16-201-x-2013000-eng.htm>>.

There are now in Canada several studies that have estimated the economic value of the natural environment. One of the first such studies was by Simon Fraser professor Nancy Olewiler, who in 2004 estimated the annual value of the Fraser River Valley's 40,000 ha of wetlands at \$231.7 million (CDN), primarily as a reflection of their 'waste-treatment' services (and the uptake of agriculturally-generated nitrogen and phosphorus in particular).²¹ More recently, both governments and non-governmental organizations (NGOs) have commissioned valuation reports for various ecosystem assets (see Table 1 above).

B. Recent Changes to Canadian Environmental Law

As one might expect, growing societal recognition of the "true value of nature"²² is being reflected in Canada's environmental laws. Probably the most significant development on this front was the passage in 2009 of the federal *Environmental Enforcement Act*.²³ The *EEA* amended — in a largely uniform way — the sentencing provisions of nine federal environmental statutes: the *Antarctic Environmental Protection Act*,²⁴ the *Canada National Marine Conservation Areas Act*,²⁵ the *Canada National Parks Act*,²⁶ the *Canada Wildlife Act*,²⁷ the *Canadian Environmental Protection Act, 1999 (CEPA, 1999)*,²⁸ the *International River Improvements Act*,²⁹ the *Migratory Birds Convention Act, 1994*,³⁰ the *Saguenay-St. Lawrence Marine Park Act*,³¹ and the *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act*.³²

While *CEPA, 1999*, the *MBCA, 1994* and *WAPPRITA* are by far the more commonly prosecuted statutes of those amended by the *EEA*,³³ its new sentencing provisions were

²¹ Nancy Olewiler, *The Value of Natural Capital in Settled Areas of Canada* (Toronto: Nature Conservancy of Canada, 2004).

²² MEA, *Living Beyond Our Means: Natural Assets and Human Well-Being, Statement from the Board*, (Washington, DC: MEA Board, 2005) at 5, online: MEA <<http://maweb.org/en/BoardStatement.asp>>.

²³ SC 2009, c 14 [*EEA*]. For a general overview of the *EEA*, see Olszynski, *supra* note 5 at 156-160; Penny Becklumb, *Legislative Summary: Bill C-16: Environmental Enforcement Act* (Ottawa: Library of Parliament, Parliamentary Information and Research Service, 2009); Environment Canada, *Background: Overview of the Environmental Enforcement Bill* (3 March 2009), online: Environment Canada <<http://www.ec.gc.ca>>.

²⁴ SC 2003, c 20 [*AEPA*].

²⁵ SC 2002, c 18 [*CNMCAA*].

²⁶ SC 2000, c 32 [*CNPA*].

²⁷ RSC 1985, c W-9 [*CWA*].

²⁸ SC 1999, c 33 [*CEPA, 1999*].

²⁹ RSC 1985, c I-20 [*IRIA*].

³⁰ SC 1994, c 22 [*MBCA, 1994*].

³¹ SC 1997, c 37 [*SSLMPA*].

³² SC 1992, c 52 [*WAPPRITA*].

³³ See Environment Canada's "Enforcement Notifications", online: <<http://www.ec.gc.ca/alef-ewe/default.asp?lang=En&n=8F711F37-1>> for the most recent enforcement actions with respect to the *CEPA, 1999*

most recently considered in detail in *R. v. Decker* (2013)³⁴ in what appears to be the first reported sentencing decision for an offence under the *CNPA*.³⁵ The accused in that case was convicted of four violations for operating an all-terrain vehicle and a motor vehicle within the boundaries of Gros Morne National Park, off of any road and without a permit contrary to subsections 3(1) and 41(2) of the *National Parks Highway Traffic Regulations*,³⁶ and for removing flora (driftwood) from the Park contrary to section 10 of the *National Parks General Regulations*.³⁷

The Court set out in detail the new sentencing scheme that, as noted above, is more or less the same in each of the above noted statutes (albeit tailored to the circumstances of each particular statute):

The [*CNPA*] requires a sentencing judge to consider the principles of sentencing set out in sections 718.1 to 718.21 of the *Criminal Code* and a number of principles and factors specifically applicable to offences committed contrary to the [*CNPA*].

Section 27.6 ... indicates that the fundamental purpose of sentencing for these types of offences ...

... is to contribute to respect for the law establishing and protecting parks through the imposition of just sanctions that have as their objectives

(a) to deter the offender and any other person from committing offences under this Act;

(b) to denounce unlawful conduct that damages or creates a risk of damage to parks; and

(c) to restore park resources.

Section 27.7(1) ... states that in addition to the principles and factors set out in the *Criminal Code*, in imposing sentence for breaches of the [*CNPA*] a sentencing judge must consider a number of additional principles ...:

(a) the amount of the fine should be increased to account for every aggravating factor associated with the offence, including the aggravating factors set out in subsection (2); and

(b) the amount of the fine should reflect the gravity of each aggravating factor associated with the offence.

Section 27.7(2) ... deems certain circumstances to be an “aggravating factor” in sentencing:

and *WAPRITTA*. It should also be noted that the *EEA* did not amend the *Fisheries Act*, RSC 1985, c F-14, which is by far the most commonly enforced federal environmental statute (especially ss 35 and 36). The *Fisheries Act* has been recently amended to reflect the higher fine regime put in place through the *EEA*, but it does not contain the same detailed sentencing provisions, including the definition of environmental damages.

³⁴ CanLII 58688 (NL PC) [*Decker*].

³⁵ *Ibid* at para 23.

³⁶ CRC, c 1126.

³⁷ SOR 78-213.

- (a) *the offence caused damage or risk of damage to park resources;*
- (b) *the offence caused damage or risk of damage to any unique, rare, particularly important or vulnerable park resources;*
- (c) *the damage caused by the offence is extensive, persistent or irreparable;*
- (d) the offender committed the offence intentionally or recklessly;
- (e) the offender failed to take reasonable steps to prevent the ... offence ...;
- (f) ... the offender increased revenue or decreased costs or intended to increase revenue or decrease costs;
- (g) the offender committed the offence despite having been warned ...;
- (h) the offender has a history of non-compliance ...;
- (i) after the commission of the offence, the offender (i) attempted to conceal its commission, (ii) failed to take prompt action to prevent, mitigate or remediate its effects, or (iii) failed to take prompt action to reduce the risk of committing similar offences in the future.

Section 27.7(4) ... indicates that “*damage*” includes “*loss of use value and non-use value*”.³⁸

For those familiar with Canada’s environmental sentencing jurisprudence, it should be clear that these provisions represent mostly a codification of the *United Keno Hill Mines* factors, albeit with some modification — the most relevant here being the inclusion of the economic terms “use value and non-use value” in the definition of “damage” (as referred to in factors (a)-(c)).

Although the evidence in *Decker* gave the Court no cause to consider these terms in any further detail,³⁹ they are not unprecedented in Canadian environmental law. The Supreme Court of Canada had occasion to consider them in the context of civil liability in *Canadian Forest Products v. British Columbia (Canfor)*.⁴⁰ In that case, the defendant company was found liable for negligently failing to extinguish a control burn. The provincial Crown sought both commercial damages and compensation for environmental damages, identifying several components of such loss:

“Use value” includes the services provided by the ecosystem to human beings, including food sources, water quality and recreational opportunities. Even if the public are not charged for these services, it may be possible to quantify them economically by observing what the public pays for comparable services on the market ...

³⁸ *Decker*, *supra* note 34 at paras 10-15 [emphasis added].

³⁹ *Ibid* at para 26. The Court notes, in contrast, a case where there was extensive damage caused by all-terrain vehicles; see *R v Lambe*, 2000 NFCA 23 (CanLII).

⁴⁰ 2004 SCC 38, 2 SCR 74 [*Canfor*].

“Passive use” or “existence” [non-use] value recognizes that a member of the public may be prepared to pay something for the protection of a natural resource, even if he or she never directly uses it. It includes both the psychological benefit to the public of knowing that the resource is protected, and the option value of being able to use it in the future. The branch of economics known as “contingent valuation” uses survey techniques to attempt to quantify what the public would be prepared to pay to maintain these benefits [emphasis in original].⁴¹

In *Canfor*, however, the Crown did not actually adduce any evidence of such loss. Consequently, while the Court did discuss in some detail the methods that could be applied in this context,⁴² it ultimately dismissed this part of the claim.⁴³ We discuss the basic concepts, principles and methods of environmental valuation in Part III. The next part sets out in further detail the applicable legal framework for the consideration of environmental harm in sentencing.

PART II: THE LEGAL FRAMEWORK FOR ASSESSING AND QUANTIFYING HARM IN SENTENCING

While the SCC’s decision in *Canfor* (and its relatively favorable disposition to the concepts and methods of environmental valuation in particular)⁴⁴ is plainly a relevant precedent, the assessment and quantification of environmental harm or damage (this paper uses these terms interchangeably) in the sentencing context differs in at least two fundamental ways from the tort liability context: the kinds of harm that matter; and the applicable burden of proof.

A. Three Kinds of Harm: Actual, Potential-Specific, and Potential General

It is probably now trite to state that in the context of environmental sentencing both *actual* and *potential* harm matter. As Stuart J. stated in *United Keno Hill Mines*,

*Extent of Injury. Penalties should reflect the degree of damage inflicted If the damage is irreparable, extensive, persistent or has numerous consequential adverse effects, the penalty must be severe. In some instances not only the actual damage caused but the potential damage that might have emanated from the polluter’s activities must be considered.*⁴⁵

Over time, and seemingly as a result of Canadian courts’ increasing focus on deterrence — both specific and general,⁴⁶ the consideration of *potential harm* has likewise taken on

⁴¹ *Ibid* at paras 138. These terms are discussed in further detail in Part III.

⁴² *Ibid* at paras 142-143.

⁴³ *Ibid* at para 153.

⁴⁴ *Supra* note 42.

⁴⁵ *United Keno Hill Mines*, *supra* note 1 at para 13.

⁴⁶ *Northwest Territories Power Corporation*, *supra* note 3 at para 24: “The sentencing principle of deterrence is based on a model which punishes the offender sufficiently that he or she will not offend again (specific deterrence) and to such a degree that others who are in the same position as the offender was in,

both specific and general dimensions. In the relatively recent case *R. v. Northwest Territories Power Corporation* (2011), the Court cited with approval several unreported decisions to explain this relationship as follow:

As stated in *R. v. Shamrock*, an unreported case of the Ontario Provincial Offences Court on February 13, 1989, at page 7:

If public welfare offences are “preventative” and their purpose is to set high standards, *no actual damage should be necessary to attract substantial penalties. The degree of risk or potential harm inherent in the activity should be the primary criterion for a substantial penalty*, and actual harm an aggravating factor ...

The issue of potential damages versus actual damage was also considered by the Nunavut Court of Justice in *R. v. City of Iqaluit*, Unreported Decision, August 8, 2002:

[6] There is no evidence in this case that the discharge of sewage in this case resulted in any fish kills or any other readily identifiable signs of environmental degradation. However, it is the potential for harm to the environment that is the gravamen of this offence. Actual damage where proved, is an aggravating circumstance that would likely elevate the sentence that would otherwise be imposed ...

Many cases have stated that deterrence is the single-most important factor in sentencing environmental offenders. If the goals of sentencing in environmental cases are to “abate, mitigate and prevent”, as indicated in the introductory remarks, *then a penalty which prevents a particular offender and other potential offenders from committing offences in the future is necessary in order to achieve the last of these goals.*⁴⁷

With respect to the potential harm (risk of damage) *specific to the offence* before the Court, the decision in *R. v. Terroco Industries Limited*⁴⁸ is perhaps the most instructive:

The greater the potential for harm, the greater the warranted penalty. The potential for harm is informed by the probability of the risk, the nature of the product, the likely magnitude of damage if the risk materializes and the sensitivity of the site including its proximity to population and fragile environments [citations omitted] ... Where there is potential for harm that is avoided by fortuitous circumstances, that potential is a relevant factor.⁴⁹

Thus, the risk of damage specific to the offence appears to be primarily concerned with fortuitous intervening forces, or at least forces not attributable to the defendant’s due diligence, but for which the actual environmental damage would likely have been greater. Returning to the *Decker* prosecution, one might imagine that Mr. Decker only narrowly and by chance avoided some rare or particularly unique flora in the area where the

will not offend because they do not want to incur the same penalty (general deterrence).” See also Elaine L Hughes & Dr Larry A Reynolds, “Creative Sentencing and Environmental Protection” (2009) 19:2 J Envtl L & Prac 105 at 108.

⁴⁷ *Northwest Territories Power Corporation*, *supra* note 3 at paras 39-42.

⁴⁸ 2005 ABCA 141.

⁴⁹ *Ibid* at para 48, recently cited with approval in *Zellstoff*, *supra* note 3 [emphasis added].

offence occurred. This specific risk of damage would also seem to be place-based; it is the risk of damage to the environment in the same place and under essentially the same conditions as where and when the offence occurred.

With respect to potential harm (risk of damage) from the regulated community more generally, two decisions under the *MBCA, 1994* provide good illustrations. In *R. v. Carriere*,⁵⁰ the accused were convicted of offences related to the illegal taking of approximately 170 birds. The Court held that:

[T]he actions of the accused have had no significant impact on the duck populations of either the Cumberland Marshes or the North American continent as a whole. But this does not end the matter. Paragraph 13(4.1)(a) of the [*MBCA, 1994*] speaks not just of “harm” but also of the “risk of harm.” I am of the view that while the actual harm caused by the accused at Mistik Lodge was small, *the risk of harm was significantly larger.*

The sustained health of North America’s wild duck population depends on the co-operation of the governments and peoples of three different countries That co-operation is not just restricted to the regulation of sport hunting, but regulation of sport hunting is key to maintaining duck populations. When one sees ducks in flocks exceeding a thousand birds, it may seem impossible that duck populations could be thinned by mere hunting. But duck hunters, particularly sport hunters, have the capacity to exert tremendous pressure. If every hunter took the view that he could double his legal limit, the annual duck hunt would potentially result in 30 million ducks killed. Perhaps the ducks could take this pressure for a short while. However, as the examples of the passenger pigeon and the whooping crane illustrate, sustained overhunting would likely lead to devastation.⁵¹

This approach was cited with approval in the relatively famous *Syncrude* prosecution (albeit in the consideration of due diligence):

I doubt that the number of ducks lost on or about April 28, 2008 at the Aurora Settling Basin would have any significant impact on total duck populations and it may be a small number compared with the loss from hunting or total losses in industrial settings... However, it is important to remember the purpose of the provincial and federal legislation. The legislation is designed to protect the environment and maintain migratory bird populations, respectively. As with most regulatory offences, the legislation is not just directed at the immediate and direct effect of the proscribed conduct but also at the potential harm if that conduct was widespread. See, for example: *R. v. Carriere* ...⁵²

Thus, the general risk of damage analysis attempts to extrapolate the conduct of the offender to the broader regulatory community. In *Carriere*, this meant other sports hunters. In *Syncrude*, the Court seemed to contemplate other oil sands operators, or at least those whose operations entail the creation of tailings ponds. In some cases at least, the applicable legislative or regulatory scheme will define the relevant community, e.g.

⁵⁰ 2005 SKPC 84, 272 Sask R 13 [*Carriere*].

⁵¹ *Ibid* at paras 45-46.

⁵² *R v Syncrude Canada Ltd*, 2010 ABPC 229, 53 CELR (3d) 196 at para 106.

for offences under the *Metal Mining Effluent Regulations*,⁵³ the relevant community would be all mining operations subject to those regulations. In contrast to the specific risk of damage, then, the general risk is not place-based but rather considers the environmental assets in question more broadly.

When considering both kinds of risk (specific and general), it may be useful to state these in algebraic terms:

$$R = MP, \text{ where}$$

R = Risk of damage (specific or general)

M = Magnitude of damage

P = Probability of occurrence

This formula captures most of the criteria set out by the Court in *R. v. Terroco, supra*, albeit in a more generalized way (e.g. it is not just applicable to “products” but could also apply to physical works or activities that have a direct impact on the environment). And while it is admittedly more complex than it may appear at first glance (both magnitude and probability can be further broken down into subcomponents), it is not being suggested here that surgical precision is required when considering the risk of damage — certainly the existing jurisprudence does not support such a standard.

B. The Burden of Proof: Beyond a Reasonable Doubt

In contrast to the civil standard of a balance of probabilities, it is also well settled in Canada that an aggravating factor must be proven beyond a reasonable doubt, and further that this burden of proof can create some difficulty in the environmental context.

The recent case of *R. v. Zellstoff Celgar Limited Partnership (2012)*,⁵⁴ is illustrative. In that case, the Crown introduced evidence that the accused deposited approximately 500 million liters of effluent into the Columbia River that did not meet its permitted requirements for total suspended solids (TSS) and biological oxygen demanding (BOD), and some of which failed the 96-hour rainbow trout test.⁵⁵ While the Court held that “the Columbia River must be considered an environmentally sensitive area” and that it “is a fish-bearing river” whose “denizens include endangered species”⁵⁶ and that harm from the deposit might appear self-evident,⁵⁷ the Court nevertheless concluded that there was

⁵³ SOR/2002-222 [MMER].

⁵⁴ *Zellstoff, supra* note 3.

⁵⁵ *Ibid* at para 43.

⁵⁶ *Ibid* at para 44.

⁵⁷ *Ibid* at para 45.

“actually no evidence of harm in this case, such that harm could be considered an aggravating factor on this sentence.”⁵⁸

This left the question of potential harm. Here, too, the Court concluded that it was “left with considerable doubt as to the degree to which the effluent that was discharged in the river ... had a potential for harm or, if so, what the magnitude of the risk was. *It is clear in the authorities that the Crown must prove aggravating factors beyond a reasonable doubt, and in this case the Crown has not met that onus.*”⁵⁹

Simply put, the Crown must introduce sufficient evidence of damage in order for the courts to rely on these aggravating factors in setting the appropriate fine, a task that admittedly poses some additional conceptual difficulties where the *risk of damage* (both specific but especially general) is concerned. Of course, this difficulty (of proving the existence of a risk — which is inherently uncertain — beyond a reasonable doubt) is not limited to an environmental valuation approach but rather has been present in each case since *United Keno Hill Mines*.

This difficulty would seem at least somewhat alleviated by the consistent adoption of the above-noted formula ($R = MP$) that, as noted above, could be further broken down into subcomponents. Thus, the magnitude of harm (M) could often be considered a function of the scale or degree of impact (low, moderate, high) and the sensitivity of the environment (e.g. a wetland or bog in a national park) or ecosystem asset (e.g. migratory birds) to disturbance (again low, moderate high), as the following table sets out:

Table 2: Magnitude of Harm as a Function of Impact and Sensitivity

	Sensitivity of Environment or Ecosystem Asset		
Impact	High	Moderate	Low
High			
Moderate			
Low			

When considering the general risk of damage, the degree of impact could be further broken down by some estimate of the size of the regulated community (as the Court seemed to do in *R. v. Carriere*): the larger the regulated community, the larger the potential impact associated with even individually minimal harm. For instance, when considering general deterrence in the context of an offence under the *MMER*, the number of mine operators in Canada would surely inform the magnitude of potential harm.

⁵⁸ *Ibid.*

⁵⁹ *Ibid* at paras 47-48.

Similarly, the probability of occurrence (P) could be broken down into ranges: low (0-30%), moderate (30-60%) and high (60-100%). Generally speaking, one would expect the probability of damage to be greater when considering the specific risk of damage, especially where damage was avoided only by a fortuitous event, than when considering general risk. In this latter context, the Crown could perhaps rely on social science evidence or statistics on regulatory compliance to support its estimation. While none of these tools would lead to a determination of risk with exact precision, they would add some predictability and transparency to an exercise that — occasionally on fairly nebulous terms — has long since been and continues to be carried out in the sentencing context.

With respect to environmental valuation specifically, while even environmental economists would concede that their results are often marked with uncertainty, it may be useful to recall that some degree of uncertainty is endemic in environmental science and law generally,⁶⁰ and further — and perhaps most importantly — that through the inclusion of “use and non-use value” in the definition of “damage” Parliament has clearly indicated that this kind of evidence should be considered for the purposes of environmental sentencing.

(For Parts III, IV and V, see the paper associated with Professor Peter Boxall.)

⁶⁰ Daniel Farber, “Building Bridges over Troubled Waters: Eco-pragmatism and the Environmental Prospect” (2003) 87:4 *Minn L Rev* 852 at 855.