

NEW MODELS FOR THE COMPENSATION OF NATURAL RESOURCES DAMAGE

MICHAEL FAURE AND JING LIU*

ABSTRACT

Current regulation and liability schemes ineffectively prevent and routinely under compensate natural resources damages. Compensation instruments, such as liability insurance, direct insurance, risk sharing agreement, environmental funds, and guarantees provided by liable parties or third parties can be used to better achieve efficient prevention and compensation. This article identifies three such models, combining regulation, liability rules, and compensation instruments. This article also identifies various factors to be considered when choosing a particular compensation scheme.

I. INTRODUCTION

Industrialization and modernization results in damage to the natural environment that supports human life. Regulation of environmental degradation has long been employed to temper environmentally harmful activity, but regulatory successes are inconsistent. Environmentally harmful activities have historically resulted in significant losses to both individuals and to the environment itself. The economic value of the environment, and corresponding damage to individuals, are within the scope of liability law typically remedied via damage awards. However, the environment is valued ecologically, aesthetically, and culturally, making it more difficult to remedy via traditional liability concepts. Given its unique value, the environment makes restoration a more effective remedy than monetary compensation. This article attempts to identify various models that can provide optimal prevention and restoration of damage to the environment itself. Before discussing the designs of specific compensation models, this article briefly introduces some important foundational concepts.

Environmentally harmful activities cause damage both to individuals and to the physical environment itself. Harm to individuals has

* Michael Faure, Professor of Comparative and International Environmental Law, Metro, Maastricht University, Netherlands. Email: michael.faure@maastrichtuniversity.nl; Professor of Comparative Private Law and Economics, Rotterdam Institute of Law & Economics, Erasmus University of Rotterdam, Rotterdam, Netherlands; and visiting Professor of the University of Pennsylvania Law School, Philadelphia.

Jing Liu, Maastricht University, Netherlands. Email: jing.liu@maastrichtuniversity.nl

long been recognized as compensable under tort law. However, physical environmental has historically only been compensable to the extent of its economic value as a natural resource. This article focuses on the latter kind of damage, damage to the physical environment. There are several terms used to denote environmental damage in different jurisdictions. For example, in the United States, the term “natural resources damage” is used in legislation and literature. Under the Comprehensive Environmental Response, Compensation and Liability Act¹ (CERCLA) and Oil Pollution Act² (OPA), some government authorities and Indian Tribes are allowed to recover damages caused by “injury to, destruction of, or loss of (loss of use of) natural resources.”³ The term “natural resources” is broadly defined in CERCLA and OPA to include “land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States . . . , any State or local government, or any foreign government.”⁴ According to this definition, natural resources damage includes not only the elements subject to private property rights such as land and minerals, but also public goods such as wildlife, birds, and fish. Injury to the natural resources is obviously included in “natural resources damage” but damages suffered by the public at large as a result of the environmental damage also qualify.⁵

In Europe, different terms are used. Under the Directive 2004/35/CE of the European Parliament and the Council of 21 April 2004 on Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage (ELD), a liability and administrative regime for “environmental damage” was established.⁶ Direct damage to the environment is included in the ELD definition, but no personal injury and property damage caused via the environment is included.⁷ Hence the European notion of “environmental damage” is more restrictive than “natural resources damage” as defined by the United States. It is limited to three components of the environment: protected species and natural

¹ 42 U.S.C. §§ 9601-9657 (2012).

² 33 U.S.C. §§ 2701-2761 (2012).

³ 42 U.S.C. § 9607(a)(4)(C) (2012); 33 U.S.C. § 2702(b)(2)(A) (2012).

⁴ 42 U.S.C.A. § 9601(16) (West 2012); 33 U.S.C.A. § 2701(20) (West 2012).

⁵ Edward H.P. Brans, *Liability for Damage to Public Natural Resources* 21 (Daniel Bodansky & David Freestone eds., 2001).

⁶ Directive 2004/35/CE, of the European Parliament and of the Council of 21 April 2004 on the Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage, 2004 O.J. (L143) 56 [hereinafter ELD].

⁷ *Id.* art. 2.1.

habitats, water (as defined in Directive 2000/60/EC), and land.⁸ “Ecological damage” is another oft used term popular among European scholars. Three approaches are used to demarcate this term. The most restricted interpretation limits damages to natural resources not subject to property rights.⁹ However a broader approach defines it as damage to the natural resources lacking market value.¹⁰ Under the third approach, the term “ecological damage” refers to damage to the environment regardless of the existence of property rights.¹¹ Given the differences in the use of terminology, for the purpose of this article, we prefer the term “natural resources damage.” This term includes not only damage to un-owned components of the environment (public natural resources), but also damage to owned components (private natural resources) having ecological value in excess of their sentimental value to their owners.

The term “compensation” usually implies monetary damages, which is of secondary importance in regards to natural resources damage. The environment is considered by economists to have both use and non-use values.¹² Use value is the value derived from people’s actual use of the environment, which can be evaluated through market values.¹³ Alternatively, non-use values cannot be measured by the market value of the natural resources.¹⁴ For example, “existence value” is an important non-

⁸ *Id.*

⁹ BRANS, *supra* note 5, at 17-19.

¹⁰ For example, when discussing the “Patmos” case, Maffei defined “ecological damage” as “a kind of damage devoid of an economic value but based upon a legal interest of the State in protecting the quality of the public domain *per se*.” Under this approach, many unowned natural resources and some owned ones having an ecological value that is not reflected in the market value of the property, but are included in the definition of ecological damage. Maria Clara Maffei, *The Compensation for Ecological Damage in the “Patmos” Case*, in INTERNATIONAL RESPONSIBILITY FOR ENVIRONMENTAL HARM 381 (Francesco Francioni & Tullio Scavazzi eds., 1991).

¹¹ See Hubert Bocken, *The Compensation of Natural Resources Damage in Belgium*, in HARM TO THE ENVIRONMENT: THE RIGHT TO COMPENSATION AND THE ASSESSMENT OF DAMAGES 150-52 (Peter Wetterstein, ed., 1996).

¹² See Frank B. Cross, *Natural Resource Damage Valuation*, 42 VAND. L. REV. 269, 281-85 (1989).

¹³ See *id.* at 281-82.

¹⁴ It is widely accepted that natural resources have both use and nonuse values. However, differences still exist in the concrete classification of the values. For example, Cross differentiates the values of natural resources damage into three types: use value, existence value, and intrinsic value. See *id.* The latter two types of values are identified as nonuse values by other scholars. For example, Dobbins and Kanner & Nagy differentiate the values of natural resources into two types: use value and nonuse value. According to Dobbins, use value includes the direct use of natural resources and option values. The option value does not involve the immediate use of a natural resource, but the possibility that the resource may be used someday. The option value incorporates the bequest value of a resource that is to preserve the resource for the use of future generations. As for the nonuse value, both existence value and intrinsic value are contained. Kanner & Nagy define use value to include both consumptive uses and non-consumptive uses. They further differentiate nonuse values (existence value) into option value, vicarious value, and intertemporal value. Jeffrey Dobbins, *The Pain and Suffering of Environmental Loss: Using Contingent Valuation to Estimate Nonuse Damages*, 43 DUKE L.J. 879, 898-908 (1994); Allan Kanner & Tibor Nagy, *Measuring Loss of Use Damages in Natural Resource Damage Actions*, 30 COLUM. J. ENVTL. L. 417, 421-24 (2005).

use value of natural resources that cannot be valued by the market.¹⁵ Compared to monetary damages, restoration provides a more effective approach, as it includes both the use value and non-use value of natural resources.¹⁶ In both the United States and Europe, restoration has been established as the primary approach to remedy natural resources damage.¹⁷ This paper uses the term "compensation" instead of restoration, because the former has a broader meaning. For example, in the time between the creation of the environmental damage and the completion of the restoration, the resource's functionality is diminished. The value of this lost function can be compensated monetarily.¹⁸ In other words, physical restoration is but one method of remedying natural resources damage, and hence only one part of compensation. However, in the context of natural resources damage, the term "compensation" includes "restoration," as well as other forms of compensation necessary to fully remedy the environmental harm.

Each compensation instrument has advantages and disadvantages. This article identifies various scenarios of compensation, as well as the different factors that make certain compensation instruments more effective than others in particular circumstances. In other words, indicators are provided to illustrate how these compensation instruments are more or less advantageous given different circumstances.

The article analyzes the various instruments available to compensate for natural resources damage. The authors provide a positive analysis by exploring both the theoretical and practical implications of mechanisms aimed at preventing and compensating natural resources damage. In addition to sketching these various compensation models as they appear in the literature and in various international legal systems, the authors also provide a critical normative evaluation of the advantages and disadvantages of various instruments currently in place to compensate for natural resources damage. In that respect, the authors use a law and

¹⁵ See Cross, *supra* note 12, at 289-91.

¹⁶ See Cross, *supra* note 12, at 298.

¹⁷ A rule was initially established by the U.S. Department of the Interior damage assessment regulations under CERCLA. Under this rule, natural resources damage is limited to the lesser of restoration costs or diminution of economic use values. The application of this rule was, however, rejected in the case *Ohio v. Dep't of Interior*, where the court found that restoration was intended to be the basic measure of recovery. *Ohio v. U.S. Dep't of Interior*, 880 F.2d 432, 450 (D.C. Cir. 1989). In Europe, operators are also required to take remedial action in case of environmental damage and to bear the costs of the actions. ELD, *supra* note 6, art. 6, 8.

¹⁸ For example, this value is compensated as "compensable value of the services lost to the public through the completion of the restoration" under the CERCLA assessment regulation, and as compensatory remediation under the ELD. 43 C.F.R. §11.83 (1986); ELD, *supra* note 6, annex II.

economics framework, specifically the approach provided in Guido Calabresi's well-known costs of accidents.¹⁹ Using this economic analysis, the authors propose a multi-layered approach to compensate natural resource damages, distinguishing between situations where a liable injurer can and cannot be identified.

This article initially explores the occurrence of continued natural resource damages, despite the many existing instruments aimed at preventing loss. Given this reality, the authors then explore optimal compensation mechanisms. Specific features of natural resources damage, which may influence the design of the compensation system, are then briefly discussed. Authors then develop optimal prevention and compensation models, which combine regulation, liability rules and compensation instrument. Three models are presented in this article, applying both mandatory or voluntary financial security systems. These three models illustrate that different kinds of compensation instruments are desirable given different circumstances. Each instrument responds differently to a given situation. Further this article explores indicators important in choosing compensation instruments. Finally, the article makes a comparison between these instruments and makes recommendations concerning the use of specific instruments. According to the indicators and characteristics of the specific instruments, the article finally makes suggestions for choosing instruments and building compensation systems under different scenarios.

II. PREVENTION OF NATURAL RESOURCES DAMAGE

Which instruments are primarily used to prevent natural resources damage? Regulation is an important instrument in addressing natural resources damage, but licenses and permits are also used to ensure that operators are qualified. Additionally environmental standards, such as emission standards, are essential to sustain environmental quality. Environmental taxes are designed to achieve optimal internalization of natural resources damage costs. Economic literature illustrates that in spite of their positive effect on compensation and corrective justice, the primary goal of liability rules is deterrence.²⁰ A substantial amount of literature compares regulation to liability rules, analyzing how both mechanisms work to minimize the social costs of accidents.²¹ Instead of arguing that one

¹⁹ See Guido Calabresi, *The Costs of Accidents: A Legal and Economic Analysis* (1970).

²⁰ Michael Faure & David Grimeaud, *Financial Assurance Issues of Environmental Liability*, in *DETERRENCE, INSURABILITY, AND COMPENSATION IN ENVIRONMENTAL LIABILITY- FUTURE DEVELOPMENT IN THE EUROPEAN UNION* 19-20 (Michael Faure ed., 2003).

²¹ See, e.g., Michelle J. White & Donald Wittman, *A Comparison of Taxes, Regulation and Liability Rules under Imperfect Information*, 12 J. LEGAL STUD. 413 (1983); Steven Shavell, *Liability for Harm Versus Regulation of Safety*, 13 J. LEGAL STUD. 357 (1984); Steven Shavell, *A Model of the Optimal Use of Liability and Safety Regulation*, 15 RAND J. ECON. 271 (1984); Pall Burrows,

instrument should be used exclusively, Steven Shavell proposed four indicators useful in determining the most effective instrument: the availability of information about risky between private parties and an administrative authority, the ability of private parties to compensate for harm caused, the availability of legal action, and the administrative costs incurred by private parties and by the public.²² When applying these indicators to natural resources damage, neither regulation nor liability rules are exclusively effective. For example, private parties may have better information about risk, the influence of their activities on the environment, and available loss reducing measures. Public regulatory schemes may be less effective than liability rules, depending on the regulation's scope, detail, and the availability of private information.²³ This is especially true of command and control instruments, such as environmental standards and environmental taxes.²⁴ Incentive based instruments are unaffected by availability of information, but carry significant implementation costs.²⁵ Compared to regulation, liability rules may have an information advantage, but are ineffective if the liable parties are insolvent. Realistically, because damages are often latent and parties are often indeterminate, the probability of natural resources damages suits is low.²⁶ Considering these aspects of regulation and liability rules, Shavell's model jointly utilizing both regulation and tort principles is promising given the difficulties in preventing natural resources damage.

Combining Regulation and Legal Liability for the Control of External Costs, 19 INT'L REV. L. & ECON. 227 (1999); Patrick W. Schmitz, On the Joint Use of Liability and Safety Regulation, 20 INT'L REV. L. & ECON. 371 (2000); Robert Innes, Enforcement Costs, Optimal Sanctions, and the Choice between Ex-post Liability and Ex-ante Regulation, 24 INT'L REV. L. & ECON. 29 (2004).

²² See Shavell, Liability for Harm versus Regulation of Safety, *supra* note 21, at 359-64.

²³ To ensure that regulatory instruments work efficiently, public authorities need to know *ex ante* to what extent potential victims may be hurt by a specific injury and how much it would cost a potential injurer to avoid the injury. In comparison, under the tort system, judges do not need to know this information beforehand. See Keith N. Hylton, *When Should We Prefer Tort Law to Environmental Regulation?*, 41 WASHBURN L.J. 515, 524-28 (2002).

²⁴ When large group of polluters are uniformly regulated, environmental standards may disincentivize some polluters from taking necessary precautions, while over-incentivizing others. "An efficient Pigouvian tax needs to be set at a level equalizing marginal damage caused by the pollution and marginal benefits resulting from its abatement." This is also difficult to satisfy. Peter Zweifel & Jean-Robert Tyran, *Environmental Impairment Liability as an Instrument of Environmental Policy*, 11 ECOLOGICAL ECON. 43, 51 (1994).

²⁵ Under incentive-based instruments, private parties have significant discretion regarding pollution abatement. This makes accurate quantitative assessments of performance by the government important. Assessment and monitoring are costly in many cases. Further, incentive-based instruments may also create high governance costs. Kenneth Richard, *Framing Environmental Policy Instrument Choice*, 10 DUKE ENVTL. L. & POL'Y F. 221, 256-67 (2000).

²⁶ Kenneth S. Abraham, *The Relation Between Civil Liability and Environmental Regulation: An Analytical Overview*, 41 WASHBURN L.J. 379, 380-82 (2002).

Legal scholars have extensively studied the role of liability and regulation. Natural resources damage includes not only damage to private natural resources but also damage to public natural resources. Public natural resources are not owned by any individual, which creates problems for compensating harm. Further, owners of private natural resources may only be incentivized to bring a suit for recovery of economic value. Both in the United States and in Europe, public authorities are granted standing in natural resources damage actions.²⁷ Public interest groups may also be authorized to act on a subsidiary basis, increasing the likelihood that suits for natural resources damage will be initiated. Such a policy was proposed in the White Paper on Environmental Liability, but not adopted in the final Directive.²⁸ Many international conventions have adopted liability channeling policies for pursuing bad actors, for example such policies have been adopted to address damages in the nuclear energy and oil production industries.²⁹ However, economic literature illustrates that such policies are inefficient. Channeling leads to under deterrence of third parties who may be equally responsible for damages by contribution to the activity's risk.³⁰

²⁷ Under both common law and federal legislations, public authorities have *locus standi* to bring suit for natural resources damage. Before the passage of CERCLA, claims for natural resources damage were brought under common law actions. The police power, public trust doctrine and the doctrine of *parens patriae* can be used to grant the state standings to sue. Note that actions under common law can still be utilized where statutes do not provide a remedy. Federal statutes largely address the inadequacies of the common law and secure full compensation for natural resources damage. Under both CERCLA and OPA, state government, the federal government, or government designees can claim natural resource damages. See Allan Kanner & Mary E. Ziegler, *Understanding and Protecting Natural Resources*, 17 DUKE ENVTL. L. & POL'Y F. 119 (2006); Kathleen Chandler Schmid, *The Depletion of the Superfund and Natural Resource Damages*, 16 N.Y.U. ENVTL. L.J. 483 (2008). Under the ELD, the competent authority designated by member states shall recover the costs of preventive or remedial actions taken from the liable parties. See ELD, *supra* note 6, art. 8.

²⁸ *Commission of the European Communities, White Paper on Environmental Liability*, at 22, COM (2000) 66 final (9 Feb. 2000) [hereinafter *White Paper*]. This approach is not accepted in the final directive. According to the ELD, only "the competent authority shall recover, . . . the cost it has incurred in relation to the preventive or remedial actions taken under the Directive." Natural or legal persons are only entitled to submit to the competent authority relevant observations and request the competent authority to take action. They cannot personally claim environmental damage. ELD, *supra* note 6, art 8.2, 12.1, 14.2.

²⁹ The International Convention on Civil Liability for Oil Pollution Damage channels liability to the owner of a tanker at the time of an incident or the first of a series of occurrences. See International Convention on Civil Liability for Oil Pollution Damage of 1992, art. III, Misc 36 (1994), Cm 2657, RMC I.7.51, II.7.51 [hereinafter CLC 1992]. Under both the Paris Convention on Third Party Liability in the Field of Nuclear Energy and the Vienna Convention on Civil Liability for Nuclear Damage, the operator of a nuclear installation is exclusively liable for nuclear damage. See Paris Convention on Third Party Liability in the Field of Nuclear Energy as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982, art. III, date, 956 U.N.T.S. 251 [hereinafter Paris Convention 1982]; Vienna Convention as Amended by the Protocol of 12 September 1997 to Amend the Vienna Convention on Civil Liability for Nuclear Damage, art. II, date, 1063 U.N.T.S. 358 [hereinafter Vienna Convention 1997].

³⁰ See Michael Faure & Wang Hui, *Economic Analysis of Compensation for Oil Pollution Damage*, 37 J. MAR. L. & COM. 179, 187-89 (2006); Michael Faure & Tom Vanden Borre, *Compensating Nuclear Damage: A Comparative Economic Analysis of the U.S. and International Liability Schemes*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 219, 264-65 (2008); Evelyne Ameye, *Channeling of Nuclear Third Party Liability towards the Operator: Is It Sustainable in a Developing*

Economists deduce that where parties have equal access to information, both strict liability and negligence rules can lead to efficient care levels, but only strict liability can influence the injurers' activity level.³¹

In the context of natural resources damage, strict liability should apply to damage created by environmentally hazardous activities, while negligence rule should apply to others. Liability should not be retroactively applied, as holding a party liable for past damage cause does not incentivize prevention.³² Some scholars hold that retroactive liability even weakens incentives to take precautions.³³ Neither joint and several liability nor proportionate liability are effective when multiple tortfeasors collectively cause natural resources damage.³⁴ Caps on liability do not deter parties from causing natural resources damage. Limiting liability may result in only partial costs internalization and insufficiently incentivizes efficient levels of care under a strict liability regime.³⁵ While insurance can cure some of these inefficiencies, note that caps may also be put on the duty to seek the insurance coverage.³⁶

The combination of regulation and liability rules still cannot guarantee optimal prevention and compensation of natural resource damages. Both instruments focus on prevention, but ultimately neglect the greater goal of compensation. Additionally, problems such as insolvency of liable parties, asymmetry of information, and the low probability of natural resources damage suits result in inefficient levels of deterrence. Given these inefficiencies, additional compensation instruments are necessary to prevent and compensate damage.

Academics and scholars have examined compensation instruments,³⁷ and compensation regimes have been implemented in various jurisdictions. For

Nuclear World or is there a Need for Liability of Nuclear Architects and Engineers?, 19 EUR. ENERGY & ENVTL. L. REV. 33 (2010). Some scholars do not oppose the channeling of liability itself but the combination of channeling and caps on liability. See Michael Trebilcock & Ralph A. Winter, The Economics of Nuclear Accident Law, 17 INT'L REV. L. & ECON. 215, 216 (1997).

³¹ Steven Shavell, *Strict Liability versus Negligence*, 9 J. LEGAL STUD. 1, 2-3 (1980).

³² Michael Faure, *Environmental Liability*, in TORT LAW AND ECONOMICS 247, 261-62 (Michael Faure ed., 2009).

³³ E.g., James Boyd & Howard Kunreuther, *Retroactive Liability or the Public Purse*, 11 J. REG. ECON. 79, 80 (1997).

³⁴ See Lewis A. Kornhauser & Richard L. Revesz, *Joint and Several Liability*, in TORT LAW AND ECONOMICS 130 (Michael Faure ed., 2009).

³⁵ See Richard A. Posner, *Economic Analysis of Law* 177-79 (6th ed. 2003); Steven Shavell, *Foundations of Economic Analysis of Law* 236 (2004).

³⁶ Faure & Grimeaud, *supra* note 20, at 200-02.

³⁷ James Boyd, *Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules Fulfilling their Promise?*, in AN INTRODUCTION TO THE LAW AND ECONOMICS OF ENVIRONMENTAL POLICY: ISSUES IN INSTITUTIONAL DESIGN 417, 417-85 (Timothy Swanson ed., 2002); Hubert Bocken, *Financial Guarantees in the Environmental Liability Directive: Next Time Better*, 15 EUR. ENERGY & ENVTL. L. REV. 13, 13-32 (2006); Hubert Bocken, *Alternative Financial Guarantees for Environmental Liability under the ELD*, 18 EUR. ENERGY & ENVTL. L. REV. 146, 146-70 (2009);

example, in the United States, compensation instruments are incorporated into statutes governing “financial responsibility.”³⁸ Similarly, ELD member states are required to encourage the development of financial security instruments.³⁹ This article examines several compensation instruments: liability insurance, first-party and direct insurance, risk-sharing agreements, environmental funds, other guarantees and the use of capital markets. Economic analysis illustrates how those instruments can reduce social costs.⁴⁰

III. THE CHARACTERISTICS OF COMPENSATION FOR NATURAL RESOURCES DAMAGE

The definition and characteristics of natural resources damage may influence the design of an optimal compensation system. Natural resources damage is defined in this article to include damage to both public and private natural resources, and includes any resource whose ecological value might exceed its economic value. Ecological value is difficult to quantify. Thus for natural resources that are more valuable ecologically than economically, the most effective remedy is restoration, not monetary compensation. Compensation instruments for natural resources damage are best structured so as to finance and promote restoration, rather than merely providing monetary compensation. Both the United States and European countries adopt this restoration-based approach. The original United States Department of the Interior assessment rules followed traditional common-law standards, defining damages as “the lesser of restoration or replacement costs or diminution of use value.”⁴¹ The “less of” rule was later overruled by *Ohio v. United States Department of the Interior*, which created a presumption that restoration costs are the proper measure of recovery in natural resources damage.⁴² The U.S. National Oceanic and Atmospheric Administration assessment rules supersede this judicial rule, further emphasizing restoration.⁴³ Under the ELD, operators are obligated to take

Michael Faure, *A Shift Toward Alternative Compensation Mechanisms for Environmental Damage?*, in SHIFT IN COMPENSATION FOR ENVIRONMENTAL DAMAGE 73, 73-102 (Michael Faure & Albert Verheij eds., 2007).

³⁸ E.g. 42 U.S.C. § 9608 (2012); 33 U.S.C. § 2716 (2012).

³⁹ ELD, *supra* note 6, art. 14.

⁴⁰ See CALABRESI, *supra* note 19, at 26-28 (defining “social costs”).

⁴¹ 43 C.F.R. § 11.35(b)(2) (1987).

⁴² *Ohio v. U.S. Dep’t of Interior*, 880 F.2d 432, 459 (D.C. Cir. 1989) (“Congress established a distinct preference for restoration cost[s] as the measure of recovery in natural resource damage cases”).

⁴³ 14 C.F.R. § 990.10 (2012); see Charles B. Anderson, *Damage to Natural Resources and the Costs of Restoration*, 72 TUL. L. REV. 417, 467 (1997).

remedial action and bear costs.⁴⁴ The ELD Annex further emphasizes that remediation of damage to water, protected species, and natural habitats “is achieved through the restoration of the environment to its baseline condition.”⁴⁵ Despite these similarities, there are important differences between American and European systems. The United States’ system differentiates between liability for cleanup costs and liability for restoring natural resources. For example, under CERCLA the Environmental Protection Agency (EPA) is responsible for response actions when there is a threatened release of hazardous materials, or when a threat of release imminently and substantially endangers the public health or welfare.⁴⁶ This rule concerns public health and the environment, but does not guarantee environmental restoration. Under CERCLA damage to natural resources may continue even after response action is taken. The ELD does not differentiate between clean up and restoration.⁴⁷ However, under the ELD a liable party is responsible for both immediate cleanup and full restoration.⁴⁸ This distinction warrants further attention in comparing compensation systems. For the purpose of this article, discussion of compensation models and instruments should be read as including both cleanup costs and restoration of natural resources.

Many different activities can result in natural resources damage. Much attention is paid to industrial pollution, but in reality other activities can also cause significant damage to natural resources. Under both CERCLA and OPA, a release or substantial threat of release triggers response action and liability.⁴⁹ The ELD regime differs in that contamination of land triggers restoration requirements, but both contamination and non-contamination events trigger restoration requirements for damage caused to protected species, natural habitats, and water.⁵⁰ This distinction illustrates the divergent policies concerning liability for clean up and damage. The U.S. system only regulates damage

⁴⁴ ELD, *supra* note 6, art. 6, 8.

⁴⁵ ELD, *supra* note 6, annex II.

⁴⁶ 42 U.S.C. § 9604(a)(1) (2012).

⁴⁷ Bio Intelligence Serv., European Commission DG ENV: Study on the Implementation Effectiveness of the Environmental Liability Directive (ELD) and Related Financial Security Issues 47 (2009), available at http://ec.europa.eu/environment/enveco/others/pdf/implementation_efficiency.pdf [hereinafter European Commission DG ENV].

⁴⁸ *Id.* at 48-49.

⁴⁹ See 42 U.S.C. § 9604, 9607; 33 U.S.C. § 2702.

⁵⁰ The ELD defines damage to protected species, natural habitats, and water according to the extent and scope of resources damage. The ELD identifies some activities (activities listed in Annex III) as triggers of environmental damage. These activities include non-pollution events, such as “water abstraction and impoundment of water subject to prior authorization in pursuance of Directive 2000/60/EC.” ELD *supra* note 6, art. 2, annex III.

caused by pollution, but neglects to regulate non-pollution. The ELD established the same remedial criteria for damage caused by pollution and non-pollution events.⁵¹ It is worth noting that the majority of existing compensation instruments cover only pollution events, and non-pollution events are still largely unregulated in this area.⁵²

The third characteristic of natural resources damage concerns emphasis on restoration. When natural resources damage or imminent threat of damage occurs, measures should be taken to prevent further damage, not simply to clean up and restore the area. Liable parties are usually the first to know that damage or the threat of damage exists. They can thus take immediate preventive and cleanup measures. However, liable parties do not necessarily have the expertise to effectively restore the natural resource, or may tend to externalize costs by taking insufficient restoration measures.⁵³ Public environmental protection authorities or the trustee of specific natural resources may have better information and expertise concerning certain natural resources and proper restoration. Therefore, it is a common practice for public authorities to intervene in environmental restoration.⁵⁴ For example, the ELD underwent a shift from a civil law to a public law compensation scheme in its final stages.⁵⁵ The earlier White Paper contained both a civil liability system and an administrative law system.⁵⁶ However, in the final Directive, only the administrative law system remained.⁵⁷ Under the ELD, necessary preventive and remedial measures

⁵¹ *Id.* annex III.

⁵² *Id.* There are several explanations for this, such as insurers' lack of experience concerning environmental insurance policies, and the lack of public awareness that the ELD covers non-pollution events.

⁵³ See James Boyd, *A Market-Based Analysis of Financial Insurance Issues Associated with US Natural Resource Damage Liability*, in DETERRENCE, INSURABILITY, AND COMPENSATION IN ENVIRONMENTAL LIABILITY: FUTURE DEVELOPMENTS IN THE EUROPEAN UNION 261 (Michael Faure ed., 2003).

⁵⁴ *Id.* at 266-67.

⁵⁵ During the years of preparation that went into creating the ELD, discussion was largely focused on a system of private law compensation. *Commission Proposal for a Directive on Toxic and Hazardous Waste*, 1976 O.J. C 194/2; Council Directive 84/631/EEC, 1984 O.J. (L326) 31 (EC); *Commission Proposal for a Council Directive on Civil Liability for Damage Caused by Waste*, at 4, COM (1989) 282 final (Oct. date, 1989). A civil law system with individual and collective compensation mechanisms was discussed under the first Commission proposal on environmental liability in the waste sector and the 1993 Green Paper on the restoration of environmental damage. *Commission Green Paper on Remedying Environmental Damage*, COM (1993) 47 final (14 May 1993).

The White Paper differentiated between damage to biodiversity and the contamination of sites and traditional damage. For traditional damage, a civil law scheme remains, but for damage to biodiversity and contaminated land, an administrative law system was introduced. In the final Directive, only the administrative system for environmental damage remained and traditional damage was excluded from the application. See Gerd Winter et al., *Weighing Up the EC Environmental Liability Directive*, 20 J. ENVTL. L. 163, 163-65 (2008).

⁵⁶ Winter, *supra* note 55, at 164-65.

⁵⁷ *Id.* at 163-64.

may be taken by the competent authority of the operator.⁵⁸ Similarly, under CERCLA the EPA is authorized to take response actions.⁵⁹ The EPA can also allow responsible parties to take specified procedural actions.⁶⁰ Natural resources trustees (federal or state trustees, and Indian tribes) are responsible for assessing any natural resources damage not recovered according to the response actions.⁶¹

The U.S. chose these administrative procedures as opposed to a pure civil liability regime. A mix of administrative and civil elements may influence the operation of compensation instruments, and requires cooperation between public authorities and the providers of compensation instruments. For example, many compensation instruments, such as liability insurance and risk-sharing agreements cover liability created by the policyholders.⁶² "Liability," however, is to a large extent determined by public administrative procedures. There may be divergences between the coverage conditions of those instruments and the "liability" determined under administrative decisions or in the courts. Thus it may be desirable to involve providers in some administrative procedures, for example in providing guidance on the assessment of natural resources damage. The cooperation between public authorities, liable parties, and providers of compensation instruments (such as insurers) is also beneficial to quantify natural resources damage and to implement restoration plans.

Another issue worth noting is that an environmentally harmful activity usually does not create natural resources damage alone. Natural resources damage is often accompanied by personal injuries and property damage. In these situations, the injurers face liability not only for natural resources damage, but also for relevant traditional damage. For example, CERCLA and OPA holds firms liable for natural resources damage, as well as for all response costs, personal injury and property damage, and lost government revenue.⁶³ Identified firms are required to provide financial responsibility for all these liabilities, instead of exclusively for natural resources damage.⁶⁴ Many compensation instruments are hence designed to comprehensively compensate for damages beyond natural resources damage. When a specific instrument is analyzed, attention needs to be paid

⁵⁸ ELD, *supra* note 6, art. 5, 6.

⁵⁹ 42 U.S.C. § 9604(a) (2012).

⁶⁰ *Id.*

⁶¹ 42 U.S.C. § 9607(f) (2012).

⁶² Boyd, *supra* note 53, at 279-80.

⁶³ *See id.* at 259.

⁶⁴ *See id.* at 281.

to its coverage: whether it covers only natural resources damage or also traditional damage.

IV. PROPOSED MODELS TO PREVENT AND COMPENSATE FOR NATURAL RESOURCES DAMAGE

A. Compensation, liability rules, and insolvency

The section will discuss models that provide efficient deterrent incentives to potential injurers, and promote compensation (restoration) of the damaged environment. Regulation, liability rules, and compensation instruments can be combined to achieve this goal.

1. Creating Damage At Various Stages

Before examining the respective roles of regulation, liability rules, and compensation instruments, we briefly discuss when and how natural resources damage occurs. An environmentally harmful activity can create environmental risks during its construction, operation, and even in the post closure phase. Regulation is the primary instrument used before the operation stage. Before the start of a new project, the operator may need to apply for a license. Considering the potential environmental impacts of the project, an environmental impact assessment may be required. Such regulation mainly aims to prevent the creation of pollution, as often the project developer is required to account for potential environmental impacts of their activity, and if necessary take preventive actions.⁶⁵ Even with such regulatory requirements, project construction may still create natural resources damage. Some regulations even go so far as to ask for compensation for such potential damage at the beginning of the project. One example is the Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive).⁶⁶ The Habitat Directive requires member states to take compensatory measures to ensure the environmental protection and overall coherence when a project is justified for overriding public interest but negatively impacts the environment.⁶⁷ The Commission published a non-binding guidance document on this issue.⁶⁸ According to this document, “compensatory

⁶⁵ See Council Directive 85/337/EEC, on the Assessment of the Effects of Certain Public and Private Projects on the Environment, preamble & art. 5, 1985 O.J. (L 175) 40, 42.

⁶⁶ Council Directive 92/43/EEC, of the Council of the European Communities of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, 1992 O.J. (L 206).

⁶⁷ *Id.* at 11.

⁶⁸ Commission Guidance Document on Article 6(4) of the ‘Habitats Directive’ 92/43/EEC: Clarification of the Concepts of Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission, (Jan. 2007), available at

measures” need to be independent of the project,⁶⁹ and the measures consist of restoration or enhancement in existing sites, habitat recreation, and proposing a new site under the Habitats and Birds Directive.⁷⁰ This explanation shows that the term “compensatory measures” has similar implication as remedial actions under the ELD.⁷¹ During the design and construction stages of an environmental harmful activity, the prevention and compensation of natural resources is mainly achieved through regulation, not liability rules.

After the construction of a facility or initiation of a project, natural resources damage may be created during operation. Regulation can also be used in this stage to ensure that operators/other relevant parties take care to prevent damage. Both command-and-control methods and market-based instruments can be used. Though these instruments can internalize costs and incentivize heightened care, information problems often prevent regulation from creating truly efficient deterrent incentives. Thus liability rules can complement regulation. Holding a party liable imposes on him a heightened obligation to restore the damaged environment. However, because operators may prove insolvent, these liability rules themselves cannot guarantee compensation. Further, it can be difficult to identify liable parties. These common problems make the development of compensation instruments increasingly desirable.

Firstly, when the liable party cannot be identified or other elements make establishing liability difficult, collective compensation mechanisms (such as environmental funds) can be used to finance restoration of the damaged environment.⁷² Secondly, potentially liable parties may employ various compensation instruments, such as liability insurance, risk-sharing agreements, and self-provided or third party provided guarantees.⁷³ During operation both government and potentially liable parties may take various measures to insure against liability and regulate activities to minimize risk of damage.

Some industrial facilities may continue to pose environmental risks even during and after the closure of such facilities. For example, after the useful life of a nuclear power plant expires, the remaining radioactive substances and the facility itself continues to pose substantial risk for human beings and for the environment. It is widely accepted that a

en.pdf. http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_

⁶⁹ *Id.* at 10.

⁷⁰ *Id.* at 14.

⁷¹ ELD, *supra* note 6, art. 2(11).

⁷² *See infra* Part V.A.

⁷³ *Id.*

decommissioning is required after the shutdown of the plant.⁷⁴ Even after the decommissioning stage, monitoring may still be required for a very long time. This is also the case for some hazardous chemical industry.⁷⁵ Proper closure and post-closure monitoring are important requirements for certain industrial activities. Additionally, a facility may still create natural resources damage after closure, and compensation instruments may be used to internalization costs. However, given the uncertainties brought by the long tail nature of the damage, the availability for corresponding compensation instruments is still low in practice.⁷⁶ Sometimes, to ensure the availability of financial assets to cover natural resources damage caused during the operation or after closure, potentially liable parties are required to provide financial security. Environmental costs related to liability are uncertain, and hence additional assurance is necessary. The requirements of closure and post-closure monitoring are more defined, but may also require financial assurance. A detailed discuss of the interaction between regulation, liability rules and compensation instruments in all the three stages of activities is beyond the scope of this article. This research focuses on compensation models for natural resources damage created during the operation of a plant.

⁷⁴ E.g., an E.U. commission recommendation was passed in 2006 to address the decommissioning of nuclear installations. According to this recommendation, all nuclear installations should be decommissioned after permanent shutdown, and the "polluter pays" principle should be applied throughout the decommissioning. See *Commission Recommendation of 24 October 2006 on the Management of Financial Resources for the Decommissioning of Nuclear Installations, Spent Fuel and Radioactive Waste*, § 3, 2006/851/Euratom, Oct. 24, 2006. In spite of the wide acceptance of the "polluter pays" principle in guidance materials, it is not fully implemented. Only European countries such as Finland, Sweden, require nuclear operators to finance decommissioning. *Comparison among Different Decommissioning Funds Methodologies for Nuclear Installations, Final Report*, at 12 (2007), available at http://www.wupperinst.org/uploads/tx_wiprojekt/EUDecommFunds_FinalReport.pdf. In the U.S., submission of a decommissioning plan or License Termination Plan is a condition of nuclear license termination. 10 C.F.R. § 20.1403 (2012).

⁷⁵ E.g., under the Resource Conservation and Recovery Act of 1976 operators of hazardous waste treatment, storage and disposal facilities are required to ensure proper closure and take post closure care. The standards for closure and post closure are codified. 40 C.F.R. § 264.110-.120, § 265.110-.121 (2012).

⁷⁶ E.g., a post-closure liability trust fund was established under CERCLA initially. When satisfying a few identified requirements, the operator of a closed hazardous waste disposal facility can transfer his liability to the fund. See 42 U.S.C. § 9606(b)(2) (2012). The fund was designed to consist of such amount as may be appropriated, credited, or transferred to it. See Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-510, §232, 94 Stat. 2767 (1980). Transfer of liability to the fund was later suspended, and according to a General Accounting Office report prepared in 1990, the suspension of the transfer of liability to the fund was due to the insufficiency of the fund. Since there were little instruments available to cover the post-closure liabilities by then, it is argued that a decision on post-closure liabilities should be made after more data and experiences were available. See U.S. GENERAL ACCOUNTING OFFICE, GAO/RCED-90-64, HAZARDOUS WASTE: FUNDING OF POSTCLOSURE LIABILITIES REMAINS UNCERTAIN (1990) available at <http://archive.gao.gov/d24t8/141474.pdf>.

2. *Mandatory financial security*

(a) *Theory*

Various scholars propose imposition of financial requirements on specific environmentally harmful enterprises. For example, Alberto Monti proposed an institutional model incorporating regulation, liability, funds and insurance in response to environmental harm.⁷⁷ According to his model, an enterprise wanting to enter or remain on the market must satisfy certain financial requirements.⁷⁸ Compliance with these requirements can be achieved by adoption of several financial products, including environmental insurance.⁷⁹ Mandatory financial security was also proposed by the Interuniversity Commission for the revision of environmental law in the Flemish region in 1995 (Draft Decree on Environmental Policy).⁸⁰ According to Part Nine of this Draft Decree, the permit-holder or holder of a notification certificate of the classified installations and activities designated by Flemish government is bound to provide financial guarantees where liable for damage to or impairment of the environment.⁸¹ Under this policy there is no general duty of financial security on all the classified installations.⁸² Instead, the government or the administrative authorities determine the requirement type and amount of financial security.⁸³ A variety of compensation instruments can be used to satisfy the financial security requirement, including: an insurance policy, a guarantee provided by a financial institution, any other form of personal or collateral security and a deposit. Introduction of a mandatory financial responsibility system is widely favored by many scholars.⁸⁴ Literature shows that financial

⁷⁷ Alberto Monti, *Environmental Risk: A Comparative Law and Economics Approach to Liability and Insurance*, 9 EUR. REV. PRIVATE L. 51 (2001).

⁷⁸ See *id.*

⁷⁹ See *id.*

⁸⁰ H. Bocken et al., *The Flemish Draft Decree on Environmental Policy: An Outline*, in THE CODIFICATION OF ENVIRONMENTAL LAW: PROCEEDINGS OF THE INTERNATIONAL CONFERENCE 31-32 (H. Bocken & D. Ryckbost eds., 1996); Faure & Grimeaud, *supra* note 20, at 226.

⁸¹ *Id.*

⁸² *Id.*

⁸³ *Id.*

⁸⁴ Many other scholars are also in favor of a system with financial responsibility, though they may differ in the concrete design of regimes. E.g., Kehne mentioned the advantages of a financial responsibility system with respect to both deterrence and compensation. He also identified the conflicts between these goals and tried to come up with a system (mainly insurance policies) that can balance those goals. See Jeffrey Kehne, *Encouraging Safety Through Insurance-Based Incentives: Financial Responsibility for Hazardous Waste*, 96 YALE L.J. 403 (1986). Feess and Hege favored a financial responsibility system consisting of both insurance and lender guarantees rather than pure strict liability and extending liability. See Eberhard Feess & Ulrich Hege, *Environmental Harm and Financial Responsibility*, 25 GENEVA PAPERS ON RISK & INS. 220 (2000); Boyer and Porrini focused on proposing a model with efficient interactions and liability sharing between governments, firms and insurance

responsibility plays an integral role in promoting deterrence and compensation, and saving administrative costs.⁸⁵

A financial responsibility system can strengthen the deterrent effects of liability rules and supplement regulatory standards.⁸⁶ It is well established that insolvency risks results in inefficient deterrence under strict liability regimes.⁸⁷ Environmental accidents are often followed by a high magnitude of claims from victims and expensive restoration, greatly reducing a firm's wealth. Given this reality, firms must demonstrate the availability of assets to cover potential liability to alleviate insolvency risks.⁸⁸ Law and economic literature supports the use of other instruments, especially extended liability, to resolve insolvency problems.⁸⁹ Extended liability holds third parties contractually connected with the directly liable party liable.⁹⁰ Other literature proposes that managers should additionally be held liable where corporations are undercapitalized.⁹¹ Further, literature also suggests that a firm's lenders should be held liability for natural resources damage.⁹² While extending liability reduces insolvency risks, some scholars argue that financial responsibility is preferable to extended liability since the latter does not guarantee costs internalization and can distort production decisions.⁹³ A detailed analysis of and a comparison between extended liability and financial responsibility is beyond the scope of this article. This research focuses on whether financial responsibility is

companies. See Marcel Boyer & Donatella Porrini, *The Efficient Liability Sharing Factor for Environmental Disasters: Lessons for Optimal Insurance Regulation*, 33 GENEVA PAPERS ON RISK & INS. 337 (2008). Kambia-Chopin analyzed financial responsibility from the perspective to solve the judgment-proof problem. Instead of the traditional insurance policies, he favored a particular form of contract which is close to an alternative risk transfer product. See Bidénam Kambia-Chopin, *Environmental Risks, the Judgment-Proof Problem and Financial Responsibility*, 30 EUR. J. L. & ECON. 77 (2010).

⁸⁵ *Id.*

⁸⁶ Kehne, *supra* note 84, at 403.

⁸⁷ See John Summers, *The Case of the Disappearing Defendant: An Economic Analysis*, 132 U. PA. L. REV. 145, 155 (1983); Steven Shavell, *The Judgment Proof Problem*, 6 INT'L. REV. L. & ECON. 45, 45 (1986).

⁸⁸ Kambia-Chopin, *supra* note 84, at 78.

⁸⁹ *Id.*

⁹⁰ Feess & Hege, *supra* note 84, at 220.

⁹¹ See Reinier H. Kraakman, *Corporate Liability Strategies and the Costs of Legal Controls*, 93 YALE L.J. 857, 872-77 (1984).

⁹² See Dieter Balkenborg, *Comment, How Liable Should a Lender Be? The Case of Judgment-Proof Firms and Environmental Risk*, 91 AM. ECON. REV. 731 (2001); Marcel Boyer & Jean-Jacques Laffont, *Environmental Risks and Bank Liability*, 41 EUR. ECON. REV. 1427 (1997); Georges Dionne & Sandrine Spaeter, *Environmental Risk and Extended Liability: The Case of Green Technologies*, 87 J. PUB. ECON. 1025 (2003); Emma Hutchison & Klaas Van't Veld, *Extended Liability for Environmental Accidents: What You See Is What You Get*, 49 J. ENVTL. ECON. & MGMT. 157 (2005); Rohan Pitchford, *How Liable Should a Lender Be? The Case of Judgment-Proof Firms and Environmental Risk*, 85 AM. ECON. REV. 1171 (1995).

⁹³ See Boyd, *supra* note 37, at 424-25; Feess & Hege, *supra* note 85, at 222.

necessary and how it should be arranged to promote the prevention and compensation of natural resources damage.

Another advantage of financial responsibility is that firms are then more likely to monitor activities, inducing efficient care. Financial responsibility establishes a principal-agent relationship between the assurance providers and the firm engaged in environmentally risky activities.⁹⁴ The principal is paid a fee, and in return bears the risk of liability for natural resources damage.⁹⁵ Under such an arrangement, the principal has strong incentives to monitor the environmental safety of the agents.⁹⁶ Through regulatory instruments, public authorities can also monitor and influence a firm's activity. However, financial responsibility also has added value. It both induces private party involvement and encourages firms to seek additional information about hazardous activities. Further, if the environmental risk is long-term there is an added incentive for intervention of insurers and other assurance providers. Assurance providers have more incentives to assess risks accurately to operate profitably, as compared to regulators who are more likely to be influenced by powerful political constituencies.⁹⁷

Financial responsibility can also promote timely, low-cost public access to compensation.⁹⁸ Alleviation of insolvency risks provides a certain level of guarantee for the availability of assets in case of damage. Assurance may also save administrative costs. Delay and great information requirements of rulemaking procedures are obstacles to the specificity and adaptability of regulatory standards. In a competitive market, assurance providers have strong incentives to control administrative costs and can amend the policy conditions more easily and cheaply.⁹⁹

(b) Practice

Financial responsibility is favored by scholars in academic literature, and has been practically adopted in many countries. U.S. statutes provide many illustrations. Under the Resource Conservation and Recovery Act (RCRA), the owners and operators of underground petroleum storage tanks are required to demonstrate their ability to restore a contaminated site and compensate for property damage or injury arising from a leaking

⁹⁴ Kehne, *supra* note 84, at 408.

⁹⁵ See Steven Shavell, Risk Sharing and Incentives in the Principal and Agent Relationship, 10 BELL J. ECON. 55, 55 (1979).

⁹⁶ Boyd, *supra* note 37, at 423.

⁹⁷ Kehne, *supra* note 84, at 410-11.

⁹⁸ See Boyd, *supra* note 37, at 423-24.

⁹⁹ Kehne, *supra* note 84, at 411-12.

tank.¹⁰⁰ OPA and CERCLA incorporate a financial assurance rule governing vessels carrying oil or hazardous substances.¹⁰¹ Financial responsibility provisions are pervasive throughout environmental law and regulation.

The financial capacity of the operators creating environmental risks should be taken into consideration. The financial capacities of insurers and other assurance providers are also material. When a financial requirement is imposed, ceilings should be set to ensure that the regulation is not unduly oppressive to operators. Financial liability caps are usually stipulated in legislation, based on some rough differentiation such as the type and size of operations.¹⁰² In some cases, ceilings can be determined on a case-by-case basis, considering the specific risks posed by an operation. In other words, the ceiling is decided according to specific procedural requirements and established estimation methodologies.¹⁰³ Case-by-case evaluation and established methodologies can better account for risk differentiation, promoting more efficient deterrence as compared to a limit on liability.

Theoretical advantages do not necessarily make mandatory financial security feasible in practice. Whether an enterprise will seek a certain level of financial security depends not only on their incentives and obligations to do so, but also on the capacity and willingness of the market to provide security.¹⁰⁴ Markets may be immature, providers inexperienced, or providers may consider environmental liability too unpredictable to cover. If markets are unwilling to provide security, it becomes meaningless to impose obligations on operators to seek the coverage. An interesting example is the German Environmental Liability Act of 1990, which obligated owners of environmentally risky operations to seek liability insurance or to comparable financial guarantees.¹⁰⁵ Note that this clause

¹⁰⁰ 40 C.F.R. § 280.93 (2012).

¹⁰¹ 33 U.S.C. § 2702 (2012); 42 U.S.C. § 9607(a) (2012). The financial assurance rule is implemented by 33 C.F.R. § 138 (2012).

¹⁰² For example, the OPA imposes different levels of limits of liability on responsible parties. The differentiation of these levels is based on the types and size of installations: the tank vessels, other vessels, offshore facilities and deepwater ports. The limitation of liability for tank vessels is further differentiated according to the size. 33 U.S.C. § 2704(a) (2012). In 2006, the limitation of vessels was increased and a third criterion was introduced to differentiate the risks created by tank vessels: the structure of tankers. Coast Guard and Maritime Transportation Act of 2006, Pub. L. No. 109-241, 120 Stat. 516 (2006). The use of double hull tankers is preferable to single hull tanker, and hence is less limited. However, the statutory differentiation is still rough and not tailored to specific conditions.

¹⁰³ An example of the latter is that some states in the US require hazardous waste treatment, storage, and disposal facilities to estimate the costs required to close the facility, based on which the financial requirement is determined. The estimate is based on a routinized methodology, which typically involves the use of standard software and worksheets associated with specific cost categories. Boyd, *supra* note 37, at 442-43.

¹⁰⁴ Faure, *supra* note 84, at 159.

¹⁰⁵ Umwelthaftungsgesetz [UmweltHG] [Environmental Liability Act], Dec. 10, 1990, BGBl. I at 2634 (Ger.), translated in FOREIGN L. TRANSLATIONS, http://www.utexas.edu/law/academics/centers/transnational/work_new/german/case.php?id=1396 (last visited Apr. 5, 2012).

was proposed and incorporated into the Act, but has not yet been implemented.¹⁰⁶

Another example is the financial security clause included in the ELD.¹⁰⁷ During the preparation of the Directive, a lot of attention was paid to the issue of financial security. The White Paper states, "availability of financial security, such as insurance, is therefore important to ensure that liability is environmentally effective."¹⁰⁸ Considering the lack of experience and immature nature of the market, the White Paper states, "the EC regime should not impose an obligation to have financial security, in order to allow the necessary flexibility."¹⁰⁹ This approach is followed in the Directive.¹¹⁰ The ELD itself does not introduce a mandatory financial security requirement, but rather requires member states to take measures toward use and development of financial security instruments.¹¹¹ The Directive requires the Commission to report on the effectiveness of the Directive and financial security issues, most recently published in October 2010.¹¹² This latest report found that member states have differing attitudes concerning the financial security systems incorporated into the ELD.¹¹³ Only a few countries have opted for mandatory financial security, but systems have not yet been implemented.¹¹⁴ The report finds it premature for the Commission to propose mandatory financial security on all European Union member states.¹¹⁵ In addition, it requires the option of mandatory financial security be re-examined before 2014.¹¹⁶

Compulsory insurance has various limits. These limits include risk of moral hazard, limited willingness of insurers to insure environmentally risky activities, and the limited willingness, availability and

¹⁰⁶ See Benjamin J. Richardson, *Mandating Environmental Liability Insurance*, 12 DUKE ENVTL. L. & POL'Y F. 293, 317 (2002); Marsh Ltd., *New Environmental Liabilities for EU Companies*, MARSH, INC. SERVICES (2009), available at <http://global.marsh.com/documents/NewEnvironmentallabilitiesforEUcompaniesv10.pdf>.

¹⁰⁷ ELD, *supra* note 6, art. 14.

¹⁰⁸ See White Paper, *supra* note 28, § 3.6.

¹⁰⁹ *Id.* § 4.9.

¹¹⁰ *Id.*

¹¹¹ ELD, *supra* note 6, art. 14.

¹¹² *Id.*

¹¹³ *Id.*

¹¹⁴ Report from the Commission to the Council, Under Article 14 (2) of Directive 2004/35/CE on the Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage, §4.1.1 (Oct. 12, 2010), available at http://ec.europa.eu/environment/legal/liability/pdf/com_2010_0581.pdf.

¹¹⁵ *Id.*

¹¹⁶ *Id.* § 4.2.

competitiveness of the insurance market itself.¹¹⁷ Compared to compulsory insurance, a system of compulsory financial security is more flexible because different instruments can be developed to cover the liability.¹¹⁸ However, the limits of compulsory insurance may also limit compulsory financial security in certain situations. For example, if the insurance market is uncompetitive and alternative liability-reducing instruments are unavailable, mandating financial security will be ineffective.¹¹⁹ If every operator is obliged to seek financial coverage, and if there is little competition among providers, quality of the financial securities will decrease and prices will increase given the scarcity. Alternatively, imposition of mandatory financial security in a mature and competitive market will lead to efficient outcomes. Where markets are not competitive, a voluntary financial security scheme is more desirable than a mandatory financial security scheme.

In addition to financial security covering liability and collective instruments covering residential natural resources damage, there are also instruments providing compensation irrespective of liability. Direct insurance and some environmental funds are such examples. Direct insurance is favored by site owners, as these policies can cover both damage on the insured site and the damage suffered by third parties resulting from that particular site. An accurate description of the insured risk is of great importance for this compensation instrument. Because restoration requirements are largely controlled by public authorities, and because coverage is defined in the insurance contract, the compatibility of direct insurance and administrative procedures deserves much attention. Another instrument that can provide coverage for natural resources damage, no matter whether liability is established or not, is an environmental fund. A variety of environmental funds exist, some based on liability and others irrespective of liability. Environmental funds should be used with caution, considering the disadvantages of funds as compared with insurance regarding difficulties in risk differentiation, controlling moral hazard, and reducing tertiary costs.¹²⁰

¹¹⁷ Faure, *supra* note 84, at 157-62.

¹¹⁸ *Id.*

¹¹⁹ Liability insurance is an oft-used instrument to help potential injurers to cover their liability. Other alternatives may be desirable in certain situations, but these often have limited application. For example, a risk sharing agreement is a useful instrument when operators have better information on risks than insurers and can effectively monitor each other. Captive insurance may suit some sectors such as the nuclear, where enterprises have sufficient capacity, but is not available for small chemical plants because of a lack of capacity. See 43 AM. JUR. 2D *Insurance* §716-718 (2003); BLACK'S LAW DICTIONARY 871, 873 (9th ed. 2009); Faure & Grimeaud, *supra* note 20, at 229-31.

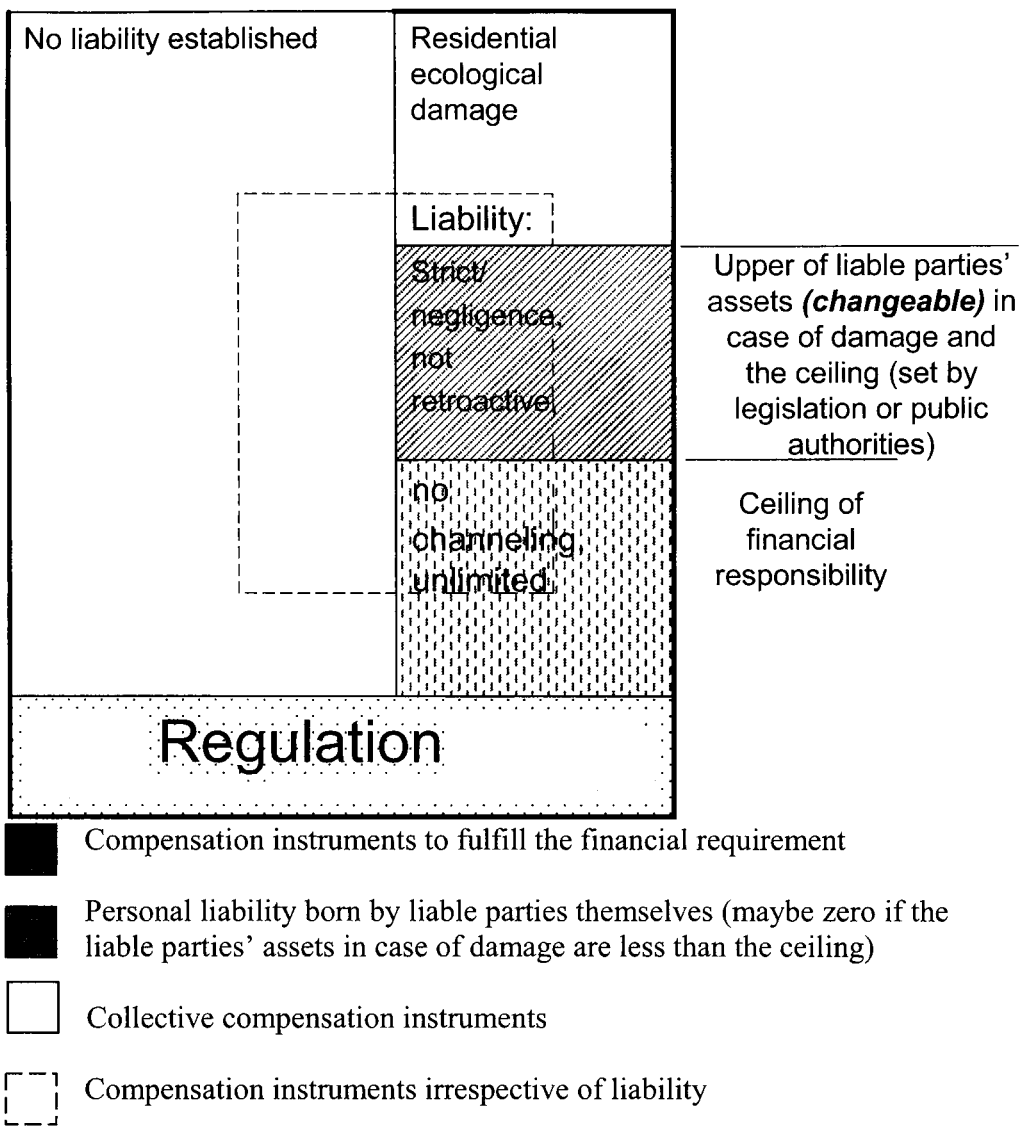
¹²⁰ Insurers are usually more specialized in risk differentiation and risk spreading. If the insurance markets are competitive, the insurers have incentives to control the problems of moral hazard and adverse selection better than funds. The government agency, as the administrator of a compensation fund does not usually have incentives to do so. Insurance policies are drafted to include a whole set of risks; competitive pressures can force the administrative structure to be cost-effective. Compensation

B. Models Of Compensation

This article presents three models of compensation, incorporating a combination of the above discussed compensation instruments. The models are distinguished based on whether financial security is mandated. These models illustrate that different strategies are necessary, based on whether or not the liable party can or cannot be identified. Additionally, different approaches are necessary dependent upon whether financial coverage can be required. These models were developed based on theoretical economic principles, but each of these models has been actually implemented in legal systems as discussed below.

fund does not have these features. See Michael Faure & Ton Hartlief, *Compensation Funds Versus Liability and Insurance for Remedying Environmental Damage*, 5 REV. EUR. COMMUNITY & INT'L ENVTL. L. 321 (1996).

1. Model I: Mandatory Financial Security



In a mature and competitive market, financial requirements should be imposed on specified parties before operations begin. A ceiling should be set for the financial requirement, as no market is able to provide unlimited coverage. It is imperative that the efficient amount of coverage be determined. James Boyd argues that optimal coverage should be just enough to internalize future liabilities.¹²¹ Coverage beyond this level ties up capital and is wasteful, while coverage below this level leads results in

¹²¹ See Boyd, *supra* note 37, at 441-42.

externalities and under-deterrence.¹²² He further clarifies this level to be the maximum of realistic environmental costs.¹²³ This theoretically sound requirement, however, is difficult to satisfy in practice. It is difficult to estimate environmental costs, as variables including the scope of damage, costs of restoration, climate change, hydrology, and geology are all uncertain. Given the uncertainty, financial requirements are often deemed insufficient natural resources damage compensation instruments. For example, in the U.S. under the Surface Coal Mining and Reclamation Act (SMCRA), first enacted in the 1970s, mining bonds are required to cover reclamation costs.¹²⁴ Despite improvements to bonding requirements over the years, bonds are not always sufficient to cover the full cost of reclamation.¹²⁵ Similar financial requirements also exist in the area of nuclear damage and oil pollution regulation.¹²⁶ Given difficulties in estimating potential environmental costs, this article does not identify the reasonable amount of financial responsibility. Instead, the article focuses on who can best determine financial responsibility ceilings, and how the ceiling should be determined.

Three approaches can be used to determine the ceiling of financial responsibility. The ceiling can be determined either on a case-by-case basis, via established estimation methodologies, or according to a relatively fixed

¹²² *Id.*

¹²³ *Id.*

¹²⁴ 30 U.S.C. § 1259 (2012).

¹²⁵ Boyd, *supra* note 37, at 445.

¹²⁶ E.g., the Price-Anderson Act (hereinafter PAA) determines the cap of the financial guarantee of the nuclear power plants. The limit has increased from \$ 560 million to \$ 12.2 billion since the enforcement of the PAA. This amount is also higher compared to the requirement in other jurisdictions. In spite of the uncertainty in estimating the potential damage caused by a nuclear accident, the caps in liability and the corresponding financial guarantees have long been criticized as a subsidy to the nuclear industry. See U.S. NUCLEAR REGULATORY COMM'N, NUREG-0957, THE PRICE-ANDERSON ACT- THE THIRD DECADE: REPORT TO CONGRESS (1983) available at <http://pbadupws.nrc.gov/docs/ML0727/ML072760026.pdf>; Dan M. Berkovitz, *Price-Anderson Act: Model Compensation Legislation? -The Sixty-Three Million Dollar Question*, 13 HARV. ENVTL. L. REV. 1 (1989); Jeffrey Dubin & Geoffrey Rothwell, *Subsidy to Nuclear Power through Price-Anderson Liability Limit*, 8 CONTEMP. POL. ISSUES 73 (1990); ENERGY INFO. ADMIN., FEDERAL ENERGY SUBSIDIES: DIRECT AND INDIRECT INTERVENTIONS IN ENERGY MARKETS (1992), available at <ftp://ftp.eia.doe.gov/service/emeu9202.pdf>. This is also true for financial requirements under OPA, which imposes limited liability and financial responsibility on tank vessels and offshore facilities. Until 2009, the financial requirement for tankers is the greater of \$3200 per gross ton or \$22 million. For offshore facilities the requirement is no more than \$150 million. However, the Deepwater Horizon explosion in April of 2010 largely dwarfed the prescribed liability limit and financial requirements. The released oil from the drilling platform is estimated at approximately 206 million gallons before its containment on July 15, 2010. Though there is no official estimation of total costs yet, it is reasonably regarded to be far more than the liability limit. To date the administration has sent eleven bills to responsible parties for the removal costs, totaling \$ 711.8 million dollars. See RESTORE THE GULF, <http://www.restorethegulf.gov> (last visited Apr. 5, 2012).

industry-wide “schedule.”¹²⁷ Under the first approach, the ceiling can be tailored to the specific risk an operation creates. Tailoring promotes better risk differentiation and cost internalization. However, individual determinations create high information and enforcement costs, and these costs may outweigh the benefits. Established methodologies can also be used to determine the ceiling. For example, in some U.S. states “hazardous waste treatment, storage and disposal facilities” are required to prepare an estimate of costs to close the facility on the basis of a routine methodology.¹²⁸ Standard software and “worksheets” associated with specific cost categories are utilized.¹²⁹ This approach allows for a variety of costs estimations, and saves administrative costs as compared to the case-by-case approach. The third approach is used most frequently. The financial responsibility for vessels carrying oil and hazardous substances are determined according to a fixed “schedule” under OPA and CERCLA.¹³⁰ For example, the OPA requires responsible parties for an indentified vessel to establish and maintain evidence of financial responsibility to meet the maximum amount of liability.¹³¹ This method ensures that the responsible party is solvent enough to compensate for any natural resources damages should damage occur. This third methodology is a sort of middle ground, as it is somewhat tailored to the specific activity, but only to an extent. The administration and enforcement costs are not as extreme as in the case-by-case method, but at the same time is more tailored than the second approach.

Additionally, three approaches may be used in determining who has the right to set the ceiling. The ceiling can be stipulated to by statutes, the government can be authorized to decide the ceiling for specified operators on a case-by-case basis, or a third possibility is to allow operators to estimate their own costs and set a ceiling accordingly, then seeking government or third-party approval.

The financial responsibility regime established under CERCLA illustrates this first category. CERCLA imposes financial responsibility on the owner or operator of vessels over three hundred gross tons using any port in the United States, navigable waters, or any offshore facility.¹³² CERCLA sets a ceiling of either \$300 per gross ton or \$5,000,000, whichever amount is greater.¹³³ By statutorily prescribing a financial

¹²⁷ Boyd, *supra* note 37, at 442-43.

¹²⁸ *Id.*

¹²⁹ *Id.* at 443.

¹³⁰ 33 U.S.C. § 2704(a) (2012). Under CERCLA, the owners or operators of all vessels over three hundred gross tons are required to provide evidence of financial responsibility with the same criteria; the greater of \$ 300 per gross ton or \$ 5 million per vessel. 42 U.S.C. § 9608(a) (2012).

¹³¹ 33 U.S.C. § 2704(a) (2012).

¹³² 42 U.S.C. § 9608(a) (2012).

¹³³ 42 U.S.C. § 9607(c) (2012).

requirement ceiling risks become more predictable for both operators and for the financial market as a whole. This approach results in fewer administrative costs, as ceilings are set according to a fixed schedule, not on a case-by-case basis. However, statutorily established ceilings suffer from the same disadvantages as limited liability. The financial requirements for operators are not tailored to individual characteristics and needs, and because financial requirements are based on general factors inefficiencies may result.

The second solution is to authorize government to set financial security that is somewhat tailored to a party based on information provided by that party. Under such a scheme, the statute classifies certain activities for which the actors must provide financial security. It is then up to the government to decide which specific parties and to what extent proof of financial security is necessary. This scheme is advantageous in that government can tailor the ceiling for each party to satisfy specific conditions, including the type and size of installations, locations, potential risks, and preventive measures. However the advantage is only realized where government is capable of differentiating parties where accurate information is available. Further, ceilings may be inefficiently set where lobbying groups influence government decision-making. This is especially true for developing countries that lack reliable administrations, but is also a challenge for developed countries.¹³⁴ The limited governance capacities, corruption and external influences are several usual problems perplexing developing countries.¹³⁵ The standard-based model provides additional discretionary powers to the environmental regulatory authority, but discretion without a solid and reliable administrative structure is risky, and abuses more prevalent. On the contrary, a rule-based system concentrates more power at the legislative or executive level, limiting the power of civil servants (who often have greater expertise) to execute precise rules.¹³⁶ In a country with an unreliable administrative structure it is advisable to set minimal statutory financial requirements. However, it may be beneficial to allow for some flexibility by allowing governments to ask for greater financial security when appropriate for a specific party. Under such a regime, minimal financial coverage is guaranteed and at the same time flexible enough to set more efficient standards when necessary. This is advantageous for developing countries, but is an effective regime for setting financial ceilings in developed countries. With a combination of legislative

¹³⁴ Michael Faure, Morag Goodwin & Franziska Weber, *Bucking the Kuznets Curve: Designing Effective Environmental Regulation in Developing Countries*, 51 VA. J. INT'L L. 95, 108-23 (2010).

¹³⁵ *Id.*

¹³⁶ *Id.* at 110-11.

and administrative determination, greater costs saving and risk differentiation can be achieved. One example is the setting of financial responsibility for offshore facilities under OPA.¹³⁷ Generally speaking, the amount of financial responsibility required from offshore facilities is \$35 million for a facility located seaward and \$10 million for a facility located landward.¹³⁸ However, the legislation makes exceptions, allowing the President to determine amounts in excess of the required amount but no more than \$150 million if a higher amount is justifiable given the relative operational, environmental, human health, and other risks.¹³⁹

One illustration of the third category is the financial responsibility provisions included in RCRA.¹⁴⁰ RCRA requires owners and operators of a treatment, storage, and disposal facility (TSDF) to demonstrate two forms of financial responsibility: for the costs of closing the facilities and maintaining post-closure care, and for bodily injury and property damage to third parties.¹⁴¹ Financial responsibility for closure and post-closure care is determined by the estimates provided by owners and operators themselves, but third party damages are specified in regulations.¹⁴² Individual TSDFs may have better information about their own safety status, potential risks, and preventive measures. Thus theoretically the individual TSDF operators can more accurately estimate costs and establish efficient financial ceilings. Realistically, relying on self-estimates alone can easily lead to inadequate coverage levels, as owners and operators tend to minimize their costs of assurance. Hence information provided by operators suffers from moral hazard problems. This approach provides sufficient coverage levels only if public authorities conduct frequent, highly critical reviews of closed plans.¹⁴³ The U.S. EPA Region IV found that costs evaluated for closure and post-closure care are chronically underestimated.¹⁴⁴ To address this underestimation, EPA Region IV developed a manual establishing evaluation methods and software to guide owners and operators in costs estimation.¹⁴⁵ In a memorandum to RCRA Waste Management Division Directors, the importance of review of cost estimates and financial assurance instruments is emphasized.¹⁴⁶

¹³⁷ 33 U.S.C. § 2716 (2012).

¹³⁸ 33 U.S.C. § 2716(c)(1)(B) (2012).

¹³⁹ 33 U.S.C. § 2716(c)(1)(C) (2012).

¹⁴⁰ 42 U.S.C. §§ 6901-6992 (2012).

¹⁴¹ 40 C.F.R. §§ 264.142-.145, .147 (2011); 40 C.F.R. §§ 265.142-.145, .147. (2011).

¹⁴² *Id.*

¹⁴³ Kehne, *supra* note 84, at 417.

¹⁴⁴ U.S. ENVTL. PROT. AGENCY, RCRA FINANCIAL ASSURANCE FOR CLOSURE AND POST-CLOSURE 46 (2001), available at <http://www.epa.gov/oig/reports/2001/finalreport330.pdf>.

¹⁴⁵ *Id.* at 46-47.

¹⁴⁶ Memorandum from Matthew Hale, Director, Office of Solid Waste, U.S. Envtl. Prot. Agency, on Review of Financial Assurance Information When a RCRA Permit is Issued, Renewed, or Reviewed to RCRA Waste Management Division Directors (Jan. 30, 2007), available at

The traditional instrument used to establish financial responsibility is liability insurance. Law and economic literature provides that insurance is advantageous in that it flattens out risk.¹⁴⁷ The risk-averse operator can instead pay insurance premiums, thus the risk of a catastrophic event resulting in natural resources damages is shifted to the insurance company.¹⁴⁸ Where insurance policies are sold in a competitive market, they will be priced effectively.¹⁴⁹ However, this is only accurate if one assumes that insurers are capable of monitoring the insured party's activity, that accidents are unilateral, that there are no administrative costs, and that no errors or uncertainty exists as to legal outcomes.¹⁵⁰ This is rarely if ever the case. When these assumptions are relaxed, as realistically they must be, liability insurance alone is less attractive, and alternative instruments may be used to satisfy financial requirements. The operator can choose among the various alternative instruments discussed above, which include liability insurance, direct insurance, risk-sharing agreements, environmental funds, and self-provided or third party provided guarantees. These alternative instruments alleviate some of the problems related to insurability, and induce capital market involvement in the internalization of environmental costs.¹⁵¹ The use of various instruments allows greater flexibility and competition. Competition gives providers incentive to promote the efficiency of their products and to reduce loading costs.

Collective compensation instruments are effective when liability is unclear, or when the financial coverage sought is insufficient to cover the damage and the injurer is insolvent. When collective instruments are used, it is essential to make polluters finance instruments, thus creating additional deterrent incentives.

The above table illustrates that the threshold of collective compensation instruments in case of insolvency lies in the ceiling of the financial requirement or the assets of the liable party when damage occurs-whichever is larger. The ceiling may be specified in legislation or by the government. The only possibility an operator has to shift the burden of compensation through collective compensation instruments is to establish smaller companies and to use limited liability entities.

[http://yosemite.epa.gov/osw/rcra.nsf/0c994248c239947e85256d090071175f/2BD455873BAF7F6B852572A7006B8023/\\$file/14765.pdf](http://yosemite.epa.gov/osw/rcra.nsf/0c994248c239947e85256d090071175f/2BD455873BAF7F6B852572A7006B8023/$file/14765.pdf).

¹⁴⁷ See Steven Shavell, *On Liability and Insurance*, 13 BELL J. ECON. 120 (1982).

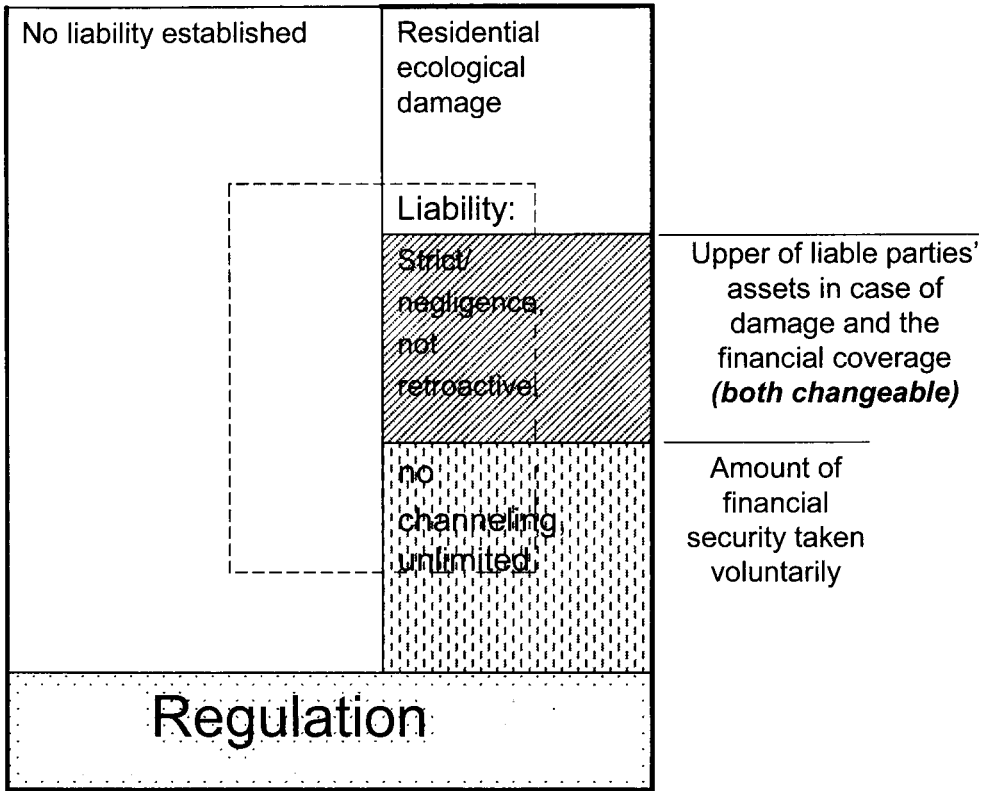
¹⁴⁸ *Id.*

¹⁴⁹ *Id.*

¹⁵⁰ *Id.* at 131.

¹⁵¹ Boyer & Porrini, *supra* note 84, at 344.

2. Model II: Voluntary Financial Security



■ Compensation instruments voluntarily taken by liable parties

■ Personal liability born by liable parties themselves (maybe zero if the liable parties' assets in case of damage are less than the amount of financial security taken voluntarily)

□ Collective compensation instruments

□ Compensation instruments irrespective of liability

Where the market providing financial products for natural resources damage is immature or uncompetitive, voluntary financial security promoting development of financial instruments with gradual introduction of mandatory financial security is a feasible approach. However, the problem with this voluntary approach is whether, or to what extent, operators are incentivized to seek financial coverage. Resorting to a compensation instrument can increase the utility of risk-averse operators.

When seeking insurance, for example, operators choose to make certain specified payments, instead of risking larger, uncertain liabilities. Thus the incentives for seeking financial coverage depends on the probability that the operator will be held liable, and on his personal attitude towards risk. If liability rules are efficiently set and if operators are always held liable for their natural resources damages, reasonable operators will seek insurance coverage up to the probable amount of damage, or up to the value of their assets, whichever is less. If operators are unlikely to be held liable for natural resources damages, they will have no incentives to seek an efficient level of financial coverage. Additionally, government may take measures to make financial coverage attractive to potential injurers. For example, favorable tax policy makes captive insurance more attractive. Norbert Pelzer argues that indentifying the obligation of members to pay a premium in a pooling system is desirable.¹⁵² In the Flemish Draft Decree on Environmental Policy (Draft Decree), an environmental guarantee account is proposed as one financial guarantee, by which potentially liable parties can make deposits to guarantee certain obligations.¹⁵³ According to the Draft Decree, deposits are tax deductible and interest is added to individual accounts.¹⁵⁴ These designs incentivize potentially liable parties to seek financial coverage.

Operators can shift the burden of compensation to collective instruments by seeking a lower coverage of financial security. Further, collective funds may also be used to dilute incentives for operators to seek individual financial security to cover liability.

Under a voluntary scheme, the government is no longer responsible for setting the ceiling of the financial requirement. Instead, the government's role is only to promote the predictability of environmental liability by improving monitoring, establishing databases, exchanging information, and making assessment guidance for natural resources damage. A predictable liability system is essential to financial security and insurability. The diffuse and indiscriminate expansion of substantive tort liability is widely regarded as an important contribution to the insurance liability crisis in middle 1980s in the U.S.¹⁵⁵ In Europe, although the ELD does not include a system of mandatory financial security, Commission reports consistently recognize that a clear legal framework is essential to

¹⁵² Norbert Pelzer, *International Pooling of Operators' Funds: An Option to Increase the Amount of Financial Security to Cover Nuclear Liability*, 79 NUCLEAR L. BULL. 37, 52 (2007).

¹⁵³ Bocken, *supra* note 80, at 31.

¹⁵⁴ *Id.*

¹⁵⁵ George L. Priest, *The Current Insurance Crisis and Modern Tort Law*, 96 YALE L.J. 1521, 1589 (1987).

promoting financial security.¹⁵⁶ Promotion of the financial market to cover natural resources damage is also a role for government. With the development of financial markets, mandatory financial requirement may be introduced gradually. This gradual approach can be applied to certain aspects of environmental damage, to types of dangerous activities, to certain industrial sectors, or by remediation type.¹⁵⁷ For example, the ELD does not introduce a compulsory scheme of financial security. Instead, it requires member states to take measures encouraging development of financial security instruments and markets.¹⁵⁸ Much discussion concerns whether or how a mandatory financial security scheme should be established in Europe. During the enactment of the ELD, it was proposed that the Directive introduce compulsory financial security first for environmental damage to water and land, or for operators of integrated pollution and prevention control (IPPC) operations.¹⁵⁹ Some member states, such as Spain, Bulgaria and the Czech Republic tried to introduce a compulsory financial security scheme for particular sectors.¹⁶⁰

¹⁵⁶ E.g., in a European Commission (DG ENV) 2009 report, it is stated that “insurability will be enhanced through the creation of clear and consistent guidelines that can be applied to all EU MS and all cases of environmental damage.” See EUROPEAN COMMISSION DG ENV, *supra* note 47, at 63. In a report prepared by the Ad-Hoc Industry, improving the predictability of liability risks under the ELD is identified as the best and most direct way to promote financial security. See *Survey of Industrial Companies: Insurance and Other Financial Security Instruments and Remediation of Environmental Damages under the EU Environmental Liability Directive*, AD HOC INDUSTRY (Feb. 2010), available at <http://www.endseurope.com/docs/100219b.pdf>; ELD, *supra* note 6, art. 14.

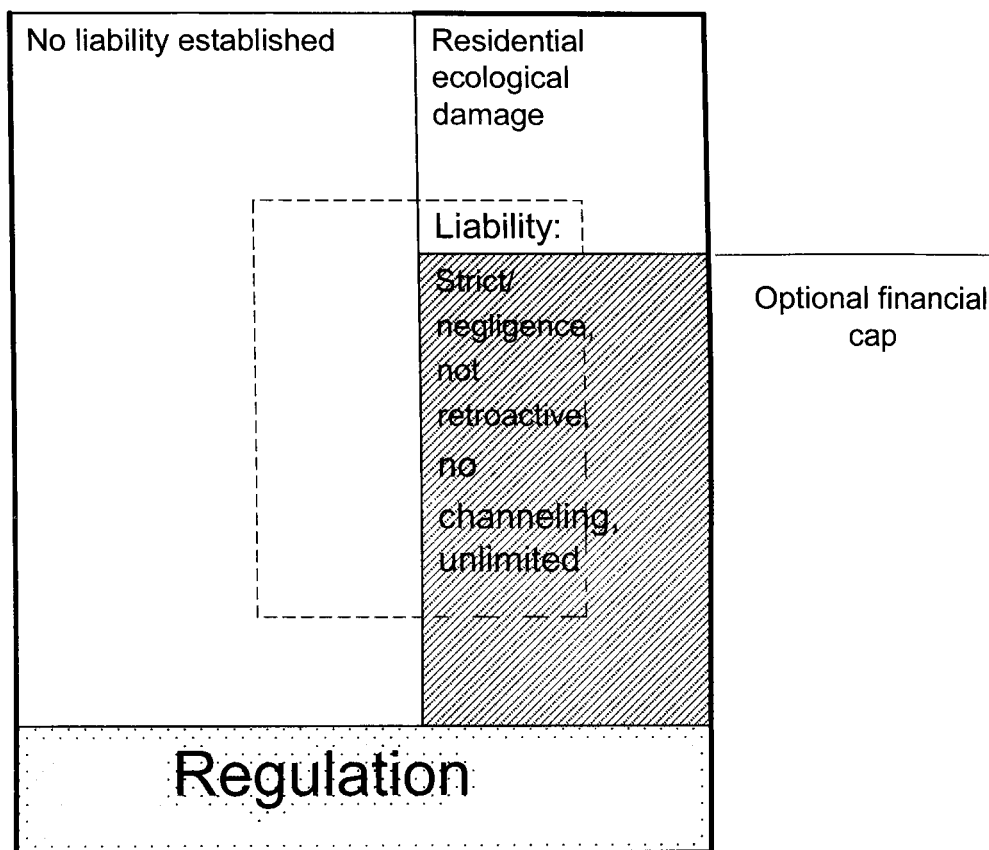
¹⁵⁷ EUROPEAN COMMISSION DG ENV, *supra* note 47, at 32-33.




¹⁵⁸ ELD, *supra* note 6, art. 14.

¹⁵⁹ European Commission DG ENV, *supra* note 47, at 32.

¹⁶⁰ *Id.* at 27.

3. Model III: Optional Financial Cap



-  Compensation instruments taken voluntarily and used to satisfy optional financial caps
-  Collective compensation instruments
-  Compensation instruments irrespective of liability

In addition to increasing the predictability of environmental liability and promoting markets to provide financial coverage, government may also introduce a system with optional caps for financial security. After all, the previous two systems may reduce an operator's duty to seek insurance coverage, but do not necessarily limit liability itself. A recommendation to this end was made in the Flemish Draft Decree on Environmental Policy.¹⁶¹

¹⁶¹ Bocken, *supra* note 80, at 29-32.

The Draft Decree adopts unlimited liability and imposes financial responsibility on the permit-holder or the holder of a notification certificate of classified installations.¹⁶² However, operators may limit liability for natural resources damage by proving a guarantee fund up to regulated amount.¹⁶³ Hence to enjoy the limitation of liability, operators must provide a guarantee fund, guaranteeing that injured parties will be compensated for natural resources damages above the amount for which operators are liable to pay. If operators can prove availability of a financial guarantee fund, their liability can be limited to a specified amount. Financial caps incentivize operators to establish sizeable “optional limitation funds,” providing greater certainty for risk-averse injurers. Individualized optional caps provide greater differentiation of risk as compared to generalized statutory caps, as they are tailored to the operator’s specific risks and possible natural resources damages.

The design of optional financial caps in the Draft Decree can shed some light on the model incorporating voluntary financial security.¹⁶⁴ In case of a lack of capacity and high concentration on the insurance and financial market, it is unfeasible to impose an obligation to seek a certain amount of financial coverage. However, in these cases government may impose an optional cap. By establishing guarantees up to the cap, the injurer limits his liability up to that specified amount. This approach gives injurers incentives to seek a financial coverage to a certain level in the undeveloped market. At the same time, since operators are not obliged to seek coverage, possible negative influences on market concentration under a mandatory scheme are avoided.

V. THE CHOICE OF COMPENSATION INSTRUMENTS

It has been advised in the above-presented models that a variety of compensation instruments should be developed and utilized to promote competition. However, this does not mean that each instrument is fit for all types operators and for all types of damage. Each instrument has its own specific strengths and weakness when analyzed in the context of a specific situation.¹⁶⁵ Thus, it is desirable to identify criteria for evaluating these instruments, and to identify which instruments best suit specific situations. To differentiate situations and identify criteria aids operators in choosing suitable instruments, and informs lawmakers and insurance providers in developing specific products and markets.

¹⁶² *Id.* at 31; Faure & Grimeaud, *supra* note 20, at 227.

¹⁶³ Bocken, *supra* note 80, at 31.

¹⁶⁴ Faure & Grimeaud, *supra* note 20, at 227.

¹⁶⁵ See generally AD HOC INDUSTRY, *supra* note 156.

A. Coverage of Compensation Instruments

Before identifying specific criteria, it is worthwhile to devote some attention to the coverage of instruments. It would be meaningless to compare compensation instruments having totally different coverage. Though this article focuses on compensation instruments for natural resources damage, natural resources damages are often accompanied by personal injury and property damage claims. According to the breadth of the coverage, compensation instruments can be classified into three categories: (1) stand-alone instruments, (2) instruments providing coverage for general environmental damage, and (3) instruments providing coverage for general liabilities.¹⁶⁶

A specific type of instrument can sometimes take on different forms. For example, insurance is a popular instrument used by operators to cover liability and costs caused by natural resources damage. The insurance can be a stand-alone policy, an environmental impairment policy, or a general third party liability (GTPL) policy. The stand-alone policies provide coverage only for specified natural resources damage.¹⁶⁷ Environmental impairment policies additionally compensate third parties for injury and property damage as a result of a pollution event.¹⁶⁸ The GTPL policies provide civil liability coverage, which may be extended to natural resources damage. In the early stage, environmental damage claims are made against insurers issuing GTPL policies.¹⁶⁹ However, over the years, it became impossible to succeed with pollution claims under these policies through the including of "absolute pollution exclusion clauses."¹⁷⁰ Uncertainties created by courts are considered one important reason of the unavailability of coverage for environmental risks. To insure against environmental risks and overcome the uncertainty created by the courts, environmental impairment policies and stand-alone policies began to develop in the mid 1980s.¹⁷¹ These new insurance products include not only liability insurance

¹⁶⁶ CEA, NAVIGATING THE ENVIRONMENTAL LIABILITY DIRECTIVE: A PRACTICAL GUIDE FOR INSURANCE UNDERWRITERS AND CLAIMS HANDLERS 17-29 (2009), *available at* http://www.cea.eu/uploads/Modules/Publications/1240585425_eld-best-practice-guide-update.pdf.

¹⁶⁷ See *id.*

¹⁶⁸ *Id.* at 13.

¹⁶⁹ B. Prozesky-Kuschke, *Insurance Against Damage Caused by Pollution*, 2000 J. S. AFR. L. 494, 499 (2000).

¹⁷⁰ *Id.*

¹⁷¹ Kim Hollaender & Michelle Ann Kaminsky, *The Past, Present, and Future of Environmental Insurance Including a Case Study of MTBE Litigation*, 1 ENVTL. FORENSICS 205, 206 (2000).

for operators, contractors, and consultants, but also first party insurance such as “cleanup cost cap coverage.”¹⁷²

The stand-alone policy has the advantage of allowing for a clear distinction between civil and public law-based insurance coverage, and can be adapted quickly and easily in response to emerging trends without hampering the established client relationship.¹⁷³ Further, the stand-alone approach promotes the development of innovative, specialist, and flexible solutions.¹⁷⁴ However, it may also result in duplication of claims when a traditional general policy exists, and increases administrative expenditures required to maintain specific policies on a separate basis.¹⁷⁵ Integrating natural resources damage coverage into existing insurance policies has advantages in saving development costs and administrative expenses. However, the lack of statistical details (for example, separate premium and tracking of claims) may hamper a proper risk assessment of claims developments.¹⁷⁶

A compensation instrument can be comprehensive or sector based. A policy can be developed to cover natural resources damage generally, no matter the type of operations conducted. For example, environmental impairment liability mentioned above can provide coverage for third party claims and cleanup costs for businesses, including chemical processing plants, heavy manufacturing plants, waste treatment, storage, and disposal facilities, hospitals, and utilities.¹⁷⁷ There are also many instruments designed specifically for a certain sector. For sectors where risk are unique and exceptional, sector-based instruments can more effectively differentiate risks and function more efficiently. For example, nuclear risk is a low frequency high magnitude risk, which creates a challenge for the individual insurers. Therefore it is usually excluded by general insurance policies, and instead is insured by nuclear insurance pools.¹⁷⁸ Another example is the risk sharing agreement, which is based on the similar level of risks and

¹⁷² See *id.*; William H. Howard, *New Issues in Environmental Risk Insurance*, 40 TORT TRIAL & INS. PRAC. L.J. 957, 959 (2004-2005).

¹⁷³ See CEA, *supra* note 166, at 17. As discussed above, many administrative elements are involved in the procedure of assessment of and compensation for natural resources damage. While the compensation for traditional damage is more civil law based, the elements of administrative law have also an influence on the insurance policy. Thus a stand-alone policy can better distinguish between civil law and public law instruments.

¹⁷⁴ *Id.*

¹⁷⁵ *Id.*

¹⁷⁶ *Id.* at 18.

¹⁷⁷ Hollaender & Kaminsky, *supra* note 171, at 206.

¹⁷⁸ Marcus Radetzki & Marian Radetzki, *Private Arrangements to Cover Large-scale Liabilities Caused by Nuclear and Other Industrial Catastrophes*, 25 GENEVA PAPERS ON RISK & INS. 180, 186 (2000).

capability of mutual monitoring among members.¹⁷⁹ Thus the risk sharing agreement is usually sector-based.¹⁸⁰

B. Criteria to Evaluate the Instruments

Liability insurance, first party and direct insurance, risk sharing agreement, environmental funds and other guarantees can all be used to compensate for natural resources damage. Those instruments have different potential in reducing Calabresi's social costs.¹⁸¹ Primary costs reduction focuses on how to prevent natural resources damage.¹⁸² Secondary costs reduction requires risk spreading or to shift the burden to the less risk averse parties.¹⁸³ This aim is similar to compensation, but is divergent in some aspects. Risk spreading and risk shifting have only a limited purpose in the context of natural resources damage. Many environmental elements are *res commune* or *res nullius*, or owned communally. Thus damage to publically owned resources is automatically maximally spread. Compensation instruments built on liability play only a limited role in risk spreading and risk shifting. However, these instruments are desirable since they limit risk spreading to parties who contribute to the risks. Different from secondary costs reduction, compensation instruments emphasizes restoration of the damaged environment, regardless of whether risk spreading is involved or not. Besides, tertiary costs should also be taken into account in evaluating the use of compensation instruments, since it is an essential factor in determining the actual availability of an instrument in the market.

As far as primary costs reduction (prevention) is concerned, several questions are relevant: Who finances the instruments? Are their contributions to the instruments risk-based? If instruments are not financed by those contributing to the risks, then recourse against contributors should be available to deter risky behaviors. Whether operators are liable in tort under the various instruments is also important. When designing specific compensation instruments, one should determine which parties could best access information, assess risk, and prevent risk- government, operators, or financial product providers?

¹⁷⁹ *Id.* at 187-88.

¹⁸⁰ E.g., in the U.S. the Price Anderson Act establishes a mutual pool by retrospective premiums for nuclear liability. A solidarity agreement in Germany also creates a similar system. Pelzer, *supra* note 153, at 42-45; Simon Carroll, *Perspective on the Pros and Cons of a Pooling-type Approach to Nuclear Third Party Liability*, 81 NUCLEAR L. BULL. 75, 88-93 (2008).

¹⁸¹ See CALABRESI, *supra* note 19,

¹⁸² *Id.*

¹⁸³ *Id.*

The following questions need to be answered in evaluating the role of compensation instruments in secondary costs reduction (compensation): Whether there is risk spreading in this instrument? When is the instrument established: before the damage happens or *ex post*? When is the compensation due? As soon as there is an imminent threat of damage so that prevention measures can be financed through the compensation instrument, after the occurrence of damage but before liability is established, or only after liability has been established? What is the capacity of the specific instrument to compensate for natural resources damage?

To evaluate the tertiary costs, one needs to consider the following factors: Do the providers of a certain instrument have incentives to control loading costs, and are they profit seeking? Whether a specific entity needs to be established to run a certain instrument? Whether the amount paid by operators to obtain coverage of one compensation instrument is recoverable if no damage happens?

C. Factors Influencing the Choice of Instruments

When deciding which instrument is more suitable in specific conditions, many factors need to be considered. Most importantly, it must be determined if liable parties are identifiable. When liable parties can be identified, liability rules can be used as an instrument to prevent and compensate for natural resources damage. Liability insurance is then the most popular instrument. If the potential injurer can transfer risk to insurers with a premium reflecting actuarial costs plus administrative costs, liability insurance can guarantee compensation without reducing the preventive incentives of potentially liable parties, making this solution most desirable.¹⁸⁴ When liable parties cannot be identified, alternative instruments must be used, such as direct insurance or environmental funds.

A related issue is the type of damage. For example, soil pollution often has localized influence, with identifiable liable parties. In these cases liability insurance can be a useful compensation instrument. Air pollution is of a more diffuse nature and identifying liable parties is more difficult. In that case environmental funds may be a more promising instrument than liability insurance.

Another factor is the nature of damage: is it general or catastrophic damage? A catastrophe means that there is damage with low frequency and high severity.¹⁸⁵ Self-insurance may be better suited for predictable risks, while risk sharing pools are able to cover less predictable risks as well since

¹⁸⁴ See Gerhard Wagner, *Tort Law and Liability Insurance*, in *TORT LAW AND ECONOMICS* 386 (Michael Faure ed., 2009).

¹⁸⁵ Véronique Bruggeman, *Compensating Catastrophe Victims: A Comparative Law and Economic Approach* 6 (2010).

the contribution can be paid *ex post*.¹⁸⁶ High severity imposes high requirements on the capacity. The use of the financial market is an instrument with high potential to increase the capacity of insurance or risk sharing agreements. Financial instruments have been developed to cover natural disasters, but have only limited use in the field of man-made disasters.¹⁸⁷

The size of enterprises creating environmental risks also plays a role in the choice of instruments. The guarantees provided by potential injurers themselves and bank guarantees are may be more readily available to larger enterprises than they are to small or medium enterprises (SME). An *ex ante* established instrument is desirable as it can provide a securable guarantee. Sometimes big companies may have the resources to provide *ex post* and ad hoc instruments to compensate for natural resources damage.¹⁸⁸ However, for SMEs with greater risk of insolvency, an *ex post* instrument is not reliable and may lack the assets to establish ad hoc compensation instruments.

The sector in which the potential injurers operate is also a factor to be considered. For example, in highly technical sectors, such as the nuclear industry, it is the operators that have the best information about risks created and how to control such risks. Thus cooperation between operators via a risk sharing agreement, for example, would be an effective compensation instrument. For more traditional sectors, where insurers have developed corresponding products based on statistical risk and claim experience, the expertise of insurers can make insurance a competitive choice.

¹⁸⁶ Göran Skogh, *A European Nuclear Accident Pool*, 33 GENEVA PAPERS ON RISK & INS. 274, 282 (2008).

¹⁸⁷ Using capital markets to cover catastrophe happens in practice. However, they are mainly linked to natural disasters. A strong link between capital market instruments and man-made accidents is still rare. According to a report by Swiss Re, among the risks securitized by the capital market from 1997 to July 2010, industrial accidents account for only one percent (\$405 million) of the covered risks. See MARIA WITTMAN ET AL., INSURANCE-LINKED SECURITIES MARKET UPDATE 7 (2010), available at <http://www.artemis.bm/articles/swissre%20update%20h12010.pdf>; Véronique Bruggeman, *Capital Market Instruments for Natural Catastrophe and Terrorism Risks: a Bright Future?*, 40 ENVTL. L. REP. 10136 (2010).

¹⁸⁸ The compensation trust fund established by BP after the Deepwater Horizon Oil Spill is an example of this. Instead of seeking insurance coverage from the market, BP has chosen to be self insured by its captive insurance company with coverage of \$ 700million. This amount is far from enough to cover all damage and costs that arise after the accident. Thus BP established a trust fund of \$ 20 billion to compensate for the removal costs, natural resources damages and individual victims. See Gloria Gonzales, *BP Oil Spill Damages to Stretch Insurance Coverage*, OIL PRICE.COM (Aug. 2, 2010), <http://oilprice.com/Environment/Oil-Spills/BP-Oil-Spill-Damages-to-Stretch-Insurance-Coverage.html>.

VI. COMPARING VARIOUS INDIVIDUAL INSTRUMENTS AND POLICY RECOMMENDATIONS

Different compensation instruments can be developed to compensate for natural resources damage, each having different influences on the reduction of social costs. This section tries to compare such instruments, considering the evaluation criteria mentioned in the section above. The first element to be compared is the scope of coverage. Then instruments are compared according to the three categories of social costs. From the perspective of primary costs, three factors are compared: the relationship with liability, the setting of contributions (who finances the instruments and how are the contributions allocated) and their ability to control moral hazard and adverse selection. Then the potential in reducing secondary costs of those instruments is compared, considering the time necessary to establish the compensation instruments, the time necessary to provide compensation, whether there is risk spreading, and capacity. The last issue to be compared is the tertiary costs created by each instrument. After those comparisons, policy recommendations are given for specific instruments.

A. Liability Insurance

Liability insurance is the most popular instrument used by potential injurers. The deterrent effect of liability insurance remains so long as the premium an insured pays corresponds with his actual risk.¹⁸⁹ Setting a risk-based premium for natural resources liability insurance is not an easy task, considering factual and legal uncertainties.¹⁹⁰ Insurers are experts in valuing uncertainties, managing risks, and in handling claims. Both feature rating and experience rating are used by insurers to set premiums.¹⁹¹ Liability insurance can create moral hazard and adverse selection problems, which can be controlled through deductibles, monitoring, and risk differentiation.¹⁹² However, even if risk-based premiums are used and moral hazard and adverse selection are controlled, efficient deterrence may still be unachievable because potential injurers are only incentivized to seek insurance coverage up to the amount of their own assets. In spite of this

¹⁸⁹ See Kenneth S. Abraham, *Environmental Liability and the Limits of Insurance*, 88 COLUM. L. REV. 942, 949-50 (1988).

¹⁹⁰ For example, uncertain causation, multiple potential injurers, and long time latency between the harmful activities and the manifestation of the damage are all factual uncertainties in establishing liability for natural resources damage. There are also legal uncertainties about liability for natural resources damage. For example, sometimes, judges use a deep pocket policy to favor the compensation, by interpreting the policy language to expand the scope of coverage. See *id.* at 960-69.

¹⁹¹ *Id.* at 949-50.

¹⁹² *Id.*

inefficiency, liability insurance is generally thought to encourage safety, as it alleviates insolvency problems and controls risks.¹⁹³ Additionally, empirical analysis supports the use of insurance. A recent study compared accidental underground fuel tank leaks in two states over a fourteen-year period.¹⁹⁴ The research shows that the shift from a state-level government assurance programs to private insurance markets reduced the frequency of underground fuel tank leaks by more than twenty percent.¹⁹⁵

Liability insurance is established before damage happens, and compensation is only awarded when liability is established. Thus the difficulties in finding liability will still prevent liability insurance from providing sufficient compensation. Under a liability insurance policy, risks are spread among potential injurers participating in the same pool. Reinsurance and capital markets can be used by insurers to increase capacity.

As far as tertiary costs are concerned, a competitive market will give insurers incentives to reduce loading costs and provide the products at reasonable costs.¹⁹⁶ Compulsory insurance is a frequently proposed alternative to overcome some drawbacks of voluntary liability insurance, as it can incentivize operators to seek insurance and reduces problems such as adverse selection and insolvency.¹⁹⁷ However, compulsory insurance is only efficient if it is provided to operators seeking liability insurance; if moral hazard is controlled; if risk-based premiums are used; and if a competitive market exists.¹⁹⁸ One example is nuclear insurance, where a monopoly exists and insurers are forced to pool together to attain sufficient coverage given the catastrophic nature of nuclear damage.¹⁹⁹ In France, Electricité de France (EDF) is the established nuclear production monopoly, and the EDF is required to provide financial security up its liability cap of € 91 million per accident.²⁰⁰ The EDF chooses to fund the first two-thirds through its own financial reserves, and funding for the last third comes from French insurance pool Assuratome, and a European mutual

¹⁹³ See Jeffrey Kehne, *supra* note 84, at 405-12.

¹⁹⁴ Haitao Yin et al., Risk-Based Pricing and Risk-Reducing Effort: Does the Private Insurance Market Reduce Environmental Accidents? 13-15 (Nat'l Bureau of Econ. Research, Working Paper No. 15100, 2009).

¹⁹⁵ *Id.* at 3.

¹⁹⁶ See CALABRESI, *supra* note 19, at 26-30.

¹⁹⁷ Wagner, *supra* note 184, at 397-98; Faure & Grimeaud, *supra* note 20, at 181-82.

¹⁹⁸ BRUGGEMAN, *supra* note 185, at 222.

¹⁹⁹ Michael Faure & Karine Fiore, The Civil Liability of European Nuclear Operators: Which Coverage for the New 2004 Protocols? Evidence from France, 8 INT'L ENVTL AGREEMENTS 227, 230-36 (2008).

²⁰⁰ *Id.* at 232.

association ELINI.²⁰¹ To cover the € 31 million, EDF pays a premium of € 6.4 million per year for all its reactors, which is argued in some literature to be 355 times higher than its actuarial premium.²⁰²

B. First Party Insurance and Direct Insurance

In addition to liability insurance, first-party insurance and direct insurance can also be used to cover natural resources damage. First-party insurance directly covers risk of damage to a particular victim or specific to a particular site, making it easier to identify circumstances influencing risk.²⁰³ Individuals can use first-party insurance to cover their personal injury or property damage. However, natural resources damage often concerns public natural resources, which are owned collectively by all. Public authorities often act as trustees of public resources, thus having standing to bring natural resources damages claims.²⁰⁴ Nonetheless, without individual victims first-party insurance is not as effective for compensating public natural resources as it is for compensating traditional damage. First-party insurance does effectively cover on-site damage and cleanup costs of the polluters themselves. For example, in the U.S. cleanup costs cap policies are available to cover the costs overruns when cleanup expenses exceed projected costs.²⁰⁵ Brownfield Restoration and Development Insurance can provide coverage for properties with known environmental problems on which there are planned remediation and planned development.²⁰⁶

Alternatively, under a direct insurance policy the potential injurer is covered for any damages suffered by third parties damaged on the insured party's particular site.²⁰⁷ Thus unlike the pure first-party insurance funded by innocent victims, in a direct insurance policy, it is the polluters that pay for damages. One example of environmental damage insurance is MSV, introduced in 1998 in the Netherlands.²⁰⁸ MSV provides integrated coverage of all environmental damage occurring on or from the insured site,

²⁰¹ *Id.*

²⁰² *Id.* at 236.

²⁰³ Michael Faure, *Environmental Damage Insurance in Theory and Practice*, in AN INTRODUCTION TO THE LAW AND ECONOMICS OF ENVIRONMENTAL POLICY: ISSUES IN INSTITUTIONAL DESIGN, 292-93 (Timothy Swanson ed., 2002).

²⁰⁴ See Boyd, *supra* note 54, at 266-67.

²⁰⁵ Ralph A. Demeo et al., *Insuring against Environmental Unknowns*, 23 J. LAND USE & ENVTL. L. 61, 82-83 (2007).

²⁰⁶ See Hollaender & Kaminsky, *supra* note 171, at 206.

²⁰⁷ Michael Faure, *Environmental Damage Insurance in Theory and Practice* 19 (2001), available at <http://www.cserge.ucl.ac.uk/Faure.pdf>.

²⁰⁸ *Id.* at 29-32.

provided it concerns pollution of the soil or water.²⁰⁹ The MSV policy is a combination of first-party insurance and direct insurance. It is first-party insurance in the sense that it is the potential polluters that are insured for the clean-up costs of their sites and the costs for the repair of damage.²¹⁰ The insured can also choose a policy to provide protection against the damage to third parties, which is direct insurance.²¹¹ Under the MSV policy, compensation is triggered when the contract condition is satisfied, as agreed to between the insured and the insurer.²¹² The advantage of direct insurance is that liability is undisputed. This may be desirable from the perspectives of both deterrence and compensation. On the one hand, the unpredictability of the tort system is removed; and on the other hand, compensation can be awarded before the liability is established. However, why would potential injurers seek coverage for damage suffered by other parties or the public, if they cannot be held liable? Questions arise as to whether the insurers are able to indentify the covered damage and execute an efficient risk differentiation. Another essential issue is the compatibility of insurance coverage with administrative procedures of damage assessment and restoration.

C. Risk-Sharing Agreement

Sometimes risks are unpredictable, so much so that the insurance market may be reluctant to provide coverage. In these circumstances a risk-sharing agreement is a useful alternative, because the establishment of an *ex ante* risk pool is no longer necessary. The highly technical and complicated risks some industrial activities favor use of risk-sharing policies. Such policies are especially useful in covering nuclear liability and liability for marine pollution by oil.²¹³ The problems of moral hazard and adverse selection can be effectively controlled through mutual monitoring.²¹⁴ Three approaches can be used to finance the risk pool: an *ex ante* payment, reserves, or an *ex ante* agreement to pay if damage happens.²¹⁵ The *ex ante* payment approach has security advantages, as the availability of funds, but may lead to immobilized assets.²¹⁶ The *ex ante* agreement needs to be

²⁰⁹ *Id.*

²¹⁰ *Id.*

²¹¹ *Id.*

²¹² *Id.*

²¹³ Michael Faure & Karine Fiore, *The Coverage of the Nuclear Risk in Europe: Which Alternative?*, 33 GENEVA PAPERS ON RISK & INS. 288, 301(2008); see also Faure, *supra* note 207, at 8.

²¹⁴ See Faure & Vanden Borre, *supra* note 30, at 274.

²¹⁵ Faure & Fiore, *supra* note 213, at 306-07.

²¹⁶ *Id.* at 306.

guaranteed by some financial instruments.²¹⁷ Monitoring is necessary for both reserves for *ex ante* agreements, to ensure the amount is still available in case of damage.²¹⁸ Implicit risk sharing is available for the nuclear risk under the Price Anderson Act, since the majority of compensation will be collected through retrospective premiums paid by nuclear operators collectively.²¹⁹ Risk sharing agreements have great cost saving potential, since these pools are not profit-seeking, and payment or reserves are not actually lost if no damage occurs.

D. Environmental Funds

There are many kinds of environmental funds, which can be used to compensate for natural resources damage when liable parties are unable to provide full compensation or can intervene when no liability is established. For example, the Oil Spill Liability Trust Fund (OSLTF) is established under the OPA.²²⁰ According to the OPA, the OSLTF shall be available for the costs for removal actions consistent with the National Contingency Plan and the natural resources damages.²²¹ The Public authorities taking removal actions can present claims directly to the fund.²²² Other claims must be made to liable parties first, and then presented to the OSLTF for uncompensated damages.²²³ The OSLTF also provides compensation for a responsible party entitled to a defense to liability or a limitation of liability.²²⁴ In these circumstances, a fund can both finance cleanup measures quickly and complement liable parties' compensation where insufficient. In other words, compensation funds have added value in comparison to other compensation instruments, because they can intervene when no liability arises, and provide an upper layer of compensation in addition to other instruments where insufficient. As timely response and restoration is essential for natural resources damage, and funds providing finances for cleanup and restoration measures before the liability is established is especially desirable.

In spite of the desirable roles played by funds, when instruments adequately cover liability there is no clear reason why funds should be preferred to liability insurance. Funds are disadvantageous as they poorly

²¹⁷ *Id.* 306-07.

²¹⁸ *Id.* at 307-08.

²¹⁹ See Faure & Vanden Borre, *supra* note 30, at 242-44.

²²⁰ *Oil Spill Liability Trust Fund*, EMERGENCY MGMT., U.S. ENVTL. PROTECTION AGENCY, <http://www.epa.gov/oswer/oe1/content/learning/oilfund.htm> (last updated Jan. 27, 2011).

²²¹ 33 U.S.C. § 2712(a) (2012).

²²² 33 U.S.C. § 2712(c), (d) (2012).

²²³ 33 U.S.C. § 2713(a), (b) (2012).

²²⁴ 33 U.S.C. § 2708 (2012); 33 U.S.C. § 2712(b) (2012).

differentiate risks and administrative costs are often high.²²⁵ To ensure that environmental funds function efficiently, clearly defined coverage and compensation procedures are necessary. Funds should be financed by potential injurers rather than via general revenues. General revenues funding shifts the burden from polluters to the general public, thus reducing prevention and deterrence incentives. Funding environmental funds by polluters is an important criterion for effective and efficient natural resources compensation. However there is an exception. If a fund covers only historical damage and is of a temporary nature, a shift in costs bearing is not necessarily inefficient. One example is the SUBAT foundation established in the Netherlands.²²⁶ The origin of the SUBAT foundation can be traced to a regulation of the Dutch Ministry of the Environment concerning "preventive measures to be followed by gas stations in order to prevent soil contamination."²²⁷ This regulation imposed severe requirements on licensees of gas stations, and made the termination of the activity costly.²²⁸ The SUBAT foundation was created to provide licensees with an opportunity to terminate activities without paying for historic soil contamination.²²⁹ The Foundation covers licensees who reported to it before August 1993 and promised not to start a new outlet on the same premises.²³⁰ The cleanups undertaken by SUBAT are financed through contributions from the oil companies, and these costs are then passed on to consumers.²³¹ In the other words, it is the consumers of the gasoline, rather the licensees of gas stations who pay for cleanup costs.²³² However, SUBAT is efficient, as the foundation is concerned only with historic damage and is temporary. SUBAT came into force in 1991 and the owners of gas stations had to apply before August 1993.²³³ Given these arrangements, SUBAT does not distort incentives in the long run, and successfully resulted in cleanup and termination of gas stations. This restoration would otherwise have been impossible.

²²⁵ See Faure & Hartlief, *supra* note 120, at 323-24.

²²⁶ Faure & Verheij, *supra* note 37, at 81.

²²⁷ *Id.*

²²⁸ *Id.*

²²⁹ *Id.*

²³⁰ *Id.* at 80.

²³¹ *Id.* at 81.

²³² Faure & Verheij, *supra* note 37, at 81.

²³³ *Id.* at 82.

E. Guarantees by the Polluters

Security mechanisms provided by the liable parties or a third party guarantor can also be used by (potentially) liable parties to cover their liabilities. This includes a variety of instruments including self-provided insurance instruments such as mortgages, liens, deposits, trusts funds and escrow agreement; as well as instruments provided by third parties, such as bank guarantees, sureties, and corporation guarantees. For example, in the U.S. many instruments can be used to achieve financial responsibility for hazardous waste storage facilities to ensure closure, post –closure care, and third-party liability. These include trust funds, surety bonds, letters of credit, insurance, financial tests and corporate guarantees.²³⁴ However, except for guarantees provided by a parent corporation, these instruments are usually only available for large companies. Small companies are typically unable to pass the financial tests necessary to prove deep pocket, are unable to provide sufficient unencumbered assets or cash assurance, or cannot seek a guarantee from financial institutions by showing good financial status and credit rating. Larger companies can more easily satisfy these requirements, but small and medium enterprises often cannot. Where possible, the capacity of small and medium enterprises to compensate damages can be assured when a parent company meeting financial standards agrees to satisfy coverage requirements.²³⁵ Some instruments have advantages in costs saving, such as self-insurance and captives. Other instruments, like bank guarantee or sureties, are not cheaply available. Additional governmental oversight is needed for these mechanisms. Regulation of reserves is essential for self-insurance and captives.²³⁶ The financial status of potentially responsible parties, and their parent corporations as guarantors, should be monitored. Guarantees provided by third parties also need to be irrevocable.

The table below gives an analytical overview of the potential of the above mentioned compensation instruments in reducing Calabresi's social costs, and makes policy recommendation accordingly.

²³⁴ 40 C.F.R. § 264.146-.147 (2006); 40 C.F.R. § 265.146-.147 (2006).

²³⁵ See Alternative Financial Guarantees for Environmental Liability under the ELD, *supra* note 37, at 160-62.

²³⁶ Michael Faure, Alternative Compensation Mechanisms as Remedies for Uninsurability of Liability, 29 GENEVA PAPERS ON RISK & INS. 455, 459 (2004).

Compensation Instrument	Comparison among Instruments				
	Coverage	Primary Costs			Secondary Costs
Liability Insurance		Relationship with liability	Setting Contributions	Controlling of Moral Hazard and Adverse Selection	Time of Establishment
	For both natural resources damage and related traditional damage; For both big companies and small/medium enterprises	Based on liability	Financed by potential injurers; Risk-based premiums; insurers are specialized in risk differentiation and have incentives to do so in a competitive market	Can be controlled by deductibles, monitoring and risk differentiation	Ex ante
First-party Insurance and Direct Insurance	For both natural resources damage and related traditional damage; direct insurance: natural resources damage and traditional damage	Irrespective of liability; Tort can still be used	First-party insurance is financed by potential victims for their individual damage or financed by polluters for onsite damage; Direct insurance is financed by potential injurers; Risk-based premiums; risk is more predictable since difficult road of liability is avoided in direct insurance	Can be controlled by deductibles, monitoring and risk differentiation	Ex ante
Risk Sharing Agreement	For natural resources damage and traditional damage	Can be used to cover liability; intervene in case of insolvency or cover losses suffered by injurers themselves	Financed by potential injurers; risk based contributions, better information for risk differentiation by operators	Mutual monitoring can lead to effective controlling	Ex ante
Environmental Funds	For natural resources damage and	Can be based on liability or	Can be financed by potential injurers or general	/	Ex ante

	traditional damage	irrespective of liability	taxes; Less ability and incentives of risk differentiation		
Guarantees Provided by Operators Themselves or Third Parties	For natural resources damage and traditional damage; available for large companies	Based on liability	Financed by potential injurers individually	/	Ex ante or ex post

Compensation Instrument	Comparison among Instruments				Policy Recommendation
	Secondary costs			Tertiary Costs	
	Time to Provide Compensation	Risk Spreading	Capacity		
Liability Insurance	When liability is established	Spread among potential injurers taking the insurance coverage	Depends on the size of the pool, incentives to seek insurance and whether the market is competitive	Profit seeking; competition creates incentives to reduce loading costs; not recoverable if no damage happens	1) can be used to cover both natural resources damage and traditional damage 2) adequate risk differentiation 3) control of moral hazard and adverse selection 4) reinsurance and capital market can be used to promote capacity 5) competition on the insurance market
First-party Insurance and Direct Insurance	When damage happens	Spread among potential victims in first-party insurance, and among potential injurers in direct insurance	Maybe limited considering the incentives to seek coverage	Profit seeking; competition creates incentives to reduce loading costs; not recoverable if no damage happens	1) first-party insurance can be used to cover traditional damage; direct insurance can be used to cover both natural resources damage and traditional damage 2) direct insurance can be used to preclude the unpredictability of liability 3) clear definition of insured risk and compatibility with administrative procedure in direct insurance 4) tort should still be allowed, but double

					compensation is prohibited 5) adequate risk differentiation 6) control of moral hazard and adverse selection
Risk Sharing Agreement	Depending on types of agreement: compensate when liability is established (used to cover liability); compensate when it is proved that the injurers are insolvent (used to provide coverage in case of insolvency); compensate when damage occurs (used to cover losses of injurers)	Spread among potential injurers	Depends on size of the pool; can be big since the payment for a catastrophe can be spread during years	Non-profit seeking; saving costs since ex-ante payment is no longer necessary; Recoverable if no damage happens	1) can be used to cover both natural resources damage and traditional damage; especially useful for highly technical sectors, or sectors that insurance market is reluctant to provide coverage 2) different methods of financing can be used, <i>ex ante</i> payment, reserve and <i>ex ante</i> agreement. Other financial guarantees should be used to guarantee the fulfilling of <i>ex ante</i> agreement. Monitoring is important for both reserve and <i>ex ante</i> agreement. 3) reinsurance and capital market can be used to promote capacity 4) risk-based contributions 5) whether competition is encouraged depends on specific situations
Environmental Funds	Depends on the specific kinds of funds; can provide compensation when damage happens or after liability fails	May be spread among potential injurers or general public	Theoretically big, but subject to political objections	Non-profit seeking, but public authorities usually have less incentives in reducing loading costs	1) can be used to cover both natural resources damage and traditional damage; preferably intervene when no liability arises or liable parties are insolvent; can be used to fund the restoration of public authorities before liability is found. 2) financed by potential injurers

					3) promote risk differentiation 4)clear compensation procedure
Guarantees Provided by Operators Themselves or Third Parties	When liability is established	No risk spreading	Depends on the financial status of the specific enterprises	Assets are not lost under guarantees provided by operators themselves, but are immobilized under reserves, mortgage, deposit; bank guarantees and sureties are usually expensive to obtain	1) can be used to cover both natural resources damage and traditional damage; useful for big companies rather than for small/medium enterprises 2) regulation of the ultimate goal of reserves when self-insurance or captives are used 3) monitoring of the financial status of potential injurers or their parent corporate as guarantors 4) guarantees provide by third parties are irrevocable

VII. TOWARDS A MULTILAYERED APPROACH TO COMPENSATE FOR NATURAL RESOURCES DAMAGE

A few indicators in choosing compensation instruments were given in Section V. Then Section VI compared five instruments according to their coverage and potential in reducing three kinds of social costs. According to the above analysis, this section tries to use indicators to design a compensation system for natural resources damage. The primary criteria in choosing instruments and establishing a compensation system is whether the liable party is identifiable. Taking into account this distinction, other indicators are also briefly examined.

A. When Liable Party Is Identifiable

When a liable party can be identified, tort law provides the polluter with incentive to prevent damage. As the law and economic literature proves, if the magnitude of damage can be accurately measured (under strict liability), or the due care level can be efficiently set (under negligence rules), a fully solvent party will have efficient incentives to prevent the

damage.²³⁷ However, the potentially magnitude of natural resources damage is great, and may push a potentially liable party into insolvency. Liability insurance is thus a useful compensation instrument: by providing an *ex ante* guarantee ensuring availability of assets in case of damage, liability insurance can both promote compensation for natural resources damage and alleviate preventive inefficiencies caused by insolvency.

Not only operators, but also financial institutions, public authorities, and insurers are experts in risk spreading and risk differentiation. By spreading risks among a group of members exposed to the same type of risks, the utility of risk averse parties can be increased and the capacity of compensation raised. By establishing premiums that correspond to an insured party's contribution to risks, the deterrent incentives created by liability rules remain in effect. Considering information asymmetry problems, liability insurance may also result in moral hazard and adverse selection issues. However, insurers are specialized in dealing with those problems: both experience rating and feature rating can be used to differentiate risks, and monitoring and limited coverage can be used to control moral hazard. These Insurers are better skilled than operators, financial institutions, and public authorities in contributing risk to injurers, thus providing better deterrent incentives. If the market is competitive, insurers are incentivized to reduce loading costs.

Despite insurers specialized skills in risk spreading and differentiation, liability insurance may not always create efficient incentives. Potentially liable parties are only incentivized to seek insurance up to the value of their assets owned, meaning that adverse selection may result, limiting the capacity of insurance.²³⁸ Thus compulsory insurance is an oft proposed remedy to these problems.²³⁹ However, as discussed above, compulsory insurance can aggravate problems of moral hazard and market concentration.²⁴⁰ Therefore, the introduction of compulsory insurance should be done with caution: it is only efficient if the scheme applies exclusively to those demanding liability insurance, if moral hazard is controlled, if risk-based premiums are used, and where competitive market exist.²⁴¹

²³⁷ Shavell, *supra* note 31, at 4.

²³⁸ See Faure, *supra* note 117, at 153-55.

²³⁹ For example, Wagner favored a private but mandatory insurance, rather than private voluntary insurance and public compensation schemes. See Gerhard Wagner, *(Un)insurability and the Choice between Market Insurance and Public Compensation Systems*, in *SHIFTS IN COMPENSATION BETWEEN PRIVATE AND PUBLIC SYSTEMS* 87, 87-112 (William Van Boom & Michael Faure eds., 2007).

²⁴⁰ Faure, *supra* note 117, at 157-61.

²⁴¹ BRUGGEMAN, *supra* note 185, at 222.

A preference for liability insurance where liable parties are identifiable does not mean that liability insurance is the only necessary compensation instrument. There are still some scenarios under which other instruments may play a role. Sometimes the insurance market is highly concentrated, thus insurers are either too reluctant to provide coverage or only provide policies at very high prices.²⁴² Under these conditions, the potentially liable parties must resort to other compensation instruments. Risk sharing agreement, captives, and guarantees provided by operators themselves or by third parties are often used alternatives.²⁴³

As mentioned above, the sector or industry to which a potentially liable party belongs to is also a factor influencing choice of instruments. For highly technical sectors in which operators have better access information concerning differentiation and control risks, such as the nuclear and oil transportation sectors, a risk sharing agreement is a useful alternative.²⁴⁴ For example, in the nuclear sector, if there is an equal or comparable level of nuclear safety and security, and equal or comparable economic conditions and legal framework, the pooling system can be efficient.²⁴⁵ A risk sharing agreement has also an advantage in dealing with less predictable risks, because an *ex ante* payment of the share is no longer necessary. It can also reduce costs in the sense that contributions can be paid *ex post*, or payment is recoverable if it is paid *ex ante*, and less damage happened during the policy time.²⁴⁶

Larger companies can also use captives or other guarantees if liability insurance is unavailable or too expensive. For example, nuclear companies can use captive companies to cover their first layer of liability.²⁴⁷ Captives are attractive to these companies because they adhere to minimum capital or surplus levels, actively managing the risk portfolio through diversification and cessions to the reinsurance market and favorable tax policies.²⁴⁸ A bank guarantee is also a possible alternative. Bank guarantees

²⁴² For example, the nuclear insurance market has been organized on a national and non-competitive basis, since the development of the civil nuclear industry. This has led to high nuclear insurance premiums. During the 17th and 18th centuries, English commercial vessels were repeatedly seized or destroyed by the enemy navies. Those catastrophic losses made private insurers unable or unwilling to underwrite to write such risks. The Protection and Indemnity Clubs have begun to develop to cover the risks created by marine transportation in response to the market needs since the mid-19th centuries. Norman J. Ronneberg, Jr., *An Introduction to the Protection & Indemnity Clubs and the Marine Insurance They Provide*, 3 U.S.F. MAR. L.J. 1, 3-4 (1991).

²⁴³ See *supra* Part V.A-B.

²⁴⁴ See Radetzki & Radetzki, *supra* note 178.

²⁴⁵ Pelzer, *supra* note 154, at 50-53.

²⁴⁶ Faure, *supra* note 236, at 471.

²⁴⁷ Faure & Grimeaud, *supra* note 20, at 215.

²⁴⁸ *Id.*

also have the disadvantage of being expensive, as banks are usually not specialized in risk spreading and are themselves risk averse.²⁴⁹

Even where liability insurance is available, its capacity is not unlimited. Considering the potentially catastrophic effects of natural resources damage, other instruments can provide an upper layer of compensation. The risk sharing agreement discussed above can act as an upper layer instruments.²⁵⁰ Environmental funds are frequently used instruments to intervene when others fail. In addition to providing an upper layer of compensation, environmental funds can also be used to finance the cleanup of natural resources damage when a threat is imminent, or when other financial resources are not immediately available.²⁵¹ It is worth noting that environmental funds should be organized in such a way that potential injurers, instead of the public at large, finance the fund.

B. When the Liable Party Is Not Identifiable

As far as natural resources damage is concerned, it is possible that the liable party cannot be identified, or causal links cannot be established. In these situations liability cannot be established, and consequently liability insurance is no longer a useful. The alternatives providing compensation irrespective of liability can then come into play, such as first-party and direct insurance, and environmental funds.

In the context of natural resources damage, first-party insurance has only a limited role to play.²⁵² Irrespective of personal injury and property damage, the victims of natural resources damage are the public, whose interests are minor and indirect. Collective action problems exist, thus disincentivizing operators to seek insurance coverage for natural resources damage to the fullest extent.²⁵³ In some jurisdictions, public authorities are given standing to sue for natural resources damage.²⁵⁴ First-party insurance can be used as an instrument to cover on-site remediation costs. In these circumstances, polluters themselves suffer damages and they can insure against the costs of remediation and restoration with their own resources.

²⁴⁹ See *supra* Part VI.E.

²⁵⁰ E.g., 10 C.F.R. § 140.11(a)(4) (2010) (explaining the requirement that nuclear power plants of a given capacity must seek insurance up to \$375 million, and in the event damage exceeds this amount, licensees will pool together to cover the second layer of compensation).

²⁵¹ See, e.g., 33 U.S.C. § 2712(a), (d) (2012) (granting State officials immediate access to funds if necessary for the immediate removal of an oil discharge, or the mitigation or prevention of a threat of discharge).

²⁵² Amanda Leiter, *Environmental Insurance: Does it Defy the Rules?*, 25 HARV. ENVTL. L. REV. 259, 313-14 (2001).

²⁵³ See *supra* Part VI.B.

²⁵⁴ *Id.*

Direct insurance is a more promising alternative, by which owners of potentially injurious sites seek insurance coverage benefitting third parties.²⁵⁵

Direct insurance is advantageous in that liability rules may then be avoided. However, a causal link between damage and an insured site must still be established. When the liable party cannot be identified, environmental funds may prove the superior compensation scheme. While insurers are more specialized in risk differentiation, environmental funds are often operated by public authorities who have little incentive to making sufficient risk differentiation and control tertiary costs. Ideally funds are financed by potential injurers, rather than by the public at large. The operators of funds need to be incentivized to differentiate risk and reduce administrative costs. If environmental funds are being financed by potential injurers, these instruments can also promote deterrence. Since liable parties cannot be identified, the environmental costs cannot be born by liable parties and thus are externalized. Environmental funds can still make otherwise externalized costs internalized by the injurers as a whole. Hence, an additional level of deterrence can be achieved.

VIII. CONCLUSION

Natural resources damage has gradually gained importance in liability law. Besides economic losses, natural resources damage also results in significant ecological, aesthetic, and cultural losses. These damages need not only to be prevented, but also to be restored and adequately compensated. This article tries to establish a compensation system providing optimal prevention and compensation of natural resources damage.

Regulation, liability rules, and compensation mechanisms can be combined to prevent and compensate for natural resources damage. This article presents three models utilizing various compensation instruments, based on availability of mandatory financial security. In all three models, regulation is the primary instruments used to prevent natural resources damage. However, effectiveness of these models is limited by availability of information and administrative costs. Regulation alone cannot create efficient preventive incentives. Thus liability rules are necessary to provide additional deterrent incentives. Natural resources damage can be catastrophic, and injurers may be insolvent. Hence compensation mechanisms can be used to guarantee or increase the capacity of injures to pay. Considering the difficulties in establishing liability rules, compensation mechanisms can also play a role when no liability is established.

²⁵⁵ See Faure & Grimeaud, *supra* note 20, at 217-24.

When the market providing financial coverage is competitive, a mandatory financial security scheme is desirable. Different compensation instruments can be used to fulfill the obligation of potential injurers to provide financial coverage. However, where the market is uncompetitive and there is reluctance to provide such coverage, a voluntary financial security scheme is more feasible. In these circumstances, government should take measures to promote the insurance market, and gradually introduce a mandatory scheme. Additionally, a scheme with an optional financial cap may also be useful, as it encourages potential injurers to seek additional financial coverage.

Different compensation instruments can be used to satisfy financial requirements. However, every instrument need not be applied to every situation. If the liable parties can be identified, traditional liability insurance is the preferable compensation instrument. Environmental funds can be used to provide an additional layer of compensation, financing the cleanup of natural resources damage *ex ante* when necessary. However, when the insurance market is uncompetitive, alternatives to liability insurance are more effective. For example, in highly technical sectors operators often have informational advantages, and can conduct effective mutual monitoring. In these situations a risk sharing agreement is favorable. Large companies can also use captives and bank guarantees.

If liable parties cannot be indentified, liability insurance is ineffective, and alternatives such as direct insurance and environmental funds should be introduced. When natural resources damage is attributable to an insured site, direct insurance is preferable to environmental funds. Where the natural resources damage cannot be attributed to an insured site, environmental funds are more effective instruments.

Further research may be necessary to analyze compensation instruments developed in recent years for natural catastrophes, which may be used as natural resources damage compensation instruments. Although natural catastrophes and natural resources damage are distinct there may be some parallels, specifically concerning identification of liable injurers. Models of government intervention in case of natural catastrophes (such as government providing insurance or acting as reinsurer of last resort)²⁵⁶ could also be usefully called upon to provide compensation for natural resources damage. These and other issues undoubtedly merit further research into this fascinating area of ecological losses.

²⁵⁶ See Véronique Bruggeman et al., *The Government as Reinsurer of Catastrophe Risks?*, 35 GENEVA PAPERS ON RISK & INS. 369 (2010).