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*Rescuing Comparative Law and Economics?*
*Exploring Successes and Failures of an Interdisciplinary Experiment*

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*Edited by Giuseppe Bellantuono*

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# COMPARING THE EFFICIENCY OF REMEDIES FOR ENVIRONMENTAL HARM: US V. EU

*Francesca Leucci*[1]

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*One central question in the economics of torts is: what is the optimal level of damages? This paper focuses on the issues of inaccuracy that may occur when dealing with environmental damage assessments. Given the nature of loss, the assessment of environmental harm raises several issues of inaccuracy that scholars largely investigated. Traditionally, they deal with the assessment of the extent of the injury, the causal links and the specific characteristics of the considered remedy. In the wake of this scholarship, the paper looks closer at the existing remedy of restoration in order to determine whether it is "*on average accurate*" and it draws on two case studies (US and EU) in order to test whether the law is in line with the economic theory.*

## I. THE ECONOMIC THEORY OF DAMAGES

In order to have optimal liability rules, damages awards should be efficient[2]. More specifically, damages (the magnitude of liability[3]) should be such that the parties would be correctly induced to minimize the total social costs of accidents (sum of the costs of care, the expected damage and the administrative costs involved in the application of the law)[4]. This economic goal needs to be kept in mind when determining the "adequate" amount of damages[5]. In other words, the goal in economics is not just to compensate the victim (return the victim to the *status quo ante*)[6], but to minimize the risk of accidents. So, one central question in the economics of torts is: what is the optimal level of damages?

A largely agreed conclusion is that there is no one optimal rule for all situations[7]. Indeed, the efficiency of damage awards necessarily relies on the specificities of the ruled situation.

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[2] J. Arlen, *Tort Damages*, in B. Bouckaert, G. de Geest (eds.), *Encyclopedia of Law and Economics* (Cheltenham: Elgar Publishing, 1999).

[3] S. Shavell, *Foundations of Economic Analysis of Law* (Cambridge, MA: Harvard University Press, 2004), 224.

[4] The central goal of tort law from an economic perspective is indeed to prevent accidents, so that accident costs are minimized. See G. Calabresi, *The Cost of Accidents: A Legal and Economic Analysis* (New Haven, CT: Yale University Press, 1970); S. Shavell, *Strict Liability Versus Negligence,* in 9(1) J. Leg. Stud. 1 (1980); Shavell, *supra* note 2; R. Posner, *Economic Analysis of Law* 14th ed. (New York, NY: Aspen, 2014).

[5] M.G. Faure, L.T. Visscher, *The Role of Experts in Assessing Damages - A Law and Economics Account*, in 3 Eur. J. Risk. Reg. 376 (2011).

[6] *Ibid.,* footnote 7 at 378.

[7] Arlen, *supra* note 2, at 682.

In view of that, Arlen identified five main criteria[8] to analyze these situations: 1) harm to replaceable versus irreplaceable goods; 2) unilateral versus bilateral risk; 3) strict liability versus negligence; 4) individual versus vicarious liability; 5) further issues: information costs, uncertainty, judgement-proof problems. For instance, current liability rules for replaceable losses are more likely to be optimal compared to liability for irreplaceable losses. Moreover, law and economics scholars agree that under a strict liability regime economic efficiency requires that the injurers pay for all the losses they caused[9]. In other words, full compensation of victims is merely a consequence of requiring injurers to pay the full cost of accidents. Therefore, as a general principle, damages should ensure "full" compensation not as a goal but as a means to achieve optimal prevention[10].

Another important principle highlighted by law and economics' scholars is that, when there are difficult-to-measure damages, the estimation should not grossly and systematically deviate from accidents' social costs. In fact, both systematic underestimation or overestimation may bring to too low care and too much activity, or to the opposite situation.

However, accuracy in the assessment involves administrative costs (or tertiary costs[11]) and it is important to set the level of damages so that the increase in tertiary costs is outweighed by the benefits (avoided expected loss). For instance, abstract assessments are arguably advantageous from an economic perspective since they allow to save costs, provided that they are a good approximation of the true magnitude of damage[12]. Moreover, since the injurer takes decisions on care and activity *ex ante* (based on the "expected" losses), more accuracy *ex post* will not necessarily result in optimal incentives. To say it better, (slightly) inaccurate assessments have to be considered efficient to the extent that losses are "on average" correct. Inaccuracy would instead bring to suboptimal incentives if specific and large components of the losses are systematically included or excluded from damage awards.

Nonpecuniary losses, such as personal injuries or environmental harms, are components of losses which are more difficult to assess and that can therefore sharpen issues of

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[8] *Ibid.*, at 682.

[9] M. Landes and R. Posner, *The Economic Structure of Tort Law* (Cambridge, MA: Harvard University Press, 1987), 987; A. Polinsky, *An Introduction to Law and Economics* (Boston, MA and Toronto: Little, Brown & Co, 1983), Posner, *supra* note 3; S. Rose-Ackerman, *The Simple Economics of Tort Law: An Organizing Framework*, in 2(1) Eur. J. Pol. Econ. 91 (1986). Calabresi differs from the later scholars since he requires accuracy in order to choose among remedies and identify a fair or just compensation of victims. Calabresi, *supra* note 4.

[10] Although full compensation in economics is required only for strict liability rules. See on this point R. Cooter, *Prices and Sanctions*, in 84(6) Col. L. Rev. 1523 (1984).

[11] G. Calabresi, *supra* note 4. Talking about transaction costs would instead be not exact since in accidental relationships there is no transaction occurring between injurers and victims.

[12] For legal examples of this efficient assessment of damages, see M. Faure, L. Visscher, *supra* note 5, at 379.

inaccuracy[13]. Apparently, many legal systems are inefficient because nonpecuniary damages are systematically underestimated, hence determining a reduced internalization of accidents' social costs[14]. For example, it has been demonstrated that personal injury damage should take into account expected life and salary expectancies[15]. Also, a good approximation of the value of life can be achieved by looking at decisions on health and safety[16]. However, even "limiting" damages to the real losses might turn out to be inefficient if the probability of detection is lower than 100%[17]. Considering that, scholars of law and economics show how following economic insights can help achieve more correct damage assessments in view of improving the deterrent effect of liability laws. Another aspect that has been emphasized in this scholarship is the contribution of experts to the judicial decision-making. Indeed, in case of difficult-to-value damages, experts can help achieve the economic goal of liability (minimizing social costs) by reducing information costs given their superior knowledge[18]. Experts might even help the judge to achieve more accurate and independent assessments. Therefore, as a general principle it would make economic sense to have experts for extremely difficult damage assessments.
Having reviewed the basic law and economic scholarship in the domain of damage calculation, this paper looks closer at the existing remedy of restoration for environmental damages in order to determine whether it is "on average" correct. The examination draws on two case studies (US and EU) to test whether the law is in line with the economic theory of remedies. The following paragraphs will thus illustrate the US law and practice on natural resource damage assessment and, then, the EU legal framework which largely relies on the US. Bearing the two case studies in mind, the last two paragraphs will compare existing remedies and conclude as to the efficiency of restoration from the perspective of law and economics.

[13] M.G. Faure, *Economic Analysis of Environmental Law: An Introduction*, in 1 Économie publique/Public economics [online] (2001).
[14] Law and economics scholars largely agree that accident law tends to compensate for the objective value of nonpecuniary losses, whereas subjective losses are neglected and they may lead to a serious underestimation of the harm if greater than objective losses.
[15] R. Lewis *et al.*, *Court Awards of Damages for Loss of Future Earnings: An Empirical Study and an Alternative Method of Calculation*, in 29(3) J. L. & Society 406 (2002).
[16] For references on the broad literature on the Value of Statistical Life, see M. G. Faure, L. T. Visscher, *supra* note 5, at 383.
[17] A.M. Polinsky, S. Shavell, *Punitive Damages: An Economic Analysis*, in 111(4) Harv. L. Rev. 869 (1998).
[18] This is due to the specialization of the expert and the advantage of the repeated player. See: M. Galanter, *Why the 'Haves' Come Out Ahead: Speculations on the Limits of Legal Change*, in 9 L. & Society Rev. 95 (1974).

## II. THE US LAW ON NRDA

Among the most interesting regional experiences on environmental damage assessment, the US is surely the first worth examining.

The legislative history of "natural resource damage assessment" (NRDA)[19] in the US dates back to the Trans-Adriatic Pipeline Authorization Act of 1973[20]. This act for the first time empowered public trustees to sue compensation for damage caused by oil spills. The so-called Superfund legislation (the *Comprehensive Environmental Response, Compensation and Liability Act,* CERCLA of 1980[21]) extended this possibility to the case of environmental damage caused by the release of hazardous substances (in addition to the discharge of oil). If public trustees follow the damage assessment procedures set forth by the law, they are granted a rebuttable presumption in litigation[22].

Before delving into damages, it is helpful to point out that in order to have an "injury" under this regime, the law requires a "*measurable adverse change, either long or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance, or exposure to a product of reactions resulting from the discharge of oil or release of a hazardous substance*"[23]. After the occurrence of an injury, trustees may recover damages, intended as the amount of money sought as compensation for the injury[24] and they can encompass:

1) damages calculated "*based on injuries occurring from the onset of the release through the recovery period, less any mitigation of those injuries by response actions taken or anticipated, plus any increase in injuries that are reasonably unavoidable as a result of response actions taken or anticipated*"[25];

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19 "Natural Resource Damage Assessment" can be defined as the process of collecting, compiling and analyzing information, statistics, or data through prescribed methodologies to determine damages for injuries to natural resources (43 CFR § 11.14 - Definitions).

20 K. Smith, *Natural Resource Damage Assessments and the Mineral Sector: Valuation in the Courts*, in E. M. Wade (ed.), *Environmental Economics and the Mining Industry* (New York: Springer Science, 1994), 15.

21 42 USC. 9601.

22 43 CFR § 11.10. "*Rebuttable presumption means the procedural device provided by section 107(f)(2)(C) of CERCLA describing the evidentiary weight that must be given to any determination or assessment of damages in any administrative or judicial proceeding under CERCLA or section 311 of the CWA made by a Federal or State natural resource trustee in accordance with the rule provided in this part.*" (43 CFR § 11.14).

23 43 CFR § 11.14. As a further clarification, the terms "injury", "loss" and "destruction" shall be regarded as synonyms.

24 *Ibid.*

25 In addition to this head of damages, the "*compensable value*" is the amount of money needed to compensate the loss of services provided by the injured natural resources between the time of the discharge or release of the hazardous substance and the time for the resources to be fully returned to their baseline conditions. "*The compensable value can include the economic value of lost services provided by the injured resources, including both public use and nonuse values such as existence and bequest values. Economic value can be measured by changes in consumer surplus, economic rent, and any fees or other payments collectible by a Federal or State agency or an Indian tribe for a private party's use of the natural resources; and any economic rent accruing to a private party because the Federal or State agency or Indian tribe does not charge a fee or price for the use of the resources. Alternatively, compensable value can be determined utilizing a restoration cost approach, which measures the cost of implementing a project or projects that restore, replace, or acquire the equivalent of natural resource services lost pending restoration to baseline".*

2) the costs of "*emergency restoration*" under 43 CFR § 11.21;

3) the "*reasonable and necessary costs of assessment*", including the costs of the preassessment and assessment plan, administrative costs and expenses necessary for, and incidental to, the assessment, assessment planning, restoration, rehabilitation, replacement, and/or acquisition of equivalent resources planning;

4) interests on the recoverable amounts[26].

The exact methodologies to assess natural resource damage have been illustrated by the US Department of Interior (hereinafter, DOI) through some regulations on the implementation of this legislation[27]. In these guidelines, the DOI referred to: market price, appraisal, factor income, travel cost, hedonic pricing, benefits transfer, conjoint analysis, habitat equivalency analysis, resource equivalency analysis, random utility modelling[28]. Further methodologies are also acceptable, provided that they determine compensable value according to the willingness to pay for the lost service or with the cost of a project that restores, replaces or acquires services equivalent to the lost services pending restoration to baseline in a cost-effective manner[29]. The DOI also provided some binding criteria for authorized officials to choose among the techniques[30]:

(i) methodologies should be feasible and reliable for a particular incident and type of damage to be measured;

(ii) methodologies should be performed at a reasonable cost;

(iii) methodologies should avoid double counting or they allow for removing it in the final calculation;

(iv) methodologies should be cost-effective.

These criteria need to be explained. Feasibility means that the chosen methodology is capable of providing information of use in determining the restoration cost or the compensable value appropriate for a particular natural resource injury, but also that the methodology addresses the particular injury and service losses. Whereas, reliability refers, alternatively, to the availability of peer review or that it receives "*general or widespread acceptance*" by experts in the field, to the fact that its application is subject to standards or

[26] 43 CFR § 11.15.
[27] 43 CFR Part 11 § 11.83 (Code of Federal Regulation – Title 43 Public Lands: Interior – Part 11: Natural Resource Damage Assessment - § 83 Damage determination phase – implementation guidance).
[28] 43 CFR § 11.83 – Damage determination phase – use value methodologies - c) compensable value 2) valuation methodologies.
[29] *Ibid.*
[30] 43 CFR § 11.83 – Damage determination phase – use value methodologies – a) General (3).

that its assumptions are supported by a "*clearly articulated rationale*". Specifically regarding "*cutting-edge methodologies*", they should be "*tested and analyzed sufficiently, so as to be reasonably reliable*"[31]. Cost-effectiveness should be interpreted as it follows: "*when two or more activities provide the same or a similar level of benefits, the least costly activity providing that level of benefits will be selected*"[32]. Furthermore, costs are reasonable under US law on NRDA "*when: the injury determination, quantification, and damage determination phases have a well-defined relationship to one another and are coordinated; the anticipated increment of extra benefits in terms of the precision or accuracy of estimates obtained by using a more costly injury quantification, or damage determination methodology are greater than the anticipated increment of extra costs of that methodology; and the anticipated cost of the assessment is expected to be less than the anticipated damage amount determined in the injury quantification and damage deetermination phases.*"[33]. Lastly, double counting means that a cost or a benefit has been calculated more than once in the damage assessment[34].

In 1990, the Oil Pollution Act (OPA) was adopted in reaction to the Exxon Valdez oil spill to ensure compensation for oil pollution and to allow the Federal State to directly manage clean-ups. Like in CERCLA, The scope of natural resource damages under the OPA encompasses: *"(A) the cost of restoring, rehabilitating, replacing, or acquiring the equivalent of, the damaged natural resources; (B) the diminution in value of those natural resources pending restoration; plus (C) the reasonable cost of assessing those damages, restoration and interim losses caused by an injury which occurs in US waters or on US shorelines."*[35].

Lastly and more importantly, the US legislation provides, at least in theory, compensation for both the loss of use value of natural resources and non-use or passive value (existence value and bequest value) of nature. However, as it will be further clarified, no clear guidelines on how to estimate nonuse values have been set forth[36]. Therefore, whether these provisions practically lead to the full internalization of social costs of environmental accidents has to be ascertained by looking at the case law. The following section wishes to shed a light on this.

[31] 43 CFR § 11.83 – Damage determination phase – use value methodologies – a) General (4).
[32] 43 CFR § 11.14 - Definitions.
[33] *Ibid.*
[34] 43 CFR § 11.84.
[35] 33 USC Ch. 40 § 2706 (d) – Natural Resources – Measure of damages.
[36] *General Electric,* 128 F.3d (D.C. Cir. 1997), par. 778.

## III. The US Practice on NRDA

In order to understand the development of the US case law on natural resource damage assessment, a previous clarification needs to be done. While the above-mentioned laws were approved (especially, CERCLA in 1980), environmental economists were conducting research on how to value the environment. Particularly, in the late 1980s they had already developed both market-valuation techniques and non-market valuation techniques. The latter aimed at assessing the value of non-market goods (environmental goods) which, in spite of the absence of market prices, have nevertheless value because of their direct use (use-values) or their mere existence (nonuse-values). Especially the contingent valuation technique was receiving much attention in that time because it seemed to be the only way to calculate the non-use value and to get closer to the total value of the environment.

The first landmark case in the US came therefore in the midst of the new adopted laws on NRDA and the findings in the field of environmental economics. Just four months after the Exxon Valdez oil spill, the famous *Ohio v. DOI decision*[37] came in the spotlight to trigger the (already lively) debate on the valuation of nature. In the latter case, Ohio and other States challenged the new regulations issued by the US Department of Interior (DOI) to specify the techniques for the assessment of environmental damage under CERCLA. With its decision, the Court of Appeals for the District of Columbia challenged the regulations[38] by explicitly stating three main principles: first, the main purpose of NRD should be to restore the damaged environment and, for this reason, damages should be based on restoration costs (the cost of a restoration project) rather than use values (unless "*grossly disproportionate to use values*")[39]; secondly, judges should be always allowed to compensate for nonuse values (it would be unreasonable to give only priority to use values and not to include nonuse values); thirdly, nonmarket valuation techniques (CV) should be used as much as market-based techniques (giving priority to market-based valuation and appraisal techniques would be unreasonable[40]). The ruling was extremely relevant because it overturned the regulation by putting on the same level of importance both restoration and

[37] 880 F.2d 432 (D.C. Cir. 1989).

[38] The issue at stake regarded the fact that damages had to be limited to "the lesser of the costs" of restoration or the lost use value under the NRD assessment regulations. In addition to that, the DOI provided a hierarchy of techniques to estimate use values and market-based techniques were given priority over nonmarket valuation techniques. Lastly, the DOI included CV as a possible technique adding that "*estimation of option and existence values (*i.e., *non use values) shall be used only if…no use values can be determined*" (43 CFR § 11.83(b)(2)).

[39] In other words, the D.C. Circuit held that the lesser of the cost was invalid since in contrast with the intentions of the Congress. By contrast, the Parliament clearly expressed preference for restoration costs as a measure of recovery (880 F.2d 432 D.C. Cir. 1989, par. 459).

[40] *Ibidem,* par. 463.

contingent valuation. In this way, the court wanted to overcome the previous trend of calculating environmental damages looking just at market prices and it opened the road towards the calculation of nonuse values through the contingent valuation method (hereinafter, CV). After the Ohio court expressed its favor for the CV, this was applied in the Exxon Valdez case and it led to a final amount of damages around US$ 9 billion[41]. Likewise, in the case *United States v. Montrose Chemical Corp.* in Southern California, damages for environmental damage were awarded for over half of US$ 1 billion. Moreover, these decisions triggered considerable debate among legal scholars around restoration costs versus lost use values[42]. Scholars were split between those supporting the use of CV (Montesinos, Dobbins, Brookshire, McKee, McConnell, Baker), those limiting its use to exceptional cases where restoration could not be applied (Cross) and those clearly against its employment in litigation because costs outweigh the benefits (Niewijk) or because clearly flawed (Cummings, Harrison, Bohm, Binger, Copple, Hoffman). The former emphasized the advantages of CV (the most complete technique to monetize environmental damages) and the latter its shortcomings (mainly, overestimation of the damage).

In 2002 Thompson made a first review of all cases after the Ohio decision to analyze how much economic evidence was introduced in litigation. Broadly speaking, every time that courts had to decide on the validity of economic evidence on the non use value of nature, they were more inclined to accept evidence based on restoration costs rather than contingent valuation. Very few cases after the Exxon Valdez relied on market-based techniques, including the well-known *California v. BP America (American Trader)*[43] that occurred in the Californian bay on 7 February 1990. There, the lost use value of Californian beaches was awarded by the jury by means of the travel cost approach and by applying the estimations of beaches in Florida. In other cases[44] in which the restoration-cost approach was not applicable because the environment was irreversibly damages, the court accepted the Habitat Equivalency Analysis (hereinafter, HEA) that considers costs of restoration referred to equivalent services. These cases show that when NRD claims regarded nonuse values of nature, a restoration approach was more frequently implemented. Arguably,

[41] R. T. Carson *et al.*, *Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez*, in 25 Env. and Res. Econ. 257 (2003). However, the case was settled for US$ 1 billion in the end, plus $3,4 billion in fines, compensation and clean-up costs, plus a lawsuit for punitive damages that were reduced to $500 million in 2008 by the Supreme Court.

[42] For a summary of the whole debate between 1989 and the late 1990s, see D. B. Thompson, *Valuing the Environment: Courts' struggles with Natural Resources Damages*, in 32(1) Env. L. 57, 62 (2002).

[43] Case n. 64 63 39 (Cal. Super. Ct. Dec. 8, 1997).

[44] *United States v. Fisher (Fisher I),* 22 F.3d 262, 265 (11th Cir. 1994) and *United States v. Fisher (Fisher II),* 977 F. Supp., par. 1198.

Judges tend to reject methods to assess non-use values since they run into issues when dealing with their validity[45]. It is very likely that this is the reason why CV has been rarely applied after the Ohio decision and until the early 2000s[46]. For instance, in *Southern Refrigerated*[47], the State claimed damages for water pollution caused by the accidental spill of an agricultural fungicide in the little Salmon River in 1987 and the court rejected the application of CV because it could not provide estimates with reasonable certainty[48]. Generally, US judges have rejected CV studies because they did not seem to meet certainty standards for scientific evidence. On the other hand, achieving such high standards in litigation is extremely expensive for plaintiffs, so parties might be disincentivized to propose a methodology that will be probably rejected.

The issue of damage calculation came again into the spotlight after the occurrence of the largest oil spill in the US so far: the Deepwater Horizon case (DWH). The accident happened in northern Gulf of Mexico (64 km from mainland Louisiana) in April 2010 with the explosion and subsequent fall of the drilling platform, which ultimately led to the release of 200 million gallons of oil for a period of 87 days[49]. Given the complexity of the event and the potential of consequences, the US Congress asked the National Academy of Science to evaluate the impacts of the DWH spill. Moreover, there was a specific request to determine whether the "ecosystem services approach" might help achieve full compensation of environmental damages[50]. Among its conclusions, the final report

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45 Kopp and Smith examined all the issues of validity that may be raised in litigation when dealing with nonmarket valuation techniques in the famous Eagle Mine case. R. Kopp, V. K. Smith., *Eagle Mine and Idarado*, in K. M. Ward, J. W. Duffield (eds.), *Natural Resources Damages: Law and Economics* (New York, NY: John Wiley & Sons, 1992). Particularly, they commented that: "*the level of economic expertise available to judges to evaluate the facts of each side's evidentiary claims probably needs to exceed what many analysts of judicial behaviour have arhued can be expected*" (at 381).

46 Contingent valuation studies were conducted in several cases but they were all settled, so that judges never ruled on their validity apart from two cases (Thompson, *supra* note 42, at 78).

47 *Southern Refrigerated,* n. 88-1279, 1991 US Dist. 1869 (D. Idaho 24 January 1991).

48 *Ibid.,* par. 55-56.

49 The 1989 Exxon Valdez spilled out almost 11 million gallons out of 53 million gallons carried by the tanker. The 1979 Ixtoc 1 spill caused the release of almost 126 million gallons. See A. Jernelöv, O. Lindén, *Ixtoc I: A Case Study of the World's Largest Oil Spill,* in 10(6) Ambio 299 (2001).

50 Committee on the Effects of the Deepwater Horizon Mississippi Canyon-252 Oil Spill on Ecosystem Services in the Gulf of Mexico, Ocean Studies Board, Division on Earth and Life Studies, National Research Council, *An Ecosystem Services Approach to Assessing the Impacts of the Deepwater Horizon Oil Spill in the Gulf of Mexico* (Washington DC: The National Academies Press, 2013). As the report pointed out at page 1, "*the ecosystem services approach is different from traditional approaches to damage assessment and restoration (e.g., the Natural Resources Damage Assessment, NRDA) because it focuses not on the natural resources themselves, but on the valuable goods and services these resources supply to people. Taking an ecosystem services view can supplement traditional methods of assessing, or valuing, damage to natural resources by estimating flows of goods and services before and after an event. In addition, thinking in terms of ecosystem services would change the way that the public and agencies conceptualize and discuss restoring natural resources to their former condition*".

highlighted that the technical complexity of the disaster largely exceeded industrial and regulatory safety measures. In fact, environmental agencies with supervision committed several mistakes before approving operations, such as excluding deep water drilling from regulatory requirements and carrying out inappropriately large-scale reviews. Admittedly, the Deepwater Horizon unveiled the inadequateness of technologies and regulatory responses to large oil spills[51]. Moreover, assessing the costs of post-spill restoration was "a monumental task" because, first, the value of all affected ecosystem services needed to be estimated and, then, the different economic methods of economic valuation had to be 'reconciled'[52]. For the DWH, the first part of the task was facilitated by the large availability of data[53]. Whereas, on the economic valuation of ecosystem services, Costanza and colleagues provided two monetary examples. The first one assumed the almost total closure of Louisiana's fishery activities for an estimated annual loss of $ 2.5 billion. The second one calculated all values of services provided by the most affected area in the region (Mississippi River Delta) with an envisaged reduction of 10-50% reduction in ecosystem services for a final total loss of $1.2–$23.5 billion per year until full ecological restoration at an indefinite time in the future[54]. Other ecologists in 2016 proposed a socio-ecological approach to restoration that integrated social (economic, ethical) and ecological variables in order to achieve a successful restoration[55]. Some ecologists also pointed out that the adoption of adequate conservation beforehand would have reduced the need for extensive post-spill restoration.

Notwithstanding the previous calculations, the legal settlement of the DWH ended up in $ 21 billion, much less than the estimated costs of cleanup ($ 61.1 billion) including economic losses and settlement funds[56]. Other scholars proposed different estimations, such as $ 145 billion[57] and $ 2 trillion based on annual sales of coast businesses[58]. That allows us to infer that settlements represent an alternative to postcrisis cost assessments but their outcome

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[51] https://www.nytimes.com/2013/12/09/booming/lessons-from-the-exxon-valdez-oil-spill.html

[52] B. P. Wallace *et al.*, *Overview Effects of the Deepwater Horizon oil spill on protected marine species,* in 33 Endang. Species Res. 1 (2017).

[53] Gulf of Mexico Ecosystem Services Valuation Database maintained by Texas A&M University and the US National Research Council's (NRC) study of the ecosystem services affected by the Deepwater Horizon (NRC 2013). See C. P. Santos *et al.*, *Gulf of Mexico Ecosystem Service Valuation Database (GecoServ): Gathering ecosystem services valuation studies to promote their inclusion in the decision-making process,* in 36(1) Mar. Pol'y 214 (2012).

[54] R. Costanza *et al.*, *The Perfect Spill: Solutions for Averting the Next Deepwater Horizon*, in 1 Solutions 17 (2010).

[55] A. Abelson *et al.*, *Upgrading Marine Ecosystem Restoration Using Ecological–Social Concepts*, in 66 BioScience 156 (2016).

[56] NOAA 2019. This amount is based on the BP assessment.

[57] Y. G. Lee, X. Garza-Gomez, R. M. Lee, *Ultimate Costs of the Disaster: Seven Years After the Deepwater Horizon Oil Spill*, in 29 J. Corp. Acc. & Fin. Journal of Corporate 69 (2018).

[58] Dun and Bradstreet Bureau of Labor Statistics, *2010 Deepwater Horizon, Oil Spill Preliminary Business Impact Analysis for Coastal Areas in the Gulf States* (2010).

is unpredictable and it depends on the process involving judges, jury trials and corporate statements. Also, lacking sufficient support of the liable party, US laws provide for national funding of cleanup and postcrisis response (Oil Spill Liability Trust Fund) but payments are limited. Compensation includes damages to natural resources, loss of subsistence use of natural resources, damages to real or personal property, loss of profits or earning capacity, loss of government revenues, and increased cost of public services. Yet, the law sets down that the Fund can pay up to $1 billion per accident, of which no more than $500 million may compensate for natural resource damages[59]. Clearly, the Fund could not cover all cleanup costs, 1 billion was only 1/60th than the needed amount.

It is apparent from the above that relying on postcrisis restoration assessments means to make the success of restoration depending on the money available from government and corporations with the risk that long-term restoration goals do not match short-term goals of elected politicians or appointed corporate directors.

## IV. THE EU LAW ON ENVIRONMENTAL LIABILITY

The second relevant regional experience on environmental damage assessment can be found in the EU, where the main legislative act providing for an assessment of environmental damage is the European Directive on Liability (ELD)[60].

Formally, the starting point of the ELD's history can be identified in the year 1986. While the entire Europe was mourning for the accident recently occurred at the Chernobyl Nuclear Power Plant in Ukraine, another dramatic event happened at the Sandoz agrochemical storehouse in Switzerland causing a tremendous release of toxic pesticides in the air and the underground water[61]. These events raised the level of perceived risk for human health and they ended up in the resolution of 24 November 1986 of the Council[62].

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[59] OPA 9001(c); 26 U.S.C. § 9509)" (USCG 2017: 2).

[60] 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, OJ L 143/56. The Directive entered into force on 30 April 2004.

[61] For a detailed description of the accident and the pollutants, see H. GÜTTINGER, W. STUMM, *Ecotoxicology An Analysis of the Rhine Pollution caused by the Sandoz Chemical Accident, 1986*, in 17(2) *Interdisciplinary Science Reviews* 127 (1992).

[62] The reference to the Council's Resolution is at p. 1 of the Commission's Proposal of 1991 (*infra* note 62). At that time the term 'Council' unambiguously referred to the Council of Ministers of the EEC (European Economic Community). Following the creation of the European Union with the Maastricht Treaty of 1992, the Council was formally renamed 'Council of the European Union' and it has to be distinguished from the

With this act, the Ministries asked the Commission to investigate the consequences of environmental harm and to review existing measures to prevent and remediate environmental harm. As a response, the Commission adopted its first Proposal for a Directive on civil liability for environmental damage caused by waste in 1989[63]. Among its primary objectives, the 'polluter-pays' principle was mentioned together with the accomplishment of the internal market, the fair compensation of victims and the internalization of waste-related costs[64]. Although the novelty of the proposal was a liability regime for '*injury to the environment*'[65] and not just for traditional damage to persons and property, the initial intentions were soon replaced by a more ambitious project that was not limited to waste.

On 14 May 1993 the Commission published the Green Paper on Remedying Environmental Damage[66] that summarized the main issues to be debated before a new piece of legislation was drafted. At the same time, in June 1993, the Council of Europe adopted the 'Lugano Convention'[67]. The following important dates included a resolution of the EU Parliament asking for a Directive on civil liability for environmental damage[68], a Working Paper on Environmental Liability in 1997[69], a White Paper on Environmental Liability in 2000[70], another Working Paper in 2001 and a proposal for a Directive in 2002[71]. After two years of continuous debate, on 21 April 2004 the Presidents of the European Parliament and the Council finally signed the text of the ELD in the version agreed by all engaged parties (the Commission, the Council, the Economic and Social Committee, the Parliament and the Conciliation Committee).

Regarding the key features of the ELD, it must be said first that the Directive did not establish a civil liability regime that enables private parties to sue for damages. It rather set down an administrative law regime that empowers public authorities to impose specific

'European Council' that remains a separate institution devoid of legislative powers and based on intergovernmental decision-making. The Lisbon Treaty officially enlisted it among the EU institutions.

63 European Commission, *Proposal for a Council Directive on Civil Liability for Damage caused by Waste* [1989] COM (89) 282, amended by [1991] COM (91) 219.

64 *Ibid.,* p. 1, par. 2.

65 *Ibid.,* p. 3, par. 5. It should be noted that the original scope of the Proposal included the three categories of damage to individuals (physical injury, death), damage to property (deterioration, destruction) and injury to the environment.

66 European Commission*, Communication from the Commission to the Council and Parliament and the Economic and Social Committee: Green Paper on Remedying Environmental Damage* COM (93) 47 final, 14 May 1993.

67 Council of Europe, *Convention on Civil Liability for Damage resulting from Activities Dangerous to the Environment*, 21 June 1993.

68 European Parliament, *Resolution A3-0232/94 of 20 April 1994 on Preventing and Remedying Environmental Damage*, OJ C 128, 9 May 1994, p. 184-185.

69 European Commission, *Working Paper on Environmental Liability*, Brussels, 17 November 1997.

70 European Commission, *White Paper on Environmental Liability* COM (2000) 66 final, 9 February 2000.

71 European Commission, *Proposal for a Directive of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage*, COM(2002) 17 final, OJ C 151, 25 June 2002.

obligations on polluters in case of imminent threat or occurred damage to the environment. For this reason, it is more correct to say that the Directive belongs to the domain of public law and not to the one of private law[72].

Secondly, on the regime of liability, the Directive opted for a double regime: strict liability for dangerous or potentially dangerous activities (listed in Annex III to the ELD) and fault or negligence for the others (activities not perceived to be dangerous under Article 3.1). Liability is imposed on the so-called '*operators of occupational activities*', where '*operator*' refers to the natural or legal person that operates, controls or even exercises decisive economic power over the technical functioning of an activity and '*occupational activity*' is defined as any economic activity, a business or an undertaking regardless its private or public, profit or non-profit purpose (Article 2.6 and 2.7 of the ELD). If the activity is listed in Annex III, then a regime of strict liability applies. On the contrary, operators of non-listed activities might be held environmentally liable only where a proof of negligence is provided by the plaintiff.

Thirdly, on the scope, for the first time the category of damage to nature or, more in general, to natural resources was legally recognised at the EU level. Indeed, it is clearly stated that the Directive does not cover traditional damages granted under international agreements on civil liability or under national civil law regulating personal injury, damage to private property or economic loss (recitals 11 and 14 of the ELD). In particular, it shall not affect any rights related to these categories of damages. More specifically, the Directive applies to '*environmental damage*', meaning '*a significant adverse effect on reaching or maintaining the favourable conservation status of* protected species *and* natural habitats '(Article 2.1.a of the ELD), to '*water damage*' as '*a damage that significantly adversely affects the ecological, chemical or quantitative status or the ecological potential of the waters* (…) *and the* marine waters ' (Article 2.1.b of the ELD) and to 'land damage' as '*land contamination that creates a significant risk of human health being adversely affected as a result of the direct or indirect introduction in, on or under land of substances, preparations, organisms and micro-organisms*' (Article 2.1.c). In principle, the Directive only refers to damage to protected natural habitats, protected species and protection areas but it allows Member States to expand its scope. Fourthly, the ELD established a regime of remediation that gives priority to restoration rather than monetary compensation. From this point of view,

[72] This is a quite common observation that can be found, *ex multis,* in G. Van Calster, L. Reins, *The Environmental Liability Directive's Background*, in L. Bergkamp, B. J. Goldsmith (eds.), *The EU Environmental Liability Directive: A Commentary* (Oxford: Oxford University Press, 2013), 9-30.

the Directive deliberately mirrored the US regulation on natural resource damage assessment that imposed on liable parties three categories of costs: the costs of restoring the impaired ecosystem to baseline conditions, the loss occurring during the restoration period (‘*interim losses*’) and the cost of assessing damages (administrative costs, costs of enforcement, data collection and monitoring)[32]. In particular, under the ELD restoration has to be achieved through primary restoration or any measures that returns natural resources to their baseline conditions, followed by complementary remediation or any measures aimed at providing the same level of natural resources ineluctably impacted in an alternative site and, lastly, by compensatory measures that compensate for the interim losses pending recovery.

## V. COMPARING RESTORATION IN THE EU AND THE US

Following the assessment of the injury, the EU procedure for damage assessment focuses on primary restoration or the action needed to return the damaged natural resources to their baseline conditions. This assessment deals with the following steps[73]: a) setting *restoration targets*, b) identifying *restoration options* (no intervention, limited intervention, and full-scale reconstruction), c) selecting restoration options through an *evaluation process* that weighs the cost of each option, the time for restoration to be effective, the extent to which each option will prevent future damage, other benefits for the environment and public health. In general, the aim is to select the least costly option that leads to the restoration targets through a process known as cost-effectiveness analysis (CEA)[74]. The cost of each option includes the costs of damage assessment and those to implement restoration (cleaning and restoring species, habitats); they need to be weighed with the benefits of restoration (in terms of ability of damaged resources to provide services) in order to establish whether a restoration option is cost-effective and that it can be implemented.

Likewise, trustees in the US have to consider a range of restoration alternatives, each being a package that includes primary and compensatory restoration actions in view of making the public whole. Primary restoration implies to consider first “*natural recovery alternatives*”[75], then

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[73] EU Commission, Directorate-General Environment, “Study on the valuation and restoration of damage to natural resources for the purpose of environmental liability”, B4-3040/2000/265781/MAR/B3, Final report by Macalister Elliott and Partners Ltd and the Economics for the Environment Consultancy Ltd, 2001.

[74] ‘*The ideal outcome of a liability regime would be a solution that provides full compensation to the public for damages to natural resources at the least cost to the liable party*’ (*ibidem*, p. 3).

[75] This means that “*no human intervention would be taken to directly restore injured natural resources and services to baseline*” (15 CFR § 990.53 – Restoration selection).

"*active primary restoration actions*" (aimed at directly returning the environment to the baseline[76] "*on an accelerated time frame*"[77]) and, thirdly, "*compensatory restoration actions*" that "*provide services of the same type and quality, and of comparable value as those injured*"[78].

The last stage of damage assessment both in the EU and the US concerns compensatory restoration options that serve to compensate the public for the loss of natural resources and services during the recovery period. There are a number of approaches that can be employed to identify and select compensatory remedies. The first is the 'service-to-service' approach that is based on a one-to-one trade- off, meaning that the lost service is replaced by a new one created through compensatory restoration. The second is the 'value-to-value' approach and it entails solutions when a one-to-one match is not possible. Its aim is to identify a restoration option such that the economic value of the compensatory services is equal to the value of interim losses. This means that whenever the service-to-service approach is not practicable, damaged natural resources have to be measured and compared in monetary terms to establish losses and gains.

Similarly in the US, if 'replacement natural resources' and services are not of comparable value, a 'scaling process' is required to value lost and replacement services. All restoration actions need to be scaled to make sure that they will provide resources and/or services equivalent to the lost ones. The valuation scaling approach may be of two kinds: 'resource-to-resource' and 'service-to-service'. To do that, trustees have to measure the value of injured natural resources or services and then "*select the restoration action that has a cost equivalent to the lost value*"[79]. Moreover, when scaling a restoration action, trustees have to discount all service quantities and/or values to the date of the claim and to evaluate the uncertainties of restoration actions. The criteria to follow when selecting the appropriate restoration action include the capability of returning the resource to baseline in an "*expeditious and cost-effective*"[80] manner while involving the interested parties in the administrative process.

In light of the above, it is clear that the economic valuation still plays an important role within the environmental damage assessment either in the EU or the US. Indeed, it allows to carry out a cost benefit analysis of restoration options, hence facilitating a decision on the

[76] The baseline is defined as "*the condition of the natural resource that would have existed had the incident not occurred. Baseline data may be estimated using historical data, reference data, control data, or data on incremental changes (e.g., number of dead animals), alone or in combination, as appropriate*" (15 CFR § 990.53).
[77] 15 CFR § 990.53.
[78] *Ibid.*
[79] *Ibid.*
[80] 15 CFR § 990.10 – Purpose.

desirability of a specific option of restoration if it has a reasonable and not disproportionate cost[81], although the value of damage is something different from the cost of cleanup[82]. The estimation of the value of damage is nevertheless required because it provides a term of comparison to avoid spending on restoration a disproportionate amount of money.

In addition, economic valuations are needed to estimate interim losses[83] and baseline conditions[84]. In fact, even when restoration is possible and cost-effective, it cannot compensate the public for the losses during the recovery period. Compensatory measures take into account these losses and make use of monetary valuation techniques.

The fundamental issue of inaccuracy either in the EU and the US is that the value of lost services is normally obtained through the habitat equivalency analysis (HEA) which raises well-known pitfalls in the estimation. Some ecological scholars argued that the HEA excludes the need for valuation due to four questionable assumptions.

First of all, the HEA assumes that the type, quality and quantity (value) of services provided is comparable to the lost ones[85](so that the two resources would provide the society with the same level of utility or wellbeing).

Secondly, the value of the injured and compensatory services are considered to be constant (and so, equal) over time (this is mathematically needed so that both sides of the equation can be canceled out)[86].

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81 *Ibid.,* at 2.

82 *Ibid.,* at 3. The 'value of damage' to the environment can be achieved through economic valuation techniques that measure public preferences for an environmental state. These techniques include stated preference and revealed preference mechanisms aimed at eliciting people's preferences through surveys, in the first case, or by using data from actual markets, in the second case. By contrast, costs of clean-up and restoration do not need to previously identify a damage and damaged parties. They are based on technical options available rather than on public preferences.

83 It must be kept in mind that interim losses occur over an infinite period of time if primary restoration is not possible. The magnitude if interim losses depends indeed on the primary restoration options and the time for recovery to take place (*Supra* note 73, 36).

84 par. V of the Executive Summary.

85 R. E. Unsworth, R. C. Bishop, *Assessing Natural Resource Damages Using Environmental Annuities,* in 11.1 Ecol. Econ. 5 (1994). That allows to assume that the present value of losses is equal to the present value of gains. Moreover, the services should be equal from an economic point of view, meaning that their demand has to be equal and they are substitutes. For instance, if a wetland area has to offset the ecological losses of a similar wetlands, then the demand and supply of these resources should be the same. It is important therefore to take account of the availability of substitutes and the income effect on the demand and supply: the availability of substitutes makes the value for restoration lower. See W. H. Desvousges *et al.*, *Habitat and Resource Equivalency Analysis: A Critical Assessment*, in 143 Ecol. Econ. 74 (2018). Some scholars argued that this assumption can be relaxed if resources are scaled and, thus, HEA can be applied to services that are not of the same type and quality. Yet, as Desvousges *et. al.* made clear, scaling requires prior knowledge of the value of the services and relative demand and supply to make sure that there is proportionality.

86 What Desvousges *et al.* (*supra* note 85) pinpointed in this regard is that "*the longer the (nda, recovery) time period involved in the HEA quantification, the less likely this assumption is to hold*". Despite this assumption, it seems that the value of environmental services is more plausibly expected to increase over time because of technological changes and rising incomes that affect the future demand for environmental services. See A. C. Fisher *et al.*, *The Economics of Environmental Preservation: A Theoretical and Empirical Analysis*, in 62(4) Amer. Econ. Rev. 605

Thirdly, marginal changes in the value of the injured services are considered to be constant over time[87].

Fourthly, costs of restoration are assumed to be equal to the value of lost services (but they might be more or less, hence determining over- or under-compensation[88]).

According to the ecological literature, all these assumptions are highly questionable. Furthermore the accuracy of equivalency analyses relies on three crucial factors: metric, baseline and uncertainty. The metric should reflect the whole change of society's well-being or utility before and after the injury[89]. However, finding a metric that can encompass all services provided by one ecosystem is extremely challenging and there is not just one way to do that[90]. For instance, it has been proved that the choice of the metric should depend on the complexity of the specific damaged ecosystem[91] and Dunford criticizes the use of a single metric for single services[92]. After the metric is chosen, it is possible to measure the change in service after the injury comparing the estimated level with the level that would have been if the injury had not occurred. The final estimation thus relies on the baseline condition. Disagreements on the baseline may surely affect the measure of the ecosystem losses[93]. Accurate assessments of the baseline should require instead to look not just at the 'without contamination' scenario but also at historical data, especially for long-term injuries (*e.g.*, mining)[94].

(1972) and A. C. Fisher *et al.*, *The Economics of Environmental Preservation: Further Discussion*, in 64(6) Amer. Econ. Rev. 1030 (1974).

87 Marginal values are crucial in the economic valuation because they depend on which amount of services is already available, on shifts in the demand due to substitutes and on rising incomes. This is also in the literature on HEA, since it is common knowledge that among the conditions for service-to-service scaling is that changes in resources and services are sufficiently small and the value per unit if service is expected to be independent of changes. See D. Chapman *et al.*, *Calculating Resource Compensation: An Application of the Service-to-Service Approach to the Blackbird Mine Hazardous Waste Site*, NOAA Damage Assessment and Restoration Program Technical Report 97-1 (1998).

88 Unsworth, Bishop, *supra* note 84.

89 Compensation is in fact an anthropocentric concept aimed at returning the society to the level of utility prior to the injury. S. G. Cole, *Wind Power Compensation is not for the Birds: An Opinion from an Environmental Economist,* in 19 Rest. Ecol. 147 (2011).

90 Common metrics used in HEA are the number of fish or the number of acres of habitats.

91 T. P. Holmes *et al.*, *Choice Experiments. Chapter 5,* in P. A. Champ, K. Boyle, T. C. Brown (eds.), *A Primer on Nonmarket Valuation. The Economics of Non-market Goods and Resources* (Dordrecht: Kluwer Academic Publishers, 2017).

92 R. W. Dunford *et al.*, *The Use of Habitat Equivalency in Natural Resource Damage Assessments*, in 48 Ecol. Econ. 49 (2004).

93 Desvousges *et al.*, *supra* note 84, explain how changes in the baseline specifically makes the service losses increasing, decreasing or constant. Therefore, it would be better to employ a before-and-after approach if historical data is available, instead of a reference location approach (based on typical baseline ecological conditions). The two approaches can be regarded as equivalent only where no changes in the baseline occur before and after the injury. See S.G. Cole *et al.*, *Main Toolkit and Annexes,* http://envliability.eu/docs/D13MainToolkit_and_Annexes/D13MainToolkit.html

94 Commercial, industrial and agricultural activities can also change the baseline over time.

The last issue that might negatively affect the accuracy of the HEA is uncertainty and the fact that equivalency analyses are not based on statistical information but on professional and subjective judgements. Therefore, unlike other valuation methods, external validation cannot be applied. All the above supports the conclusion that equivalency analyses are unlikely to provide accurate estimates of losses and gains, unless careful attention to the metric, the baseline and the external validity is paid. Lacking clear guidelines on these points, the accuracy of final estimates clearly depend on the discretion of the judge.

## VI. CONCLUSIONS

Both in the EU and the US two main forms of restoration exist as a remedy for environmental harm. Normally, the costs of primary restoration represent the biggest part, whereas compensatory restoration serves to compensate the public for the diminution in quality and quantity of the resource on a temporal (interim losses) or permanent basis.

Restoration costs are frequently valued based on the HEA, whereas interim losses can be calculated either by market-based approaches (where market prices are available) or non-market valuation techniques (where the impaired resource is not traded in the market) or even benefits transfer approaches (although their accuracy may vary depending on the data available and the specific circumstances).

As argued in the official report on the effects of the accident, the new ecosystem services approach to restoration might supplement and improve traditional methods of natural resource damage assessment. However, its application in environmental damage assessments is not yet binding under current liability regimes either in the US or the EU. Moreover, it suffers from several limitations that need to be tackled through further research.

Given the above-illustrated pitfalls of HEA and the state of the art the ecosystem services approach, the preference given to restoration as a primary remedy cannot exclude inaccuracies, hence undermining the optimality of the final estimation for the deterrent effect of liability laws. More specifically, restoration does not seem to be an accurate 'on average' remedy due to the issues of inaccuracy and the questionable assumptions pointed out in the ecological scholarship. On the other hand, if one wants to achieve better accuracy in damage assessment with the current approach, litigation costs are likely to be very high, with a subsequent possible disincentive to file a lawsuit. As already mentioned, more accuracy would be economically desirable and bring to optimal incentives of care and activity.