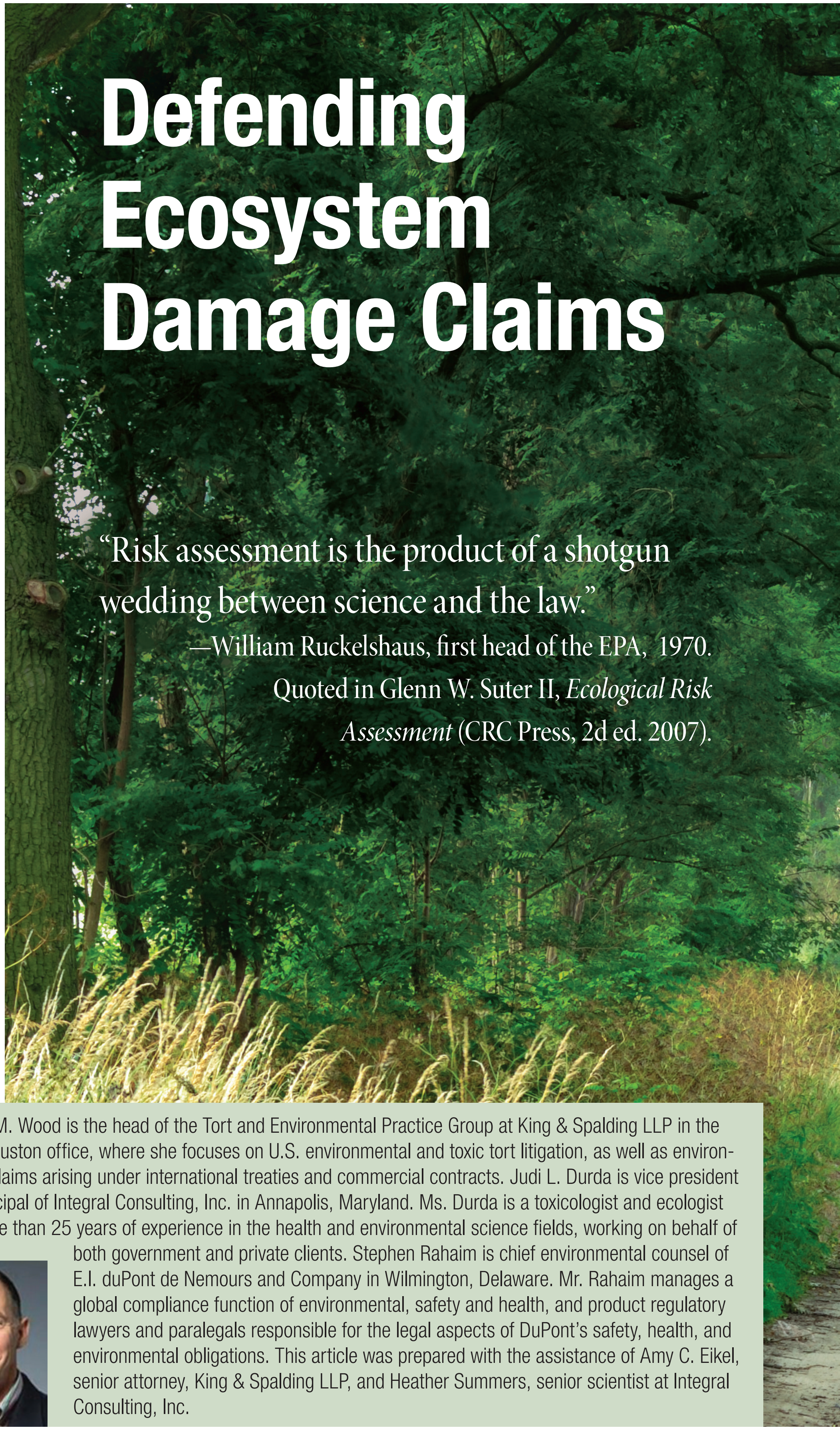
When the "Exposed" Are Bugs and Bunnies



Defending Ecosystem Damage Claims

By Carol M. Wood, Judi L. Durda, and Stephen Rahaim

Despite the complexities, defense counsel have strategies for defending against ecosystem claims—whether in toxic tort and product liability litigation, government enforcement actions, or natural resource damage assessments.

"Risk assessment is the product of a shotgun wedding between science and the law."
—William Ruckelshaus, first head of the EPA, 1970.
Quoted in Glenn W. Suter II, *Ecological Risk Assessment* (CRC Press, 2d ed. 2007).



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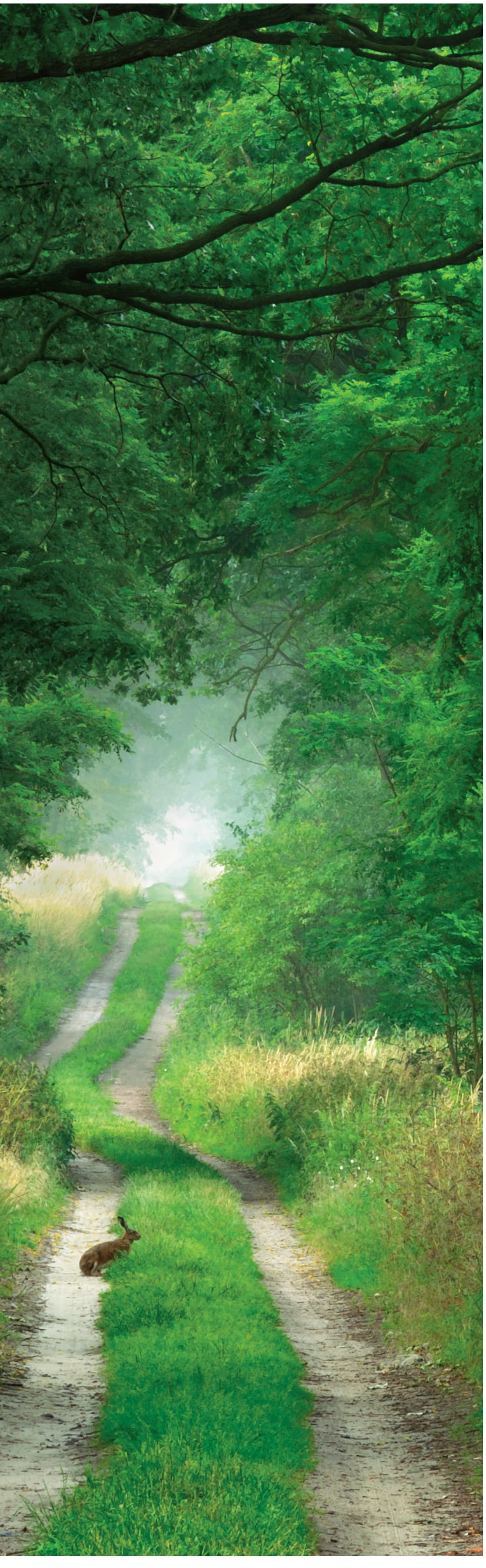

Claims alleging ecosystem damages are increasing in frequency, yet the defenses to these claims are not as developed as human health claims, and the standards used for ecological risk assessment tend to be imprecise and subjective. *See* Glenn W. Suter II, *Ecological Risk Assessment* 22 (CRC Press, 2d ed. 2007) (Suter 2007) ("Risk assessments have emphasized risks to human health and have largely neglected ecological effects."); Hope *et al.*, at 991 (2006) (noting that "the practice of ecological risk assessment is not as fully formalised as… that of human risk assessment.").

Ecological response to toxic chemicals is complex and most often cannot be distilled down to simple metrics indicating the presence or absence of effects. In a toxic tort action alleging, for example, contamination of drinking water and personal injury, the analysis of risk and damages is relatively straightforward in that it involves only one species, human beings. But when a plaintiff or a government agency alleges that an entire ecosystem has been damaged by a defendant's actions, these claims often involve multiple species, as well as implicating the multiple interactions that constitute a complex ecosystem.

In the area of human health risk, there is extensive guidance for conducting risk assessments. *See, e.g.*, U.S. Environmental Agency (EPA), Risk Assessment Guidelines (RAG), https://www.epa.gov (compiling a list of 98 guidance and policy documents developed by the U.S. Environmental Agency to guide human health risk assessments). In addition, well-developed numerical toxicity criteria exist that are routinely used or considered by most practitioners, and well-defined metrics for characterizing the potential risk and supporting assessment of potential harm. *See, e.g.*, EPA, Integrated Risk Information System (IRIS), https://www.epa.gov/; *see also* EPA, Risk Assessment Guidance for Superfund (RAGS) (1989) (excess lifetime cancer risk and non-cancer hazard indices). In contrast, guidance for ecological risk assessment is less extensive and more general. *See* EPA, Framework for Ecological Risk Assessment (1992); Guidelines for Ecological Risk Assessment (1998). However, there are no centralized universally accepted toxicity criteria for use in ecological risk assessments and no consensus on how to define risk and the level of risk that should be considered acceptable. The evaluation of ecological risk is further complicated by the need to consider potential risks to multiple species of fish, birds, insects, and animals.

As explained by the EPA,

> Ecological risk assessment is a process for evaluating the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. A critical early step in conducting an ecological risk assessment is deciding which aspects of the environment will be selected for evaluation. This step is often challenging because of the remarkable diversity of species, ecological communities, and ecological functions from which to choose and because of statutory ambiguity regarding what is to be protected.

EPA, Generic Ecological Assessment Endpoints (GEAEs) for Ecological Risk Assessment, Preface (2003).

Claimants such as private litigants or regulators can take advantage of "gray areas" caused by this complexity and lack of consensus. The numerical guidelines that do exist are often misused and distorted by claimants in an effort to seek increased damages.

This article, along with the accompanying table, "Contrast Between Human and Ecological Risk Assessment" (see pages 28–29), provides a brief overview of how ecosystem claims arise; compares human health risk assessments with ecological risk assessments to highlight the similarities and differences; and discusses strategies for defending against ecological injury claims as they arise in toxic tort and product liability litigation, government enforcement actions, and natural resource damage assessments.

Ecosystem Damage Claims Can Arise in a Variety of Contexts

Claims of ecological damages have been asserted in the following circumstances: toxic tort or statutory claims by private litigants or government entities; government—federal or state—claims to mandate remediation; and natural resource damage claims for lost "services" under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund).

Table 1: Contrast Between Human and Ecological Risk Assessment

ELEMENT	HUMAN HEALTH RISK	ECOLOGICAL RISK	COMMENT	REFERENCE
What is being protected?				
Species of interest	One	Many		EPA 1992; EPA 1998; EPA 1999
Assessment focus	Individual people (assessment endpoint—probability of death or injury of an individual)	Populations, communities, ecosystems (assessment endpoint organism-level attributes applied to population of organisms—frequency of mortality, average reduction in growth or fecundity; assessment endpoint population-level attribute applied to individual population—extirpation, production or abundance) Definition of endpoints in terms of entities and attributes of environmental value	Populations are collections of individual organisms and are the smallest unit of ecological organization that persists through time; individual organisms are not focus of ecological risk assessments unless endangered or threatened species might be present. Communities are the combination of populations in a defined area Ecosystem—the interactions of populations and communities with the physical/chemical environment	Suter 1996; Suter et al. 2005; EPA 1992; EPA 1997; EPA 1998; EPA 1999; EPA 2003a; EPA 2004
What types of toxic effects are evaluated and how?				
Cancer	Excess lifetime cancer risk	Not typically a focus	Cancer is most often a disease in older members of the population; in ecological systems, older organisms are typically no longer reproducing and therefore not important to the continuation of the population	EPA 1989; EPA 1997; EPA 1998; EPA 2005
Non-cancer	Organ or organ system effects (e.g., kidney, liver) in a person	Populations—abundance, productivity Communities—community compositions (e.g., species diversity) Ecosystems—Ecological processes (e.g., nutrient cycling)	Effects on populations are sometimes estimated by evaluating toxicity in individual members of the population based on changes in growth, reproduction, or survival and extrapolating/modeling how those individual effects translate to the population of organisms. There are no universal models for estimating population-level effects.	Suter et al. 2005; EPA 1997; EPA 1998; EPA 1999; EPA 2003a
Direct testing	Not conducted	Toxicity testing with surrogate organisms in laboratory or field	Toxicity testing in contaminated site settings most commonly conducted using sediment or surface water (e.g., for NPDES discharges)	Suter 1996; EPA 1994; EPA 1997
Toxicity criteria	Generally accepted sources of toxicity data (e.g., EPA IRIS) used by most practitioners	No generally accepted source of toxicity data across practitioners; leads to practitioner-specific interpretation and analysis of literature on toxicity and effects. Need for considerations of nonchemical stressors in addition to chemical stressors	Compendia of screening level toxicity values (e.g., NOAA SQuiRT) are available but only to be used to identify the potential for risk, not final risk estimates or clean up. Many instances in regulatory or litigation settings where these screening values are misused as final pronouncements of risk, damage, or as clean up targets	Hope et al. 2006; EPA 1989; EPA 1992; EPA 1997; EPA 1998; EPA 2004
Exposure	Typically modeled based on assumptions regarding the frequency, duration and magnitude of contact with a contaminant; EPA and other guidance available to support models	Measured or modeled	Modeled exposures are used like in human health risk assessment, but site-specific measurement of exposures provides most direct measure of exposure that takes into account ecological factors (e.g., species distribution and movement) and chemical factors (e.g., bioavailability)	EPA 1989; EPA 1992; EPA 1993; EPA 1999; EPA 2001; EPA 2011

Table 1: Contrast Between Human and Ecological Risk Assessment

ELEMENT	HUMAN HEALTH RISK	ECOLOGICAL RISK	COMMENT	REFERENCE
How are assessments conducted and what is acceptable?				
Guidance	Common approach for assessing human health risk generally based on EPA/NAS guidance on risk assessment generally accepted by most practitioners, adopted by states, and mirrored in international guidance (e.g., WHO)	No common approaches universally accepted	EPA guidance followed in some settings but not all; some states have specific guidance for ERA that mirrors EPA guidance (e.g., TCEQ), others have no guidance or guidance that differs from EPA or is more screening-level focused(e.g., RBCA)	Hope et al. 2006; Suter et al. 2016; EPA 1989; EPA 1992; EPA 1997; EPA 1998; EPA 2001
Risk thresholds	Human health risk metrics generally accepted to be based on cancer risk (e.g., 1 in a million risk); and non cancer hazards (e.g., hazard quotients <1)	No generally accepted metrics for defining effects on populations, communities or ecosystems	Direct measurement in the field on the condition of populations (e.g., organisms abundance, population, productivity) and comparison to reference/background conditions is often proposed as a way to evaluate site-specific risks/injury but no consensus on what to measure, how to compare and how to define reference/background	Hope et al. 2006; Suter 1996; Suter et al. 2016; EPA 1998; EPA 2003b; EPA 2004
Decision points	EPA sets clear guidance regarding acceptable or unacceptable risk and those are broadly adopted by practitioners; for cancer risk, risks less than 1 in a million are generally accepted as indicating an acceptable level of risk	No guidance on what is an acceptable level of ecological risk	Screening risk assessments are often based on simple comparisons of exposure to effects using a ratio (i.e., hazard quotient) approach, but consensus is lacking on what toxicity data to use (e.g., which endpoint, effect or no effect levels) or if a hazard quotient approach provides meaningful data for indicating potential risk	Suter et al. 2016; EPA 1998; EPA 1999

Toxic Tort or Statutory Claim by Private Litigant or Government Entity

Claims based on harm to an ecosystem can arise in toxic tort or statutory actions in which a private litigant, a state, or some other governmental entity alleges that releases of harmful substances by the defendant have impacted an ecosystem, thereby requiring extensive remediation costs or personal injury compensation, or both. *See, e.g., Ruff v. Ensign-Bickford Indus., Inc.,* 171 F. Supp. 2d 1226, 1229 (D. Utah 2001) (discussing testimony of ecological risk assessment expert in nuisance and product liability lawsuit by landowners near manufacturing plant who alleged that they contracted cancer from chemicals that "left the defendants' plant via a water pathway that carried the chemicals into soil and wells on plaintiffs' properties," and alleged that plaintiffs "contracted cancer by eating produce grown in this contaminated soil and from eating fish grown in ponds on their properties.").

Lawsuits seeking redress for damages to ecosystems have alleged common law causes of action such as nuisance, trespass, negligence, and product liability. *See, e.g., Interfaith Cmty. Org. v. Honeywell Int'l, Inc*., 263 F. Supp. 2d 796, 850 (D.N.J. 2003) (federal district court in bench trial holds Honeywell strictly liable under New Jersey common law for damages and injunctive relief in connection with predecessor company's "abnormally dangerous activity" of disposing of chromium ore processing residue at site of former production facility), *aff'd*, 399 F.3d 248 (3d Cir. 2005).

Non-governmental associations (NGOs) such as "river keeper" organizations have brought citizen suits alleging ecological damages under common law theories as well as under statutes such as the Clean Water Act, 33 U.S.C. §1251 *et seq*., or the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §6901 *et seq*. *See, e.g., Maine People's All. and Nat. Res. Def. Council v. Mallinckrodt, Inc.,* 471 F.3d 277 (1st Cir. 2006) (affirming district court's order that former chemical manufacturer pay for scientific study of mercury contamination downriver of plant, and, if needed, remediation of downriver area). In *Maine People's Alliance,* the district court examined "the available data concerning mercury contamination in various species in the lower Penobscot, including benthos, killfish (minnows), lobsters, blue mussels, cormorants, osprey, and eagles," and "[t]his examination led the court to conclude that 'mercury is methylating downriver' and that 'methylmercury is bioavailable, entering biota, and biomagnifying throughout the food web.'" *Id.* at 282 (affirming *Maine People's All. v. Holtrachem Mfg. Co., LLC*., 211 F. Supp. 2d 237 (D. Me. 2002)); *see also Ohio Valley Environmental Coalition, Inc. v. Fola Coal Co., LLC*, 845 F.3d 133 (4th Cir. 2017) (in citizen suit brought by environmental groups, affirming federal district court's findings that defendant's discharges into the Stillhouse Branch creek tributary contributed to "a significant adverse impact to the chemical and biological components of the stream's aquatic ecosystems" and affirming appointment of special master and permanent injunction for corrective action); *PennEnvironment v. PPG Indus., Inc.,* 127 F. Supp. 3d 336, 375 (W.D. Pa. 2015) (in citizen suit brought by environmental organization, finding manufacturer liable under RCRA for past disposal of slurry waste into former sandstone quarries; wildlife was reported in area near disposal site, including deer, birds, and squirrels, site was accessible by children, and exposure to high pH leachate and seep water presented potential for unacceptable risks, including skin and eye irritation and gastrointestinal effects).

The novel use of the public nuisance doctrine to sue a product manufacturer based on the improper use or disposal of its products by other parties has been subject to criticism.

In addition, governmental entities have sought compensation for ecosystem damages by asserting novel theories of recovery, including public nuisance, against manufacturers based on their customers' use and release of products into the environment. *See, e.g., Port of Portland v. Monsanto, et al.*, No. 3:17cv00015-MO, 2017 WL 57777 (D. Or., filed Jan. 4, 2017) (alleging public nuisance, common law indemnity, product liability design defect, product liability failure to warn, negligence, post-sale negligence, and trespass, and seeking compensatory and punitive damages, based on allegations that the company sold PCB-containing products to customers whose use or disposal of those products caused PCB contamination of Portland waters and injured the water, sediment, fish and wildlife); *State of Washington v. Monsanto, et al.*, No. 16-2-29591-6-SEA, 2016 WL 7188606 (Wash. Super., filed Dec. 8, 2016) (alleging public nuisance, product liability design defect, product liability failure to warn, negligence, equitable indemnity, and statutory trespass, and seeking compensatory damages, damage for injury to natural resources, including the economic impact to the state and residents, and clean-up costs, based on allegations that the company sold products containing PCBs and the use or disposal of those products by others injured the natural resources of Washington State).

The novel use of the public nuisance doctrine to sue a product manufacturer based on the improper use or disposal of its products by other parties has been subject to criticism. *See, e.g.,* Peter Hayes, *Is the Public Nuisance Universe Expanding?,* 32 Toxics Law Reporter 86 (BNA Jan. 26, 2017) (noting defense counsel's criticism of the expanded use of public nuisance as "so vague and malleable that it can accommodate almost every wrong"); *see also* J.B. Ruhl, *Making Nuisance Ecological,* 58 Case W. Res. L. Rev. 753, 776–77 (2008) (noting "the many criticisms of nuisance law in the modern pollution control context," including "difficult questions of causation").

Some courts have dismissed public nuisance claims based on post-sale contamination on the grounds that the defendant could not control post-sale handling of the product. *See Town of Westport v. Monsanto Co.*, No. CIV.A.-14-12041-DJC, 2015 WL 1321466, at *3–4 (D. Mass. Mar. 24, 2015) (dismissing nuisance claim based on PCB-containing products because defendant manufacturer, post-sale, no longer had the power to abate the nuisance); *see also City of Bloomington, Ind. v. Westinghouse Elec. Corp.*, 891 F.2d 611, 614 (7th Cir. 1989) ("Since the pleadings do not set forth facts from which it could be concluded that Monsanto retained the right to control the PCBs beyond the point of sale to Westinghouse, we agree with the district court that Monsanto cannot be held liable on a nuisance theory."); *But see San Diego Unified Port Dist. v. Monsanto Co.,* No. 15-CV-578-WQH-JLB, 2016 WL 5464551, at *8 (S.D. Cal. Sept. 28, 2016) (denying dismissal of port district's nuisance claim based on post-sale contamination of waterways by PCB-containing products); *City of Spokane v. Monsanto Co.*, No. 2:15-CV-00201, 2016 WL 6275164 (E.D. Wash. Oct. 26, 2016) (denying dismissal of nuisance claim).

The remedies sought in ecosystem damages cases might include injunctive relief in the form of an order for remediation, an order to pay for scientific studies to assess whether remediation is needed, compensatory and punitive damages, or a combination of these.

Government (Federal or State) Claim to Mandate Remediation

The federal EPA or other governmental entities may bring a lawsuit under CERCLA, 42 U.S.C. §9601 *et seq.*, or under state law equivalents. Through CERCLA, the EPA was given the authority to seek out parties allegedly responsible for any release of hazardous substances into the environment and to require them to remediate or pay for remediation to ensure that the affected area is brought back into compliance with applicable or relevant regulatory standards, largely focused on human health. In addition, such lawsuits may seek to require a defendant to remediate damage to ecosystems and involved species of organisms. *See, e.g., United States v. Georgia-Pac., LLC*, No. CIV.A. 1-09-CV-429, 2009 WL 3413594 (W.D. Mich. Sept. 30, 2009) (describing human health and ecological health risk assessments for Kalamazoo River Superfund Site in CERCLA action brought by EPA; discussing potential risks to human health for different exposure pathways, including the consumption of fish from the river; observing potential risk to animals that eat fish (such as mink), omnivorous birds such as robins that consume earthworms, and terrestrial mammals such as the red fox who forage near the river and eat prey animals that have taken up substantial amounts of PCBs).

Defense of these claims often involves negotiations with the EPA, state agencies, or both, regarding the extent of the alleged damage and the appropriate scope of remediation.

Natural Resource Damages for Lost "Services" Under CERCLA

In addition to CERCLA actions to require defendants to remediate or pay for remediation, government agencies may bring claims for natural resource damages (NRD) for the loss of ecological resources (such as lost habitat or wild animals killed or injured by a hazardous substance) and human use "services" (for example, the non-economic recreational or aesthetic benefits of fishing or viewing wildlife). *See* 42 U.S.C. §9601(16) (defining "natural resources" as "land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources…."). Natural resource damage claims are brought on behalf of the public by federal, state, or tribal agencies (trustees) against parties alleged to be responsible for unpermitted releases of oil or hazardous substances that have allegedly injured natural resources and prevented the public from enjoying the natural resources for a certain period of time. Natural resource damages assessments must take into account the complexity of ecosystems and the potentially large number of species affected. *See* Allen Kanner, *Natural Resource Restoration*, 28 Tul. Envtl. L.J. 355, 359 (Summer 2015) ("Ecosystems are unique, delicate, and infinitely complex, and there are inherent limits on scientists' ability to understand any given ecosystem. Similar to the art of restoring paintings or practicing medicine, natural resource restoration is both an art and a science.").

Natural resource damage claims are limited to injuries to natural resources owned or under the control of the governmental trustees; claims for natural resource damages on private property are not included. 42 U.S.C. §9601(16).

The amount of the NRD assessed can be substantial. In 2015, BP agreed to a settlement with the federal and five state trustees that included, among other items, $8.1 billion in natural resource damages arising from the April 20, 2010, Macondo-well blowout and the massive oil spill that followed in the Gulf of Mexico. *See, e.g.,* Press Release, U.S. Department of Justice, U.S. and Five Gulf States Reach Historic Settlement with BP to Resolve Civil Lawsuit Over Deepwater Horizon Oil Spill, (Oct. 5, 2015). The BP NRD settlement was meant to compensate for the harm done to habitats such as coastal wetlands, marine mammals, fish and water column invertebrates, sturgeon, submerged aquatic vegetation, oysters, sea turtles, and birds and lost recreational use. *Id.*

Uncertain Standards Make Ecological Damage Claims Challenging to Defend

The issues facing defense counsel are similar whether ecological damage claims arise in private party toxic tort or product liability lawsuits, EPA enforcement actions seeking remediation, or natural resource damage claims. However the claim arises, the uncertainty and the lack of clear standards defining "ecological damage" makes potential liability hard to predict.

Defense attorneys are typically more familiar with human health claims, which are generally more common than ecosystem claims. Helpful resources in *human health risk assessment* may be found in the list of resources referred to above. EPA, Risk Assessment Guidelines, *supra*; EPA Risk Assessment Guidance for Superfund (RAGS), Volume 1, including part A (EPA 1989), part D (EPA 2001), part E (EPA 2004), and part F (EPA 2009); EPA Exposure Factors Handbook (EPA 2011); Update of Standard Default Exposure Factors (EPA 2014); Human Health Toxicity Values in Superfund Risk Assessments (EPA 2003b). Helpful resources in *ecological risk assessment* may also be found in the list of resources. EPA, Risk Assessment Guidelines, *supra*; Framework For Ecological Risk Assessment (EPA 1992); Wildlife Exposure Factors Handbook (EPA 1993); Ecological Risk Assessment Guidance for Superfund: Process For Designing and Conducting Ecological Risk Assessments, Interim Final (EPA 1997); Guidelines for Ecological Risk Assessment (EPA 1998); Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA 1999); The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (EPA 2001); Generic Ecological Assessment Endpoints (GEAEs) for Ecological Risk Assessment (EPA 2003); Framework for Inorganic Metals Risk Assessment (EPA 2007); Risk Characterization for Ecological Risk Assessment of Contaminated Sites (Suter 1996).

The table on page 28 compares the elements to human health risk assessment and to ecological risk assessment, illustrates some of the key similarities and differences of the two, and demonstrates the complex issues that may arise when defending ecological damage claims. The assessment elements include species of interest and the assessment focus, the cancer risk, other human health risks, testing, toxicity criteria, exposure, sediment sampling, and state risk assessment programs, if they exist exist.

Species of Interest and Assessment Focus

As noted above, human health assessment involves only one species, human beings,

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and focuses on the probability of death or injury to an individual person. *See* EPA 1992, *supra*; EPA 1998, *supra*; EPA 1999, *supra*. Ecological risk assessment involves multiple species, with the focus of the assessment placed not on individual animals but on (1) populations of organisms; (2) communities, which are defined as the combination of populations in a defined area; and (3) the ecosystem itself, which includes the interactions of populations and communities of organisms with the surrounding physical and chemical environment. Suter *et al*. 2005; EPA 1992; EPA 1997; EPA 1998; EPA 2003a; EPA 1999; EPA 2004; Suter 1996.

Cancer Risk

The type of toxic effects evaluated in human risk assessments differs from those evaluated in ecological risk assessments. A human risk assessment might focus on identifying whether an excess lifetime cancer risk exists. In contrast, cancer risk is not typically a focus of an ecological risk assessment. Cancer is most often a disease in older members of a population; in ecological systems, older organisms are typically no longer reproducing and therefore not significant to the continuation of the population. EPA 1997; EPA 1998; EPA Carcinogen RA 2005; EPA 1989. Notwithstanding this, the U.S. Department of the Interior has defined cancer as an indicator of natural resource injury under CERCLA damage assessment regulations. *See* 43 C.F.R §11.62 (f)(1)(i).

Ecological effects can be caused by a variety of factors beyond regulated hazardous substances.

Non-Cancer Risks

A human health risk assessment evaluates the possibility of effects to an individual's organs (*e.g.,* kidney or liver) or organ systems and function (*e.g.*, the ability to produce healthy children). In contrast, an ecological risk assessment typically does not evaluate effects on an individual organism, but instead it evaluates changes that occur in groups of organisms or the environment in which they interact. These changes include (1) the abundance and productivity of populations of organisms; (2) species diversity and the composition of communities of organisms; and (3) ecological processes, such as nutrient cycling in an ecosystem. Suter *et al.* 2005; EPA 2003a; EPA 1998; EPA 1997; EPA 1999. Effects on ecological populations are sometimes estimated by evaluating toxicity in individual members of the population based on changes in growth, reproduction, or survival, and by extrapolating or modeling how those individual effects translate to the population of organisms. However, there are no universal models for estimating population-level effects, and opposing experts often come up with vastly different results when analyzing the same data. Suter *et al.* 2005; EPA 2003a; EPA 1998; EPA 1997; EPA 1999.

Testing

Direct testing, that is, controlled and designed exposure to assess toxicity, is not conducted on people. In contrast, ecological risk assessment commonly involves toxicity testing using sediment or surface water to characterize the potential toxicity of a chemical, or it involves toxicity testing with surrogate organisms in the laboratory or in the field. EPA 1994; EPA 1997; Suter 1996. Toxicity tests are used to determine whether surface waters and sediments are harmful to organisms in the ecosystem, and they also can be used to determine if any particular chemical is the cause of any observed harmful effects.

Ecological effects can be caused by a variety of factors beyond regulated hazardous substances. Some of these factors may include low dissolved oxygen associated with sewage discharge, sedimentation from farms, or urban development. Direct toxicity testing of surface water or sediments—along with testing at reference locations from nearby areas that are removed from the source of hazardous chemicals being investigated—can provide insight into the cause of any toxicity that is observed. Testing in reference areas also can be used to establish "baseline" or background conditions against which site conditions can be evaluated.

Toxicity Criteria

Most practitioners in human health assessment use generally accepted sources of toxicity criteria, such as the EPA's Integrated Risk Information System (IRIS), which is available online. EPA, IRIS, *supra*.

> IRIS remains in the first tier of the recommended hierarchy as the generally preferred source of human health toxicity values. IRIS generally contains reference doses (RfDs),reference concentrations (RfCs), cancer slope factors, drinking water unit risk values, and inhalation unit risk values that have gone through a peer review and EPA consensus review process. IRIS normally represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review.
> EPA 2003b.

In contrast, there is no generally accepted source of toxicity data for ecological risk assessments. There is also a need to consider whether an ecosystem is being affected by nonchemical stressors in addition to chemical stressors, such as low dissolved oxygen in surface water habitat, habitat loss, or nonnative species invasions (for example, the zebra mussel in the Great Lakes). *See* EPA, Great Lakes, Invasive Species, https://www.epa.gov. The lack of clear guidance allows for practitioner-specific interpretation and analysis of literature on toxicity and effects. *See* EPA 1992; Hope *et al.* 2006 (nonchemical stressors); EPA 2004; EPA 1989; EPA 1998; EPA 1997. This can often set the stage for a "battle of the experts" because there is no universally accepted approach.

Some collections of screening-level toxicity values are available, such as the Screening Quick Reference Tables (commonly called SQuiRTs) developed by the National Oceanographic and Atmospheric Administration (NOAA). *See* National Oceanic & Atmospheric Administration, Screening Quick Reference Tables (NOAA SQuiRTs), http://response.restoration.noaa.gov. The SQuiRTs provide chemical-specific concentration limits for a variety of chemicals in surface water and sediment that are potentially associated with some type of adverse effect in certain ecological settings. However, the SQuiRT screening values are often misused in regulatory or litigation contexts; they are intended to be used only to identify the *potential* for risk. NOAA very specifically states that "they do not represent official NOAA policy and do not constitute criteria or clean-up levels." *See* NOAA Office of Response and Restoration, SQuiRT Cards, http://response.restoration.noaa.gov ("The SQuiRT cards are intended for preliminary screening purposes only: They do not represent official NOAA policy and do not constitute criteria or cleanup levels. NOAA does not endorse their use for any purpose other than preliminary screening.").

Despite that explicit denial, some plaintiffs' counsel misleadingly refer to them as "SQuiRT regulations" and assert that the SQuiRT tables define ecological cleanup standards. It should be noted that NOAA has distanced itself from the use of SQuiRTs, which calls their continued validity into question; the tables are no longer being maintained and have not been updated since 2008, and the NOAA website cautions that the SQuiRT tables "may contain outdated or broken links." *Id.* Regardless of the numerous qualifiers, a jury and some less-sophisticated state environmental agencies that do not understand the complexities of ecological risk assessment might still gravitate to these tables for lack of an alternative bright line.

The proper context for the SQuiRT tables is as screening levels to determine whether further evaluation is needed. If a tested level is below the screening standard, it should not be considered problematic, but if the tested level is above the screening standard, then a site-specific analysis should be done to determine the actual ecological conditions of the site in terms of the chemistry, species, and interactions between species.

Other commonly used *preliminary* ecological screening standards for soil can be found in EPA national and regional guidance, such as EPA Ecological Soil Screening Levels (Eco-SSLs). EPA Eco-SSLs 2005: Ecological Soil Screening Level Guidance. More recently (January 2017), the Texas Commission on Environmental Quality (TCEQ) has developed a set of chemical and media-specific ecological screening benchmarks for use in conducting ecological risk assessments in Texas. *See* TCEQ, Ecological Risk Assessments, What Is an ERA?, https://www.tceq.texas.gov. These benchmarks have been consolidated from a wide range of publically available sources, including the EPA's Eco-SSL tables and the original publication sources included in NOAA SQuiRT tables. *See* Supporting Documentation for the TCEQ's Ecological Benchmark Tables (TCEQ 2017).

Exposure

In a human health assessment, exposure is typically modeled based on assumptions regarding the frequency, duration, and magnitude of contact with a contaminant. The EPA and other government guidance are readily available to support models. EPA 1989; EPA 2001; EPA 2011.

Exposure models are also used in the ecological risk assessment context. However, because the assessment needs to evaluate exposures across all members of an ecological population or community, simple exposure models coupled with simplifying assumptions will in most cases not provide a robust or accurate estimate of exposures. Additionally, simple models and assumptions are not appropriate for modeling complex processes such as chemical accumulation within an ecological food web. In those cases, it is important to include site-specific measurement of exposures because site-specific data provides the most direct measure of exposure that takes into account ecological factors (for example, species distribution and movement) and chemical factors (such as bioavailability). EPA 1992; EPA 1999; EPA 1993.

Sediment Sampling

While the general topic of sediment sampling is more appropriate for a stand-alone article, it deserves some reference here, given that ecological risk to aquatic organisms is often measured by the concentration of chemicals detected in the sediment. The scope of sediment sampling and the type of sediment sampling that is performed are factors that could affect an ecological risk assessment. Although these concepts are also relevant to human health risk assessments, there are different considerations.

Numerous government publications and technical papers advise that the effect of sediment contamination on the ecosystem should generally be evaluated within the "biologically active zone" (BAZ), which is the portion of the sediment column in which biological activity occurs (as determined by the presence of organisms). Under most aquatic settings, the BAZ occurs within the top 4 to 6 inches (10–15 cm) of the sediment, though in some settings it could be as shallow as the top 2 inches (5 cm). *See, e.g.*, EPA 2015.

Ecological risk assessments should use data collected from the BAZ; data collected from deeper sediments does not represent the conditions to which organisms could be exposed. Experienced regulators will often understand and accept that scope of sampling, but often plaintiffs' counsel will not, particularly when the highest concentrations of a contaminant are buried at a depth below the BAZ. Claimants might argue against limiting or excluding deeper sediment samples by hypothesizing scenarios in which the animals would be exposed to lower depth impacts, such as possible future dredging or alleged "deep burrowing" animals.

Metals are common contaminants at industrial sites, both naturally occurring metals and residuals of various industrial operations. A chemical test known as "analysis of acid-volatile sulfide and simultaneously extracted metals" (AVS/SEM) is used to determine the bioavailability of certain metals in sediment. EPA 2007. If a sediment environment is anoxic and sulfides are present at certain concentrations, the sulfides can bind certain metals (*e.g.*, Cd, Ni, Cu, Pb, Zn) so that those metals are not bioavailable to the environment despite the concentrations of metals detected. Thus the AVS/SEM test is a well-established method to assess ecological risk that should be considered, depending on the complexity of a site, and whether screening standards are exceeded. The only limitation is the current small number of metals that have been scientifically shown to be restricted by sulfide binding. In addition, pH and total organic carbon should be evaluated in certain circumstances to determine if they would have a binding property at a site for metals or non-polar organic chemicals, or both. *See* Interstate Technology & Regulatory Council (ITRC), Incorporating Bioavailability Considerations into the Evaluation of Contaminated Sediment Sites, Contaminated Sediments Team (ITRC 2011), http://www.itrcweb.org.

In a human health assessment, exposure is typically modeled based on assumptions regarding the frequency, duration, and magnitude of contact with a contaminant.

State Ecological Risk Assessment Program

Unlike human health risk-based state regulatory programs, which are widely adopted throughout the United States and other parts of the world, state ecological risk assessment programs are less common and vary widely in terms of structure and science. For example, the Louisiana Department of Environmental Quality has a very robust risk-based corrective action (RBCA) human health program known as "RECAP," but the ecological guidance in this document is very limited. *See* Louisiana Department of Environmental Quality, Risk Evaluation, Corrective Action Program (LDEQ RECAP 2003) (http://www.deq.louisiana.gov), (http://www.deq.louisiana.gov). It is largely contained in Chapter 7, a three-page section of the 100-plus page document, which describes the ecological risk assessment in very broad terms and largely relying on EPA guidance. LDEQ RECAP 2003, at 110.

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Contrast that program with that of the Texas Commission on Environmental Quality (TCEQ), which has had a detailed, ecological risk assessment program for many years, and in January of 2017 issued new guidance specifically on how to conduct ecological risk assessments at remediation sites in Texas, as well as how the TCEQ might evaluate those assessments. *See* TCEQ, Ecological Risk Assessments, Conducting Ecological Risk Assessments at Remediation Sites in Texas, https://www.tceq.texas.gov, (TCEQ 2017). The new, 239-page guidance provides a detailed approach to what it calls "ERAs," including use of a default ecological Protective Concentration Level (PCL) Database for soil and sediment impacts for a variety of wildlife receptors and chemicals of concern. The default values can be used to develop cleanup levels or can be modified to account for site-specific factors. TCEQ 2017.

Washington state and California are also recognized for having robust ecological risk and damage assessment programs. The California programs are California EcoNOTEs (http://www.dtsc.ca.gov), and CalEcotox 2016 (http://oehha.ca.gov).

The Washington Toxics Cleanup Program, run by the Washington State Department of Ecology, involves a Sediment Management Standards Rule (http://www.ecy.wa.gov), and terrestrial ecological evaluation (http://www.ecy.wa.gov).

The more advanced a regulatory ecological risk assessment program, the more protection it provides in defending against ecosystem claims when a client is in compliance with the state program.

Strategies for Defending Against Ecological Injury Claims

So how does the defense counsel navigate these issues? Below are some strategic issues to keep in mind.

Consider the Audience

Different methods may be required to appeal to a jury than to a government regulator, and there are also differences in an effective approach, depending on whether the individual from the government agency is more technically oriented or more politically oriented.

Site Observations Don't Lie

Obtaining site-specific data can be critically important. Using a "standard" safe or unsafe level of a certain substance is not helpful for use across the board in different types of environments. Depending on the complexity of the site, typically a case should be viewed from a site-specific standpoint.

Seek Other Causative Factors

Resist any attempts of a claimant to attribute all damage or effects to a defendant's actions. Defense counsel should point out that not all of the observed effects are caused by the substance, contaminant, or facility at issue and should attempt to identify other factors or reasons for an observed depletion of certain populations of organisms. The regulator or plaintiff's counsel is likely to attempt to attribute all depletions to the presence of the substance at issue, but there may be other factors or reasons for population-level effects. Diffuse anthropogenic sources impact many ecosystems, and additional sampling in "reference" areas can be valuable to distinguish between site-related and regional effects. Often it can be demonstrated that the chemical involved is at a background level and did not come from a defendant's operations.

Demystify Scientific Terms to Counter Vague Fears

The goal is to find an effective way to communicate simple concepts to a regulator or a jury. Plaintiffs win when they can make the defense case seem complicated. Explain the relevant concepts simply and clearly; a clear understanding will make the issues less "scary" to a jury. Combat a plaintiff's "risk or potential for risk" case with simple themes that allow jurors to use their own common sense to understand the science better and help lead them to the correct result.

Seeing Is Believing

Demonstrative trial exhibits can be effective in telling your story visually. Site photographs and videos can be compelling evidence to rebut a plaintiff's claim that a site is an ecological disaster. Favorable images of the property and the wildlife on and around the property can support the defense case and call a plaintiff's larger case into question.

The Future Is Now

If the underlying claim alleges historical impacts, jurors may be inclined to understand that if a real problem existed, it would have manifested itself by now.

Garbage In, Garbage Out

A quantitative, ecological risk assessment is a calculation. If the inputs (or assumptions) are flawed or unrealistic, the final result will also be flawed or unrealistic. Is a claimant's expert using the maximum concentration taken from a single sample to draw conclusions across a 100-acre site? Is the claimant's expert consistently selecting assumptions that will conclude with the greatest risk result? Defense counsel should translate these unrealistic assumptions to everyday scenarios that a juror can easily understand.

The Cure Is Often Worse than the Alleged Problem

Often, a plaintiff uses the specter of ecological risk to support claims for a costly remediation. Defense counsel should focus on the ecological harm posed by a plaintiff's remediation plan (which is often developed separately from the ecological risk assessment). By placing the ecological risk posed by the remediation plan on trial, defense counsel often can expose flaws in a plaintiff's case and demonstrate the absurdity of the positions being taken by the plaintiff's counsel and experts.

Early Involvement of Regulators Can Be Helpful

Natural resource damage claims are difficult to defend due to the complexity of the ecosystem involved and the potentially large number of species affected. Early involvement with the government agencies in identifying appropriate target species for study is useful in avoiding exaggerated injury claims. Often cooperative agreements for funding such studies with regulators can appropriately focus the scientific data generated.

Advocate Science-Based Rather than Fear-Based Solutions

It is important to communicate that the mere presence of a particular chemical at a particular level does not necessarily mean that an unacceptable risk is present. There necessarily has to be a concept of acceptable risk. The levels of every measureable chemical do not have to be zero. Some substances are naturally occurring. A chemical can be *potentially* hazardous, but—as with human health risk—whether it is actually hazardous depends on many other variables.

Conclusion

Defense counsel need to be aware of the complexities and potential pitfalls of ecological damage claims, and be prepared to address issues involving multiple species and multiple interactions among different organisms and populations in a complex ecosystem. It is to defense counsel's advantage to be familiar with some of the tactics that the opposing counsel may use to take advantage of the lack of clear regulatory guidelines to evaluate toxicity, exposure, and risk to multiple species of fish, birds, insects, and animals. FTD