Habitat and Resource Equivalency Analyses in Resource Compensation and Restoration Decision Making

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Of the scientific fields relevant to the environmental practitioner, none are more complex than those that attempt to understand and define the impacts of human activity on ecosystems. During a congressional hearing, former Forest Service Chief Jack Ward Thomas famously quoted ecologist Frank Egler in describing the problem as, at some level, unknowable: "For not only are ecosystems more complex than we think, they are more complex than we CAN think."

Nonetheless, those who work on projects with impacts on natural resources are increasingly being called on to make decisions premised on some level of understanding of the costs of past and future impacts of human activities on ecosystems. These decisions are being made in a wide variety of contexts that range from the assessment of liability for compensatory restoration of natural resources under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Oil Pollution Act (OPA) to the assessment of compensatory mitigation in federal permitting contexts—for example, as part of Section 404(b) analyses under the Clean Water Act (CWA), in evaluating jeopardy and adverse impact under the Endangered Species Act, or in environmental impact statements (EISs) evaluating project impacts under the National Environmental Policy Act (NEPA).

Two tools that have been developed to value, relatively, such past and future impacts are the habitat equivalency analysis (HEA) and the resource equivalency analysis (REA). As HEAs and REAs proliferate, it is important to understand under what the circumstances such tools can legitimately be used to deliver the intended result—a quantification of restoration required to compensate for service losses resulting from past or projected future injury to natural resources. It will also be important for lawyers to understand the factors that affect the legal defensibility of HEAs and REAs across the variety of contexts in which they are being used. This article will explore the use of HEAs and REAs in decision making. In addition to providing a general explanation of these methodologies, this article will examine the existing legal frameworks within which these tools are being applied. It will then provide case examples to illustrate the basic scientific framework of HEAs and REAs and to assess their fit within the appropriate legal context. Finally, it will provide recommendations for future application of these tools consistent with both legal and scientific frameworks.

In both HEAs and REAs, the valuation is achieved through the provision of restoration projects (compensatory restoration) that provide the same type and quality of ecological services that have been affected by a release of hazardous substances or that will be affected by a future permitted project. Because the services are identical, the prices of the services drop out of the valuation exercise. What is left is to determine the number of services that need to be provided and the cost of providing those services.

HEA uses a habitat metric, such as acres of land, and analyzes a change in services provided by that habitat, such as a percent reduction in services as a result of an injury. REA typically uses a resource metric that has had a population or quantity change. For example, an injury to a stream may have caused a reduction in the fish population. The number of fish in the stream reflects the reduction in services in the stream that resulted from a reduction in the quality of the habitat. Improvements in habitat at the site or elsewhere may increase the populations of fish and provide compensatory restoration. The number of fish projected to be produced through compensatory restoration is scaled with the number of fish lost as a result of the injury.

The legal framework for application of HEAs and REAs depends first on whether the analysis is intended for use in litigation. It also depends on whether the likely litigation is a de novo trial subject to federal or state evidentiary rules or a record review under a federal or state administrative procedures act. Whether or not litigation is initially intended, it is important to recognize that there are very few decisions made in the natural resources arena that are not potentially subject to litigation. That might be a de novo trial or a record review, but ultimately some fundamental legal constraints are likely to apply. Any HEA or REA offered in a trial de novo in federal or state court must survive challenges to the admissibility of expert evidence under Federal Rule of Evidence (FRE) 702 or its state-law equivalent. In federal court, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), governs. The majority of states either have adopted *Daubert* or apply an analysis consistent with *Daubert*.

To meet the *Daubert* admissibility standard, the expert evidence must be both reliable and relevant. "Reliable" means that the principles and methodology used by an expert are

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grounded in science. *Clausen v. M/V New Carissa*, 339 F.3d 1049, 1056 (9th Cir. 2003). Among the factors to be considered in judging reliability are (1) whether the scientific theory or technique can be and has been tested; *Daubert*, 509 U.S. at 583; (2) whether the theory or technique and the particular application has been subjected to peer review and publication; *Id.*; (3) whether the technique has an acceptable error rate, including whether the modeling is contradicted by real-world data; *New Mexico v. Gen. Elec. Co.*, 335 F. Supp. 2d 1266, 1286 (D.N.M. 2004); and (4) whether both the methodology and its application follow generally accepted scientific methods in the scientific community and, particularly if the scientific analysis did not grow naturally and directly out of independent research and has not been subjected to scrutiny through peer review and publication, whether objective sources show that it follows the scientific-evidence method, as practiced by at least a recognized minority of scientists in the field. *Clausen*, 339 F.3d at 1056.

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The second necessary piece of the *Daubert* admissibility standard is that the evidence must be "relevant," or "fit," meaning that "the reasoning or methodology underlying the testimony . . . properly can be applied to the facts in issue." *Daubert*, 509 U.S. at 592–93. *See, e.g.*, *Gen. Elec.*, 335 F. Supp. 2d at 1309–10 (in which court rejected expert testimony on estimated natural resource damages for lack of "fit"). Outside the context of de novo litigation, other laws and policies govern the rigor of legal review to be applied to administrative decision making, most classically the federal Administrative Procedures Act (the APA) and its state-law equivalents. In the context of the noncontested-case administrative proceedings in which the issue will most often arise, the APA requires a court reviewing an agency administrative decision to set aside agency actions found to be "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A). The arbitrary and capricious test applicable to informal agency decision making is explained in *Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Insurance Co.*, 463 U.S. 29, 43 (1983):

> Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors that Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.

In the context of natural resource-related claims, application of the arbitrary and capricious standard varies and sometimes is particular to the legal context. For example, in reviews under NEPA, the job of the reviewing court is to ensure that the agency took a "hard look at the environmental consequences" of its decision. *Balt. Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 97 (1983) (internal quotation marks and citation omitted).

Courts frequently cite *Davis County Solid Waste Management v. U.S. Environmental Protection Agency*, 101 F.3d 1395 (D.C. Cir. 1996), for the level of judicial review applied to the final requirement of 5 U.S.C. § 706(2)(A), that the action be "in accordance with law." In that case, the court set aside the Environmental Protection Agency's emission standards because it found that the standards "violate[d] the plain meaning" of the governing statute. 101 F.3d at 1405. More recently, additional constraints on administrative agencies have been imposed by the Information Quality Act (the IQA or Data Quality Act), Section 515 of Public Law No. 106-554, which, although not applicable to the agency decision itself, is applicable to information disseminated in the course of agency decision making. The IQA required the Office of Management and Budget to promulgate guidance to agencies ensuring the quality, objectivity, utility, and integrity of information disseminated by federal agencies. 67 Fed. Reg. 8452 (Feb. 22, 2002). Federal agencies were in turn required to publish their own agency-specific guidelines by February 2003. In some administrative proceedings, the IQA-driven information quality "correction" process is now proceeding in parallel to agency decision making. *See, e.g.*, BLM, Data Quality Guidelines/Bulletin for Peer Review (listing the BLM correspondence on corrections in the context of information in draft EISs).

HEAs and REAs have been used much more frequently in settlement contexts than they have in contested litigation. In the context of the settlement of federal claims for natural resource damages (NRD) under CERCLA, the sole role of the district court is to determine whether the consent decree is fair and reasonable and consistent with the statutory purposes, while also giving deference to the agency and to CERCLA's policy favoring settlement. *United States v. Fort James Operating Co.*, 313 F. Supp. 2d 902, 906–07 (E.D. Wis. 2004).

Scientific Framework of HEAs and REAs and Case Examples

Generally, a HEA or REA will include five steps: developing a scaling metric that can reflect the reduction in services at issue; measuring the level of services provided by the injured resource and comparing it with the baseline level of services (the condition absent the injury); determining or predicting changes in service levels over time; determining the scale of compensatory restoration that would provide services of the same type and quality; and determining the cost of providing

compensatory restoration using the most cost-effective methods. The following case examples illustrate the HEA and REA processes. For each case, understanding the legal context is critical to understanding the applicable legal standards.

In the context of de novo trials, one of the few reported cases upholding compensatory damages on the basis of an HEA is *United States v. Great Lakes Dredge & Dock Co.*, 259 F.3d 1300 (11th Cir. 2001), which was a trial in federal court subject to FRE 702 and *Daubert*. The United States, on behalf of the National Oceanic and Atmospheric Administration, sued Great Lakes Dredge & Dock Company for damages to the Florida Keys Marine Sanctuary under the National Marine Sanctuaries Act of 1972, 16 U.S.C. §§ 1431–1445. The United States claimed that the grounding of a vessel had destroyed 7,495 square yards of sea bottom, consisting of turtle grass, manatee grass, and finger coral, and that the dragging of a pipe under tow had created a scar along the sea bottom approximately thirteen miles long. 259 F.3d at 1302.

The United States' expert presented an HEA to "scale (quantify the size of) the equivalent area to be restored, and therefore, to quantify the damages for lost interim services and the acquisition of equivalent resources." *Id.* at 1305. The district court held that the United States was entitled to compensatory restoration damages for the interim lost use of the resources during the period from destruction to recovery. It found that the United States' use of HEA "was appropriate to scale the compensatory seagrass restoration project." *Id.* at 1303.

Great Lakes challenged the use of HEA in determining restoration costs, arguing first that "HEA is not appropriate under *Daubert* . . . as a methodology for determining damages in this case," and second, that the data used for the equations "could not pass muster under *Daubert*." 259 F.3d at 1305. The Eleventh Circuit upheld the application of HEA, concluding that "[t]he district court did not abuse its discretion when it determined that use of the HEA was appropriate and that the underlying scientific data satisfied *Daubert*." *Id.* Of the *Daubert* factors discussed above, the court favorably commented on the peer-review status of the work, noting that "the HEA was peer reviewed and accepted for publication prior to trial." *Id.* Although not discussed by the circuit court, the trial court had considered the *Daubert* "generally accepted scientific methodology" prong, finding that, as a relatively new technique, HEA had not had "the necessary time to truly gain general acceptance beyond the government agencies," but that "the relative 'youth' of a scientific technique does not make it any less valid." *United States v. Great Lakes Dredge & Dock Co.*, No. 97-2510-Civ-Davis, Order at 4 (S.D. Fla., July 28, 1999).

Two examples of the unsuccessful use of REAs in de novo trials are bench trials wherein the New Jersey Department of Environmental Protection sought to use REA to prove a claim for compensatory NRD based on injury to groundwater under the New Jersey's Spill Compensation and Control Act (the N.J. Spill Act). *N.J. Dep't of Envtl. Prot. v. Essex Chem. Corp.*, No. MID-L-5685-07 (N.J. Super. Ct. Law Div. July 26, 2010) (*Essex I*), *aff'd*, 2012 WL 913042 (N.J. Super. Ct. App. Div. Mar. 20, 2012) (*Essex II*); *N.J. Dep't of Envtl. Prot. v. Union Carbide Corp.*, No. MID-L-5632-07 (N.J. Super. Ct. Mar. 29, 2011) (not for publication) (*Union Carbide*). These were de novo trials in state court, governed by state evidentiary rules, so FRE. 702 and *Daubert* did not directly apply. They were also bench trials, wherein the judge's "gatekeeper" role to rule on admissibility of the expert testimony was not as critical. The trial judges in both cases admitted expert testimony under New Jersey Rule of Evidence 702, but ultimately found none of it persuasive and dismissed the state's claims. In *Essex*, the appellate court affirmed.

In both cases, the state sought to prove a right to compensatory restoration damages for injury to groundwater. The state's expert (the same in both cases) relied on an REA to calculate the cost of compensatory restoration. The state's expert did not use REA in the manner described above, which would have been focused at each step on the *services* provided by the injured groundwater and by the postulated restoration. Instead, he began by assuming that the necessary compensatory restoration would require replacing the entire volume of contaminated groundwater with uncontaminated groundwater at a preservation site, thus implicitly assuming both a 100 percent loss of all services from the groundwater at the subject site and that the only ecological services provided by the compensatory preservation site would be those provided by uncontaminated groundwater. He then estimated the amount of land that would overlie an equivalent amount of groundwater that could be purchased for compensation. He used the average cost of acquiring land in the area multiplied by the number of acres that resulted from his calculations as the basis for damages.

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Although in both cases the state's expert testimony was admitted, the trial judges were ultimately persuaded to reject that testimony, in part based on the same reliability and relevance factors applicable under *Daubert*. First, on the issue of reliability, although both plaintiff and defendant experts in *Essex* agreed that REA is a *generally accepted* scientific tool, the *Essex* trial court found that the state's expert had failed to establish why the REA methodology was appropriate in that particular case. Although the opinion does not directly address whether peer-reviewed literature exists to support this REA application, the trial court found it troubling that the state's expert "had not identified any *comparable cases* in which REA had been applied." *Essex II*, 2012 WL 913042, at *5 (emphasis added). Second, on the issue of relevance, the *Essex* trial court noted that REA "is ordinarily used in the context of injury to wildlife . . . . Plaintiffs failed to establish a basis for using that analysis in this case." *Id.* at *8.

Finally, both trial courts found the REAs to be inadequate

in that they focused only on the quantity of groundwater impacted and did not quantify the damages by looking at the ecological services or values lost as a result of the injury to groundwater, or the services to be gained by the proposed restoration. The *Essex* trial court noted that, although compensatory restoration claims under the N.J. Spill Act are not solely limited to loss of use damages, the state had not presented evidence of either any intention to use the site's groundwater or any specifics as to what nonuse value it had, and the REA did not account for how values were assigned. *Essex I*, slip op. at 14–15. Further, the REA did not provide credits to account for the fact that the proposed compensatory open-space acquisition would provide services in addition to groundwater services, such as recreational areas and habitats for wildlife. *Essex II*, 2012 WL 913042, at *9. The *Union Carbide* trial court similarly found that the state's expert had "made no adjustment for the different types and quality of services provided by the lost resource (groundwater) and the proposed restoration project (permanent land preservation). Undeveloped land provides services over and above protection of groundwater quality that are not accounted for. . . ." *Union Carbide*, slip. op. at 11.

The assessment must be focused and appropriately applied to answer the substantive legal question that has been raised, whether that is because it must "fit" under *Daubert* or must be "in accordance with law" under the APA.

In the settlement context, NRD trustees for the Hylebos Waterway in Washington achieved settlement of their NRD claims by first issuing for public comment a *Hylebos Waterway Natural Resource Damage Settlement Proposal Report* (*Hylebos Report*), which was built largely around an HEA. The *Hylebos Report* was based on an HEA in which the scaling metric used to reflect the reduction in ecosystem service was "discounted service acre years" of sediment services. Essentially, the trustees used the ecological services provided by the sediment benthos to a limited set of species as a surrogate for all NRD injuries at the site. Settlements were then negotiated over roughly a five-year period, resulting in more than a dozen settlements, each of which was entered as a consent decree in federal court, resolving claims under CERCLA, OPA, CWA, and the Washington Model Toxics Act. Settlements consisted of combinations of commitments to construct or pay damages to be used for the construction of restoration projects, payment of trustee oversight for that work, and payment of NRD assessment costs. In each case, the proposed consent decree was lodged in federal district court and published in the Federal Register for comment before entry. As discussed above, the standard applied by the court in that context is whether the settlement is fair and reasonable, giving deference to the agency and to CERCLA's policy favoring settlement.

It is important to note that the *Hylebos Report*, published three years before the first settlement under it, generated significant controversy. Disagreements were raised with respect to almost every aspect of the five stages of the HEA described above. With respect to the metric itself, disagreements were raised as to the species—and life-stage-specific focus of the HEA (on juvenile salmonid), habitat functional classifications, threshold-injury values, and the service-loss rate assumptions on which the HEA was built and the geostatistical estimation techniques by which it was applied. Disagreements were also raised with respect to baseline reductions in services not related to the contamination. Middle Waterway Action Committee report (June 17, 2002). Despite these technical disagreements with the initial proposed model, however, most parties eventually reached settlement. As discussed above, at that point judicial review applied only to the fairness and reasonableness of the settlement itself. In that context, without either *Daubert* or an APA-level review, the settlements passed muster.

The pending NEPA process for the Gateway Transmission Line in Idaho and Wyoming is an example of the use of an HEA in a noncontested administrative proceeding. It relies in part on an HEA to scale mitigation for the losses of habitat services for the Greater Sage-Grouse from the vegetation loss, noise, and human presence anticipated to accompany project development. The HEA was developed under a framework supplied by BLM biology staff and with the input of a multiple-agency and stakeholder technical advisory team. The Gateway HEA followed the five steps of the HEA outlined above. First, it developed a metric that scored the most important variables that influence the habitat services provided to the Greater Sage-Grouse, such as the distance from roadways, distance from fences, vegetation classifications, and distance from areas where the birds gather during mating season.

Second, it used the metric to measure both the habitat services provided in the predisturbance baseline condition and the reduction in those services at three different project phases: during construction, after construction but before full recovery of the habitat, and after habitat recovery. Third, it relied on peer-reviewed literature to establish recovery endpoints to account for the gradual recovery of services to baseline levels during and after restoration. For example, it assumed that the areas of sagebrush-dominated shrubland and steppe would provide 1 percent of baseline services five years after construction began, 5 percent of services at year nine, 20 percent of services at year twenty-four, and 100 percent of services at year 104. Fourth, it used the same metric to measure the habitat uplift provided by various habitat conservation measures proposed by the technical advisory team, including fence removal, restoration of preferred vegetation, removal of encroaching unfavorable vegetation, and conservation easements. Finally, it compared the cost of the proposed habitat conservation measures in light of the habitat services gained from those measures. BLM, *Addendum to the Draft Environmental Impact Statement for the Gateway West Transmission Line Project on the Effects of the Proposed Project on Greater Sage-Grouse* (June 2012) (the Sage-Grouse EIS Addendum).

Although the Sage-Grouse EIS Addendum has not yet been

subject to judicial review (as discussed above), if challenged the review would combine a "hard look" under NEPA and an arbitrary and capricious review under the APA. Comments submitted on the Sage-Grouse EIS Addendum have also raised issues under the IQA with the quality of the information on which the HEA relies, which will therefore provide another level of review, at least at the agency level.

Conclusions Regarding the Use of HEAs and REAs

The case examples above illustrate that HEAs or REAs may be useful to quantify impacts of activities on ecological services, but only when the assessment fully matches the legal framework in which it is being applied. In all cases, the assessment must be focused and appropriately applied to answer the substantive legal question that has been raised, whether that is because it must "fit" under *Daubert* or must be "in accordance with law" under the APA. For example, an HEA performed to assess natural resource damages under CERCLA will in any context need to directly answer the question posed by the statute: What are the "damages for injury to, destruction of, or loss of natural resources . . . resulting from [the] release"? 42 U.S.C. § 9607(a)(4)(C). The HEA will need to be focused so as to answer this question with respect to the specific injury to natural resources that is alleged to have resulted from the release.

In addition, the assessment must meet the applicable reliability standard, whether that is a full application of *Daubert*, an arbitrary and capricious review under the APA, a "hard look" under NEPA, or the "reasonable and fair" requirement for entry of a consent decree. This means that the degree of rigor with which the HEA must answer the substantive question will depend on the reliability standard applicable in the particular context. Using the same NRD example, if a cooperative NRD assessment has resulted in a settlement that will be entered through a consent decree, the court will review the HEA, along with all the other settlement factors, including litigation risk, and judge the reasonableness of the settlement. In that context, even a relatively simple HEA will likely pass muster.

If that same NRD assessment requires a federal restoration plan, however, the agency developing that plan will need to make certain that the information it disseminates in the course of its review meets the criteria of the IQA. Then, if the restoration plan is challenged in court under NEPA, the court will be required to take a "hard look" at the aspects of the HEA that answer whether the recommended compensatory restoration meets the restoration criteria of the rules enacted under CERCLA, 43 C.F.R. pt. 11, and to judge whether the HEA is "arbitrary and capricious," which would include finding that it is not inconsistent with other data before the agency. Finally, if a trustee intends to proceed to court under CERCLA to prove its NRD case, the HEA will need to satisfy a full *Daubert* analysis. In the latter case, it would be best if the HEA itself were peer-reviewed, but it must at least be consistent with peer-reviewed HEA applications (of which there currently are not many). It will need to be transparent (reproducible) and not contradicted by real-world data.

In other applications of HEAs and REAs, such as within NEPA processes, it will be important to recognize the differences between the use of these tools in a CERCLA case, in which the focus is on historical services losses, and in an EIS, in which the primary objective will be to determine appropriate levels of mitigation from the temporary disruption of various habitat services. Thus, it is important to match the specificity and rigor of the HEA or REA applications to the intended use.