From Fire Comes Life: Why Courts Assessing Forest Fire Damages Should Recognize Ecological Benefits

by Amanda Hemmerich

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Summary

Recent court decisions have awarded the federal government substantial recovery for damages from forest fires caused by a private party's negligent conduct. In traditional forest fire cases, plaintiffs typically recovered response and suppression costs, in addition to compensation for the value of damaged timber or restoration costs. By framing forest fire impacts as "natural resource damages" and "intangible environmental damages," the federal government has recovered increasingly large amounts for alleged harm to the environment and the value of lost ecosystem services. But a significant point of contention is whether there is injury to the natural environment or loss of ecological services following an unintentional forest fire that mimics a naturally occurring fire regime. Fire is an integral part of ecological landscapes and should be distinguished from traditional natural resource damages because of its beneficial effects. Forest fire damages should be evaluated under a framework that factors both beneficial and adverse impacts into recovery.

Over the past decade, the federal government has used state law to become increasingly aggressive in obtaining significant judgments[1] and settlements[2] in forest fire cases. In 2012, the federal government settled a case against California's largest private landholder, Sierra Pacific Industries, Inc., and several other timber industry defendants for an estimated $122.5 million.[3] In this case, the U.S. Department of Justice (DOJ) initially sought to recover damages close to $1 billion resulting from the Moonlight Fire, a fire that started on private land and then spread into two national forests where it burned over 46,000 acres. The increased demand for monetary recovery was partly based on "compensation for the degradation of natural resources (recreational and habitat values, for example) while the burned forest recovers from the fire."[4] This is only the most recent decision in which the federal government has been successful in recovering noneconomic damages to federal lands resulting from negligent fires caused by private parties.

While recovery of environmental damages was historically limited to resources that provided quantifiable economic products (chiefly timber), there has been a growing recognition in the last few decades that natural resources, as ecosystems, provide a wider array of services to society than merely serving as a source of raw materials.[5] It is not surprising that federal courts now acknowledge the legitimacy of recoverable damages for habitat and ecological service losses resulting from forest fires, with some claims

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1. *See* United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136 (E.D. Cal. 2008); United States v. CB & I Constructors, Inc., 685 F.3d 827, 42 ELR 20146 (9th Cir. 2012).
2. *See* Elizabeth Warmerdam, *Fires in National Forests Net $50M in Settlements*, Courthouse News Serv., June 7, 2013, http://www.courthousenews.com/2013/06/07/58340.htm (discussing agreement by Pacific Gas & Electric Co. and its contractors to pay the U.S. government to settle allegations of negligence in causing two forest fires in 2004 on federal land).
3. United States v. Sierra Pac. Indus., Inc., 879 F. Supp. 2d 1096 (E.D. Cal. 2012).
4. Letter from Benjamin B. Wagner, U.S. Attorney, E.D. Cal., to Hon. Darrell Steinberg, Pres. Pro Tempore, Cal. State Senate, and John A. Perez, Speaker, Cal. Assembly, Re: Trailer Bill Language for the Natural Resources and Capital Outlay Area of the Governor's Proposed Budget (Part 777—Timber Harvest Reform) (May 25, 2012), *available at* http://www.wildcalifornia.org/wp-content/uploads/2012/06/US_Atty_Letter_05.25.12.pdf.
5. James Peck, *Measuring Justice for Nature: Issues in Evaluating and Litigating Natural Resources Damages*, 14 J. Land Use & Envtl. L. 275, 277-78 (1999).

placing higher economic value on ecosystem services than on traditional forest products.[6]

Existing state statutes and recent lawsuits set legal precedents for recovering damages that could allow double or triple damages[7] for damaged timber as well as significant financial liability for damages to the natural environment, including losses associated with recreational use and "intangible" environmental losses.[8] Recent federal decisions have allowed parties to recover damages from forest fires to compensate for lost environmental services (for example, habitat, hydrological function, sediment control, and carbon sequestration) based on state laws and regulations, in addition to claims for compensation of more traditional goods and services (for example, forest restoration, fire suppression, lost timber, and lost property).[9]

The federal government has begun to frame the effects of forest fires as "natural resource damages,"[10] "intangible environmental damage,"[11] and "environmental and ecological damages"[12] by alleging harm to the environment and seeking recovery for the value of lost ecosystem services. However, natural resource damage claims have predominantly been associated with releases of hazardous substances or oil spills, not forest fires, and are recovered under federal laws such as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).[13] Yet it is clear from recent decisions that courts are willing to expand the common-law concepts of damage and harm to encompass forest fires and permit recovery of damages to the natural environment.

These natural resource damages create a new category of compensable damages with a broad range of potential monetary losses, where no quantification method has recognized the ecological role of fire. Under certain federal and state statutes, the federal government can recover noneconomic damages that result from injuries to natural resources.[14] These types of damages are premised on restoring the natural resource to its prior condition and compensating the public for the loss in services associated with natural resource injuries. However, a significant point of contention is whether there is an actual injury to the natural environment or loss of any ecological service following an unintentional forest fire that mimics a naturally occurring fire regime.[15] Therefore, it is important to understand the role of fire as an ecosystem process and properly characterize how a forest ecosystem is affected by fire in order to assess liability for potential fire damages.

This Article addresses the legal and scientific complexities of forest fire cases being framed as natural resource "damage" claims, and considers whether the traditional natural resource damage methodologies are appropriate for measuring forest fire damages. The purpose of the Article is to highlight the uniqueness of fire events and propose that the law determine forest fire damages based on ecological principles that account for both fire's beneficial and adverse impacts when assessing damages.

Part I of the Article provides some context for understanding how the natural environment is characterized and an overview of current valuation methods. Part II discusses specific statutory provisions governing liability for negligently caused fires and cost recovery for forest fire damages. Part III discusses how fire damages were traditionally measured and the transition toward recoverable damages for environmental harm. Part IV addresses the ecological significance of fire, and Part V discusses the application of natural resource valuation methods to forest fire damages. Finally, the Article concludes that recoverable damages should take the ecological role of fire into consideration because fire is an integral part of ecological processes and is distinct in its ability to provide both beneficial and adverse effects.

6. David A. Hanson et al., *Adapting Habitat Equivalency Analysis (HEA) to Assess Environmental Loss and Compensatory Restoration Following Severe Forest Fires*, 294 Forest Ecology & Mgmt. 166 (2013); *see, e.g.*, *CB & I Constructors, Inc.*, 685 F.3d at 837 (affirming the district court's decision that under California law the government could recover damages for all of the damages caused by fire, including intangible harm to the environment); United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1144 (E.D. Cal. 2008) (holding that the United States is entitled to recover damages caused by fire, including separate injuries to trees, soil, reforestation, and pre-merchantable timber costs).
7. *See, e.g.*, Or. Rev. Stat. §477.089(2)(b) (West 2013); Cal. Civ. Code §3346(a) (West 1997).
8. Thomas Deardorff & Svetlana Semenova, Exponent, *Environmental Damages Associated With Wildland Fires* (2014), *available at* http://www.exponent.com/files/Uploads/Documents/Newsletters/EP_2014_Vol1.pdf.
9. Steven S. Kimball, *Forest Fire Damages in Transition*, 56 Fed. Law. 38 (2009).
10. *Union Pac. R.R. Co.*, 565 F. Supp. 2d at 1138.
11. *CB & I Constructors*, 685 F.3d at 829.
12. United States v. Sierra Pac. Indus., No. CIV S-09-2445 KJM-EFB, 2012 WL 1898945 *1, *1 (E.D. Cal. May 23, 2012).
13. 42 U.S.C. §§9601-9675, ELR Stat. CERCLA §§101-405; *see* 42 U.S.C. §§9601, 9607(a) (2006) (providing liability for damages resulting from injury to natural resources).
14. Robin A. Cantor et al., Exponent, *Seeing the Forest Through the Trees: NRD and Dynamic Ecosystems* (2011), *available at* http://announce.exponent.com/feature/wildlandfire/NRDA.pdf. *See also* Dave Owen, *The Biggest Natural Resource Damages Case You've Never Heard of*, Envtl. L. Professor Blog, Aug. 2, 2012, *at* http://lawprofessors.typepad.com/environmental_law/2012/08/the-biggest-natural-resource-damages-case-youve-never-heard-of.html.
15. A fire regime "[d]escribes the patterns of fire seasonality, frequency, size, spatial continuity, intensity, type (crown fire, surface fire, or ground fire), and severity in a particular area or ecosystem." U.S. Forest Serv., *Fire Effects Information System Glossary*, http://www.fs.fed.us/database/feis/glossary.html (last visited Feb. 28, 2016).

I. Anchor Point[16]: Damages to the Natural Environment

The concept of natural resource damages is expansive. "Damage is a legal concept determining what a liable party has to do or pay to make the public or environment whole for the injuries to natural resources."[17] Valuation of natural resources and ecosystem services enables courts to assess damages for environmental harm, deter polluters, and more effectively ensure the protection of natural ecosystems.[18] One of the most critical aspects of natural resource damage litigation is determining the value of a damaged resource. Given the broad scope of how natural resources are defined and the difficulty in measuring noneconomic resources, the litigated value of damages can vary significantly depending on the theoretical approach for valuing natural resources and the economic method used to measure the damage.[19]

A. *The Progression of Environmental Values*

Natural resources are generally thought of as the individual materials or substances occurring in the natural environment that provide economic and social services to human society.[20] The traditional definition of natural resources was limited to marketable products such as minerals, timber, and agricultural land.[21] However, advancements in ecological science and appreciation of forest ecology have led to a more informed understanding that forests provide value and services beyond traditional forest management objectives.[22] With its roots in natural resource management and environmental economics, the concept of ecosystem services holds that ecological systems produce goods and services that contribute to social and economic well-being. As such, the definition of natural resources has expanded to include ecological elements and those services derived from ecosystem processes.[23]

The expansive scope of services provided by natural resources introduces significant complexity in defining the "extent of these resources in the particular circumstances of natural resource damage litigation."[24] And although some services may be readily assigned a monetary value based on market systems, this approach has its limits in quantifying subjective elements and the value of lost services of the natural resource.[25]

The initial difficulty in measuring loss of use damages in natural resource claims is ascertaining the meaning of "value" and then determining which value characteristics of natural resources should be recoverable.[26] Damages to the value of a natural resource typically fall into two categories: harm to use values and harm to nonuse values. Use value refers to the worth of natural resources to individuals who directly or indirectly use them, both for consumptive uses (for example, timber production) and non-consumptive uses (for example, fishing or hiking).[27] Use values tend to be less controversial because they are easy to identify and the law uses existing market value when assessing damage to such resources.[28]

People also identify with intrinsic elements of the natural environment such as scenery, and place a value on knowing certain resources exist, or that a resource will be available in the future.[29] Existence value acknowledges that the presence of natural resources, even if an individual does not intend to use the resource, provides value to society.[30] Option value is the value that people place on having the option to enjoy something in the future, although they may not currently use it.[31] Similarly, bequest values are measured by people's willingness to pay to preserve the natural environment for future generations.[32]

B. *Valuation and Recovery of Environmental Damages*

In its simplest form, valuation of damages for harm or injury to natural resources is based upon a two-tiered system of analysis: (1) the cost of restoring the damaged resource or replacing it through acquisition of an equivalent resource; and (2) the determination of lost use and nonuse values of the natural resource from the time of injury until fully restored.[33] The second category primarily consists of noneconomic damages that reflect losses to natural resources that either do not have direct use or whose values could not be inferred using economic models.[34] These losses typically include impaired or destroyed habitat, diminished recreational opportunities, and aesthetic enjoyment of the natural resource. Prior to the Storrie Fire case[35] in 2008, noneconomic environmental damages were

16. An anchor point is "[a]n advantageous location . . . from which to start building a fire line. An anchor point is used to reduce the chance of firefighters being flanked by fire." U.S. Forest Serv., *Fire Terminology*, http://www.fs.fed.us/nwacfire/home/terminology.html#C (last visited Dec. 13, 2015).
17. Allan Kanner, *Tribal Sovereignty and Natural Resource Damages*, 25 Pub. Land & Resources L. Rev. 93, 102 (2004).
18. Frank B. Cross, *Natural Resource Damage Valuation*, 42 Vand. L. Rev. 269, 270 (1989) [hereinafter Cross, *NRD Valuation*].
19. Peck, *supra* note 5, at 279.
20. *Id*. at 277.
21. *Id*.
22. Hanson et al., *supra* note 6, at 166.
23. Peck, *supra* note 5, at 278.
24. *Id*. at 279.
25. *Id*. at 282.
26. Cross, *NRD Valuation*, *supra* note 18, at 281; Allan Kanner & Tibor Nagy, *Measuring Loss of Use Damages in Natural Resource Damage Actions*, 30 Colum. J. Envtl. L. 417, 420 (2005).
27. Cross, *NRD Valuation*, *supra* note 18, at 281.
28. *Id*.; Peck, *supra* note 5, at 279.
29. *See* Cross, *NRD Valuation*, *supra* note 18, at 285-97.
30. *Id*. at 281.
31. *Id*.
32. *Id*.
33. Thomas A. Campbell, *Economic Valuation of Injury to Natural Resources*, 6 Nat. Resources & Env't 28, 29-30 (1992).
34. Deardorff & Semenova, *supra* note 8, at 2.
35. United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1151-52 (E.D. Cal. 2008); *see also* McGregor W. Scott, U.S. attorney for the Eastern District of California, U.S. DOJ, Press Release, July 22, 2008. The Storrie Fire settlement was the federal government's first notable success in forest fire litigation for which it was awarded compensation for "damages to its natural resources."

traditionally seen in claims involving contaminated site cleanups or oil spills.

1. Federal Statutes: The Root and Seed for Recovering Natural Resource Damages

Several federal environmental statutes include provisions that authorize the recovery of natural resource damages and allow trustees to recover damages for injuries to natural resources held in public trust.[36] These statutes were enacted for the purpose of addressing releases and threatened releases of hazardous substances that could be detrimental to the natural environment.[37] The evolution of natural resource damage law and the need to determine ecological and noneconomic damages was prompted by the *Exxon Valdez*[38] oil spill.[39] This incident led to extensive efforts by federal agencies to develop regulations and guidance documents for assessing damages to natural resources, such as streams, wildlife resources, and aesthetic and recreational resources, as part of the Natural Resource Damage Assessment (NRDA) framework.[40]

These regulations implicitly recognize that existence and bequest values are within the permissible scope of noneconomic damages associated with oil spills and releases of hazardous materials.[41] Natural resource damage claims and related law are based on the policy perspective that natural resources have noneconomic value, albeit values that can be monetized.[42] Therefore, only compensation for these purportedly noneconomic values can be included in a natural resource damage claim.[43]

Natural resource damage claims are based on the restoration of damaged natural resources and serve to compensate the public for "[i]njury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury."[44] The measure of damages is usually the cost of restoring injured resources to their (pre-contamination) baseline condition, compensation for the interim loss of damaged resources while pending recovery, and the reasonable costs associated with assessing damages to the natural resource.[45] NRDAs are used to evaluate the extent of the harm to the natural resource and rely on methodologies prescribed by federal agencies, including habitat equivalency analysis and contingent valuation.[46]

2. Habitat Equivalency Analysis: Measuring Ecological Loss

Habitat equivalency analysis (HEA) is a common method to assess and determine compensation for resource injuries.[47] HEA is a service-to-service (or resource-to-resource) scaling method that is used to determine the level of compensatory restoration that is necessary to "make the public whole" without having to calculate any actual economic value of the lost resource.[48] This method follows a "compensatory restoration" approach and uses the cost of replacing services lost to the injury as the measure of damages.[49] It is based on the premise that the "public can be compensated for past losses of habitat resources through habitat replacement projects providing additional resources of the same type."[50]

HEA does not use a monetary measure of the value of lost natural resource services, but utilizes a technique to replace these resources with an equivalent resource by creating new habitat or improving injured habitat beyond the baseline level.[51] HEA assumes that equivalent habitats will provide equivalent services, such that years of lost services can be compensated for by restoring acres of additional habitat.

HEA has commonly been utilized for oil spills or hazardous substance releases to estimate interim losses of ecosystem services for purposes of measuring compensatory restoration damages. Its use in quantifying forest fire habitat damages involves determining a baseline for habitat services that would have occurred in the absence of the fire, and determining the lost services from the time of the event until ecosystem functions have been restored to baseline conditions.[52]

3. Contingent Valuation for Nonuse Damages

Contingent valuation is a method favored by environmental economists as a means to estimate the full range of the public's value of environmental resources.[53] Con-

36. CERCLA, 42 U.S.C. §9607(a) and (f); Clean Water Act (CWA), 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607, *see* 33 U.S.C. §1321(f)(5) (1994); Oil Pollution Act (OPA), 33 U.S.C. §§2701-2761, ELR Stat. OPA §§1001-7001, *see* 33 U.S.C. §§2702(b)(2)(A) (1994).
37. Marissa L. Curran, *The Wildlife Wildcard: Natural Resource Damages and Putting a Price on Nature*, 30 Nat. Resources & Env't 10 (2015).
38. In 1989, the tanker *Exxon Valdez* spilled nearly 11 million gallons of crude oil into Alaska's Prince William Sound. It is considered one of the worst human-caused environmental disasters in recent history. *See* Exxon Valdez Oil Spill Trustee Council, Oil Spill Facts, "Questions and Answers About the Spill," http://www.evostc.state.ak.us/%3FFA=facts.QA (last visited May 23, 2016).
39. Terry Fox, *Natural Resource Damages: The New Frontier of Environmental Litigation*, 34 S. Tex. L. Rev. 521, 521-22 (1993).
40. Hanson et al., *supra* note 6, at 167; *see also* CERCLA, 42 U.S.C. §§9601 et seq., 43 C.F.R. subtit. A, pt. 11, OPA, 33 U.S.C. §§2701 et seq., 15 C.F.R. §990, and CWA, 33 U.S.C. §§1251 et seq.
41. *See* 43 C.F.R. §11.83(d)(5)(ii) (1987); *see also* Allan Kanner & Mary E. Ziegler, *Understanding and Protecting Natural Resources*, 17 Duke Envtl. L. & Pol'y F. 119, 144 (2006).
42. *See generally* Cross, *NRD Valuation*, *supra* note 18.
43. *See* 43 C.F.R. §11.10 (2007); Peter E. Tolan Jr., *Natural Resource Damages Under CERCLA: Failures, Lessons Learned, and Alternatives*, 38 N.M. L. Rev. 409, 413 (2008) ("Natural resource damages are above and beyond the cost of cleanup under CERCLA.").
44. 42 U.S.C. §§9601(6), 9607(a)(4)(C) (2000).
45. *See, e.g.*, *id.* §§9607(a)(4), (f).
46. Curran, *supra* note 37, at 11.
47. Tolan Jr., *supra* note 43, at 417.
48. Hanson et al., *supra* note 6, at 167.
49. Cantor et al., *supra* note 14.
50. *See* National Oceanic and Atmospheric Admin, Damage Assessment and Restoration Program, *Habitat Equivalency Analysis: An Overview*, https://darrp.noaa.gov/economics/habitat-equivalency-analysis (last visited May 14, 2016).
51. Charles B. Anderson, *Damage to Natural Resources and the Costs of Restoration*, 72 Tul. L. Rev. 417, 478 (1997).
52. Hanson et al., *supra* note 6, at 166.
53. Jeffrey C. Dobbins, *The Pain and Suffering of Environmental Loss: Using Contingent Valuation to Estimate Nonuse Damages*, 43 Duke L.J. 879, 882

tingent valuation simplifies the process of valuing natural resources by asking the public what monetary value they place on certain resources.[54] This method involves researchers creating a hypothetical market in which the general public is asked what they would pay for the natural resource, what they would pay to avoid environmental harm to the natural resource, or what they would accept as compensation for the injury to or destruction of the natural resource.[55] By averaging the responses, the study results in a value that reflects how much individuals would be willing to pay for the existence of a resource and, therefore, how much the destruction or loss of that resource would cost the public.[56]

Contingent valuation has consistently been a source of controversy because it is entirely hypothetical and because it assumes that people's survey responses accurately reflect how they would respond in a marketplace transaction.[57] Opponents of this method generally argue that contingent valuation is too imprecise, untested, biased, and prone to overestimation of damages.[58] It also receives criticism for whether respondents have sufficient information or an adequate foundation in scientific principles to make a sound economic valuation of the damaged resource.[59]

Nonetheless, the contingent valuation method gained credibility in *Ohio v. U.S. Department of the Interior*, where the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit recognized that "existence values may represent 'passive' use, but they nonetheless reflect utility derived by humans from a resource, and thus, *prima facie*, ought to be included in a damage assessment."[60] The court found that the contingent valuation method was "consistent with congressional intent" and should be available as a method for measuring natural resource damages.[61] As a result, most federal regulations governing the assessment of natural resource damages endorse the use of contingent valuation.[62]

II. Watch Out Situations[63]: Forest Fire Liability and Recovery of Damages

In the absence of a federal liability scheme, the legal framework governing fire on public lands is federal tort claims litigation and concurrent state laws.[64] Because states maintain jurisdiction over national forests,[65] any applicable state forest protection or fire law also applies to federal lands. Therefore, the ability of the federal government to recover damages for harm to public lands caused by forest fires is governed by the law of the state where the fire occurred.[66] While there tends to be substantial overlap between the two causes of action, the general rule is that the costs of suppressing a fire can only be recovered by statute, whereas damage to property is potentially subject to both statutory and common law.[67]

A. Preparedness: Statutory Liability for Fire Damages

Many states impose liability upon a forest landowner or others based on negligence in the setting of a fire or in preventing the spread of a fire. In fact, many states have laws that require private landowners to keep any fire that starts on their land from spreading to adjacent lands.[68] Many of these statutes provide that a person who lawfully ignites a fire must do so in a reasonable manner to prevent it from escaping and damaging another's property. If the individual's negligence results in damage to another's property, that party can be liable for the full amount of damages.

State laws governing liability for damages caused by an escaped forest fire were passed during a time when large fires were less of a concern, more easily extinguished, or tended to occur at a distance from residential areas.[69] Many state forest protection codes were enacted to prevent forest fires from destroying privately and publicly owned forest lands within the state, and those that authorized the recovery of damages often failed to clearly define what types of damages were permissible.[70]

Accordingly, federal agencies, particularly in the fire-prone western United States, have sought to recover substantial damage awards under such laws from private parties for fires that damage federal lands and property. In an effort to provide more certainty and efficiency, at least four states have amended their laws or enacted legislation to clarify liability exposure and recoverable damages resulting from forest fires. These statutes either eliminate or reduce the recovery of noneconomic (for example, "ecological") damages, and better define the specific types of economic damages that are available.

(1994).
54. Cross, *NRD Valuation*, *supra* note 18, at 315.
55. *See generally* Dobbins, *supra* note 53, at 882-86.
56. *Id.* at 882.
57. Cross, *NRD Valuation*, *supra* note 18, at 315; *see also* Frank. B. Cross, *Restoring Restoration for Natural Resource Damages*, 24 U. Tol. L. Rev. 319, 329 (1993).
58. Note, *"Ask a Silly Question . . .": Contingent Valuation of Natural Resource Damages*, 105 Harv. L. Rev. 1981, 1984-89 (1992).
59. Cross, *NRD Valuation*, *supra* note 18, at 317.
60. 880 F.2d 432, 464, 19 ELR 21099 (D.C. Cir. 1989).
61. *Id.* at 477.
62. *See* 43 C.F.R. §11.83(c)(2)(vii); 15 C.F.R. §990.53(d)(3)(i).
63. Watch Out Situations include a list of 18 situations for firefighters to beware because they signal potential hazards on the fire line. *See* National Park Serv., *Fire and Aviation Management*, www.nps.gov/fire/wildland-fire/safety/for-employees/firefighting-orders.cfm (last visited Mar. 2, 2016).
64. Robert B. Keiter, *The Law of Fire: Reshaping Public Land Policy in an Era of Ecology and Litigation*, 36 Envtl. L. 301, 322 (2006).
65. *See* 16 U.S.C. §480 (1982).
66. *See* United States v. California, 655 F.2d 914, 917 (9th Cir. 1980).
67. Charles Riordan, *Calming the Fire: How a Negligence Standard and Broad Cost-Recovery Can Help Restore National Forests After Wildfires*, 41 B.C. Envtl. Aff. L. Rev. 233, 237 (2014).
68. *See, e.g.*, Wash. Rev. Code §76.04.730 (1994) (unlawful for any person to negligently allow fire starting on the person's own property to spread to the property of another); Alaska Stat. Ann. §41.15.110 (West) (liability imposed for failing to prevent uncontrolled spread of fire).
69. Richard W. Goeken, *States Begin to React to Large Recoveries for Escaped Wildfires by Limiting Landowners' Liability for Non-Economic Damages*, Forest Landowner, Sept. 6, 2013, at 17.
70. *Id.*

B. *Eyes on the Green: Statutes Limiting Liability for (Noneconomic) Fire Damages*

California has a specific statute governing liability for negligently set fire, which makes the tortfeasor "liable to the owner of such [burned] property for any damages to the property caused by the fire."[71] The state recently enacted a statute limiting the ability of "public agencies" (including the federal government) to recover noneconomic damages in cases involving the unintentional escape of a fire onto public or private property.[72] Although the new law continues to provide for the recovery of certain "ecological and environmental damages," it also requires that these damages be both quantifiable and reasonable in relation to the pre-fire fair market value of the damaged property.[73] In addition, such damages may not be enhanced under California laws that allow for the tripling of damages.[74]

Following California's lead, three other states passed legislation that limits or entirely prohibits the recovery of noneconomic environmental damages. In 2013, Idaho enacted a statute specifically limiting the damages that are recoverable when a person negligently allows a fire to escape from his land.[75] Allowable damages include reasonable suppression costs, economic damages, and either: (1) the diminution of the fair market value of the property; or (2) the actual costs for restoration of the property, but not intangible environmental damages.[76] As an added measure of caution, a statement of legislative intent is included with the new statute, providing that "intangible environmental damages are clearly speculative in nature and should not be recoverable."[77]

Similarly, Oregon enacted a law clarifying the liability rules for escaped wildfires. Oregon's new law more clearly defines liability for property damage caused by an escaped wildfire.[78] The law provides for the recovery of "economic and property damage," which is defined as the lesser of either the difference in the fair market value of the property immediately before and immediately after a fire or the cost of restoring property to the condition the property was in immediately before a fire, plus any other objectively verifiable monetary losses.[79] The state's new law clarifies that double damages apply only if the wildfire is the result of willful, malicious, or grossly negligent violations of state law, while simply negligent conduct will result in liability only for the actual amount of economic and property damages.[80] And regardless of whether the fire was caused negligently or willfully, any unreimbursed firefighting expenses can also be recovered.[81]

Montana also passed legislation that limits liability for forest or range fires. Montana's law provides that for a negligent or unintentional forest fire, recoverable damages are limited to (a) the reasonable costs for controlling or extinguishing the fire; (b) economic damages; and (c) either: (i) the diminution of fair market value of the damaged property; or (ii) the restoration costs associated with restoring the damaged property to its undamaged state.[82] The law defines economic damages as "objectively verifiable monetary loss, including but not limited to out-of-pocket expenses, loss of earnings, loss of use of property, and loss of business or employment opportunities."[83]

III. Mop-Up[84]: Forest Fire Damages

Recoverable land damages and appropriate methods to value damage to natural resources have long been contentious issues in litigation. Forest fires present an interesting challenge to an assessment of recoverable damages because forest land, particularly national forests, can be difficult to value.[85] If a forest fire spreads onto federal lands, the federal government will generally seek to recover the cost of suppressing the fire, as well as the cost of any damage to its land and timber.[86] In the absence of a clear federal standard, recoverable damages from a forest fire are generally governed by state law.[87] The traditional approach to assessing forest fire damages was the lesser of either the reduction in value of land and timber caused by the fire, or the cost to restore the damage.[88]

Recently, the federal government has been increasingly aggressive in seeking recovery for damage to federal lands from private-party defendants whose negligence allegedly started the fire.[89] When an unnaturally ignited (negligent) fire spreads onto public forest, federal prosecutors disregard these accepted valuation methods in favor of approaches that include loss of environmental services, lost recreational opportunities, and noneconomic environmental damages. The government has sought monetary recovery for the harvest value of timber that cannot be harvested, plus the cost of replanting trees, plus the value of unmeasurable or intangible environmental resources.[90] As discussed above,

71. Cal. Health & Safety Code §13007 (West 2012).
72. *Id*. §13009.
73. *Id*. §13009.2(a); Goeken, *supra* note 69, at 18.
74. Cal. Health & Safety Code §13009.2(d).
75. Idaho Code §38-107(2) (West 2013); Goeken, *supra* note 69, at 19.
76. Idaho Code §38-107(2).
77. 2013 Idaho H.B. 132 (2013).
78. Or. Rev. Stat. §477.089 (West 2013).
79. *Id*.
80. *Id*. §477.089(2)(a); Goeken, *supra* note 69, at 19.
81. Or. Rev. Stat. §477.089(2)(a).
82. Mont. Code Ann. §50-63-104 (West 2013).
83. *Id*.
84. Mop-up means "[t]o make a fire safe or reduce residual smoke after the fire has been controlled by extinguishing or removing burning material along or near the control line, felling snags, or moving logs so they won't roll downhill." U.S. Forest Serv., *Fire Terminology*, http://www.fs.fed.us/nwacfire/home/terminology.html#C (last visited Dec. 13, 2015).
85. Riordan, *supra* note 67, at 245.
86. Norman J. Wiener, *Uncle Sam and Forest Fires: His Rights and Responsibilities*, 15 Envtl. L. 623, 634 (1985) (under common law, the federal government may recover reasonable fire suppression costs only if its land has been threatened or damaged.); *see* Chesapeake & Ohio Ry. Co. v. United States, 139 F.2d 632, 633 (4th Cir. 1944).
87. Riordan, *supra* note 67, at 245-46; *see* United States v. California, 655 F.2d 914, 917-18 (9th Cir. 1980).
88. Wiener, *supra* note 86, at 633-34.
89. *See* Kimball, *supra* note 9, at 38-39; Karen Bradshaw Schulz, *Legal Issues in Forest Fire Cost Recovery*, Cal. Forests, Spring 2012, at 20 (commenting that California has a state department devoted to cost recovery).
90. Kimball, *supra* note 9, at 38; *see*, *e.g.*, United States v. CB & I Constructors, Inc., 685 F.3d 827, 829-30, 42 ELR 20146 (9th Cir. 2012) (upholding

federal courts now recognize that the federal government may recover resource damages caused by wildfires in addition to fire suppression costs.

A. *Holding Line: Traditional Approaches for Forest Fire Damages*

The traditionally accepted measures of recoverable damage to real property include the difference between the market value of the property before and after damage, in cases where the injury is permanent; or the reasonable cost of restoring the property to its original condition, if the damage is temporary and the property is capable of being restored.[91] Courts have recognized that in some cases it may be appropriate to award diminution in market value and restoration costs where those amounts are not duplicative.[92]

As discussed, some states have chosen to enact statutes that govern damages while other states govern damages by applying the common law.[93] As a general rule, whether statutory or judicial, the essential purpose of tort damages is to "make the injured party whole."[94] The goal of such methods is that compensation should place the injured party in the position that he or she would have occupied had the injury not occurred.[95] Accordingly, several states have adhered to the principle that damages for injury to real property (that is, forested land and trees) are determined by the diminution in value of the land—the difference between the value of the property before and after the injury.[96]

1. Diminution in Market Value and Compensation for Lost Timber

The government's traditional approach sought compensation primarily for the commercial value of damaged and destroyed timber.[97] In addition to recovering the costs of suppression, the measure of damages for marketable timber was the difference between its value before and after the fire, as determined by expert opinion based on the volume of timber and available pricing.[98]

This was the preferred method in *Feather River Lumber Co. v. United States*, in which the U.S. Court of Appeals for the Ninth Circuit ruled that "[a]s to the merchantable timber, the measure of damages was the value of the trees, and that measure was applied by the [expert] witness by proof of local stumpage prices."[99] The court also affirmed damages for harm to the young growth, which "while it had no market value, had a value to its owner."[100] In doing so, the court reasoned that "what was required to make the government whole . . . might properly include the cost of restoring the land to the condition in which it was before the fire."[101] When burned or severely damaged trees retain a quantifiable market value, this value may serve as an alternative basis for compensation.[102]

2. Restoration Costs

Recognizing that diminution in value would not always be sufficient to fully compensate an injured plaintiff, courts began awarding restoration damages.[103] The *Restatement (Second) of Torts* endorses the view of more recent cases by recognizing that where land is used for "a purpose personal to the owner," an injured party may claim the actual cost of restoring property to its previous condition.[104] Some jurisdictions provide that restoration costs can be used to compensate for injuries to trees that have little or no market value.[105]

Restoration damages are generally available when the cost of restoration does not significantly exceed the diminution in market value of the property.[106] Under those circumstances, courts have granted restoration damages as an attempt to fully compensate landowners for their loss.[107] An award for restoration damages recognizes the landown-

recovery for fire suppression costs and intangible environmental damages); United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1139 (E.D. Cal. 2008) (allowing federal government to recover damages for fire suppression costs, timber loss, reforestation costs, and loss of use of habitat and environmental services).

91. James R. Cox, *Reforming the Law Applicable to the Award of Restoration Damages as a Remedy for Environmental Torts*, 20 Pace Envtl. L. Rev. 777, 784 (2003).
92. Denoyer v. Lamb, 490 N.E.2d 615, 618-19 (Ohio Ct. App. 1984) (court held that in order to be fully compensated, the landowner was not limited to diminution in value of the property and was entitled to restoration costs); Huber v. Serpico, 71 N.J. Super. 329, 343-45 (N.J. Super. Ct. App. Div. 1962) (court held that plaintiff's recovery was not limited to diminution in value of land because of the trees' "peculiar value to the owner").
93. Riordan, *supra* note 67, at 246; *see* Keitges v. VanDermeulen, 483 N.W.2d 137, 140-42 (Neb. 1992) (providing an overview of how different jurisdictions deal with recovery for damaged timber).
94. *See* Evenson v. Lilley, 228 P.3d 420, 422 (Kan. Ct. App. 2010) ("The underlying purpose of any measure of damages in a tort action is to make the injured party whole again.").
95. *See* Henderson v. Nielsen, 871 P.2d 495, 500 (Or. Ct. App. 1994) ("As a general rule, the function of tort damages is to compensate the injured party for its loss.").
96. Riordan, *supra* note 67, at 246; *see, e.g.*, United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1142 (E.D. Cal. 2008) (diminution in property value is the measure of damages for injury to productive trees); Hassoldt v. Patrick Media Grp., 100 Cal. Rptr. 2d 662, 672 (Cal. Ct. App. 2000) ("The usual measure of damages in a case involving damage to a tree is the difference between the value of the real property before and after the injury.").
97. Kimball, *supra* note 9, at 38; *see also* Wiener, *supra* note 86, at 626-38.
98. Feather River Lumber Co. v. United States, 30 F.2d 642, 644 (9th Cir. 1929); Wiener, *supra* note 86, at 633.
99. *Feather River*, 30 F.2d at 644. It is worth noting that the damage to public lands amounted to $187,275.58 and the cost of extinguishing the fire was $2,053.51.
100. *Id.*
101. *Id.*
102. Riordan, *supra* note 67, at 246. *See*, *e.g.*, United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1147 (E.D. Cal. 2008) (recognizing that landowner may recover damages for burned timber).
103. Carol Adaire Jones et al., *Tropical Conservation and Liability for Environmental Harm*, 45 ELR 11032, 11036 (Nov. 2015); *see*, *e.g.*, Heninger v. Dunn, 101 Cal. App. 3d 858, 863 (Cal. Ct. App. 1980) (restoration cost is proper measure where owner has a personal reason for restoring land to its original condition).
104. Riordan, *supra* note 67, at 248; Restatement (Second) of Torts §929 cmt. b (1979).
105. Riordan, *supra* note 67, at 248.
106. Restatement (Second) of Torts §929(1)(a) & cmt. b (1977); *see* Keitges v. VanDermeulen, 483 N.W.2d 137, 143 (Neb. 1992).
107. Brereton v. Dixon, 433 P.2d 3, 5 (Utah 1967) (noting that market diminution damages will not always fulfill the goal of full compensation and, therefore, restoration damages are generally available).

ers' right to use their property as they see fit, as well as the inability to assess a fair and exact diminution in market value.[108] Restoration of damaged natural resources is an appealing remedy because it can directly address the harm and has the ability to capture nonmarketable qualities, including aesthetic or personal values.[109]

B. Extended Attack: Toward Theories of Environmental Damage

Although earlier forest fire cases were settled at an amount derived from the cost of suppressing the fire, in addition to the commercial value of damaged or destroyed timber, more recent cases have been settled for amounts that far exceed that range of costs. While the potential loss of habitat caused by a fire can have broad ecological and economic consequences,[110] the valuation process is complicated by the fact that recovery is based on claims related to "harm to environmental services" or "intangible environmental damages."[111] Following a forest fire, these losses are typically construed as loss of potential wildlife habitat as well as diminished recreational opportunities and public enjoyment of the natural resource.[112]

Placing an economic value on these types of environmental damages can be difficult and often involves philosophical questions.[113] As it stands, the current deficit of case law addressing the question of recoverable damages resulting from a forest fire, and the tenuous nature of natural resource damage law, specifically in forest fire litigation, allows for various interpretations of what values are harmed and the range of lost ecological services. In the absence of well-defined regulatory or other generally accepted guidance for fire damages, this has led to the adoption and inclusion of methods for quantifying the value of lost ecosystem services similar to those used in federal statutes.[114]

1. Quantifying Noneconomic Damages Using Habitat Equivalency Analysis

HEA is one approach that has been utilized to quantify forest fire habitat damages. The concept was first applied to the Big Creek Fire case,[115] an action for damages attributed to a fire in 1994 that burned more than 5,000 acres, in which half of the forest experienced moderate to high burn severity, and which cost more than $7.7 million to suppress.[116] The United States sought compensation for the value of lost commercial timber and replanting costs for mature and young trees by using HEA to evaluate compensation; however, the case eventually settled for $14 million without any amount of damages paid based on HEA (or reforestation costs).[117]

Nonetheless, advocating that "the people of the United States are entitled to compensation for the unique aspects of the damaged forests, above and beyond the fair market value of the timber destroyed,"[118] the federal government successfully applied this method in relation to damages caused by the Storrie Fire[119] in calculating $13 million for lost scenery, recreation areas, and habitat.[120] Prior to these cases, HEA had only been utilized for circumstances involving destruction of coastal environments and oil pollution, where this method was prescribed by statute or regulation.[121]

In *United States v. Union Pacific R.R. Co.*, the federal government sought compensation for injuries resulting from a forest fire that burned more than 50,000 acres of national forest in California.[122] In addition to compensation for lost timber, the government sought damages for loss of nontimber forest services during the period of regrowth, including aesthetic use, wildlife habitat, and recreational use.[123] The government utilized HEA to quantify the harm to the habitat and environment and the duration for reforestation to achieve the former condition.[124] The HEA expert conducted the analysis by calculating losses based on the diameter of full-grown tree trunks against the cost of fuel reduction (brush clearing to reduce the threat and severity of future forest fires) to quantify the equivalent service.[125] The court affirmed that habitat equivalency damages are legally permissible and separately compensable under state law in a recovery action for forest fire damages.[126]

108. Christopher E. Brown, *Dump It Here, I Need the Money: Restoration Damages for Temporary Injury to Real Property Held for Personal Use*, 23 B.C. Envtl. Aff. L. Rev. 699, 702 (1996).
109. Cross, *NRD Valuation*, *supra* note 18, at 298; *see also* Peck, *supra* note 5, at 279-81.
110. Hanson et al., *supra* note 6, at 166.
111. Deardorff & Semenova, *supra* note 8, at 2.
112. *Id.*
113. Riordan, *supra* note 67, at 250.
114. Hanson et al., *supra* note 6, at 166.
115. United States v. Southern California Edison Co., 413 F. Supp. 2d. 1101, 1104 (E.D. Cal. 2006). The Big Creek Fire originated at one of SCE's electrical facilities located within the Sierra National Forest when one of its transformers shorted due to a trespassing squirrel. The United States maintained that SCE was liable for the forest fire damages, among other allegations that SCE failed to comply with vegetation clearance requirements, failed to maintain appropriate animal guards near the enclosure, and failed to maintain operable fire suppression equipment. *See Edison Pays $14M to Settle Forest Fire Claims*, Central Valley News Bus. Times, Sept. 20, 2006, *at* http://www.centralvalleybusinesstimes.com/stories/001/?ID=3063.
116. Kimball, *supra* note 9, at 39.
117. *Id.* at 43. In this case, the United States retained Robert Unsworth, one of the developers of HEA, who provided a calculation of damages based on this method.
118. Scott, *supra* note 35, at 2.
119. United States v. Union Pac. R.R. Co., 565 F. Supp. 2d 1136, 1151 (E.D. Cal. 2008).
120. Kimball, *supra* note 9, at 38-39. The author explains that although the Big Creek Fire was the federal government's first attempt to expand its recovery of fire damages, it was the Storrie Fire case that brought the issue to the attention of the public. To highlight the transition, the United States settled the Big Creek Fire for a total amount ($14 million) that was less than twice the suppression costs ($7.7 million), whereas the total settlement award in the Storrie Fire ($102 million) was more than four-and-one-half times the $22 million claimed suppression costs.
121. *Id.* at 43.
122. 565 F. Supp. 2d 1136, 1139 (E.D. Cal. 2008).
123. *Id.* at 1151.
124. *Id.*
125. Kimball, *supra* note 9, at 43.
126. *Union Pac. R.R.*, 565 F. Supp. 2d at 1138.

2. What Is It Worth?: Measuring Damages by Their Value to the Public

Following *Union Pacific*, where damages were awarded for harm to the soil and wildlife habitat, the Ninth Circuit further expanded the potential scope of cost recovery from forest fires by adopting an approach similar to contingent valuation in the 2012 case *United States v. CB & I Constructors, Inc.*[127] The decision upheld an award for environmental damages and recognized the recovery of nonuse values based upon a jury determination of damages.[128]

In June of 2002, a construction contractor working on private land adjacent to national forest land negligently started a fire that eventually burned about 18,000 acres of federal land.[129] At trial, the jury awarded the United States $7.6 million in traditional damages for fire suppression, emergency mitigation, and resource protection costs, plus $28.8 million in intangible environmental damages.[130] Among the types of intangible environmental harm caused by the fire for which the government sought recovery were damage to native vegetation, destruction of threatened species habitat, and damage to a historic mining camp.[131]

The government did not provide any testimony to quantify the environmental harm, preferring instead to focus solely on the nature of the harm and extent of damage on the forest.[132] In rejecting the defendant's arguments that expert testimony was needed to determine the value of lost ecosystem services (for example, lost recreational use) or evidence about the cost of restoring the forest, the Ninth Circuit simply explained that "there is not one particular method for ascertaining plaintiff's damages."[133] Instead, the court found that the government's evidence about the "nature and character" of the burned forest was sufficient and, therefore, a rational means for the jury to determine damages.[134]

In its presentation to the jury, the government analogized the valuation of environmental harm to other forms of noneconomic damages, including damages for pain and suffering.[135] In its closing argument, the federal prosecutor asked the jury, "What is it worth?" and suggested two possible methods to calculate an award for intangible environmental damages: either a "multiplier" applied to the economic damages, or by determining a "price per acre" for the 18,000 acres of burned national forest land.[136] In upholding the award for intangible environmental damages, the court found that such environmental damages are similar to other noneconomic damages by reason of being "subjective, non-monetary losses."[137]

The Ninth Circuit's reasoning that "[i]n the public lands context, the federal government is more akin to a trustee that holds natural resources for the benefit of present and future generations,"[138] illustrates the growing parallel between recent forest fire litigation and traditional natural resource damage claims. Because the federal government is tasked with managing national forests on behalf of the public and because the integrity of these resources is valued by society, when this integrity is compromised, the public should be compensated.[139] And although this Article does not fully explore the similarities between forest fire litigation and traditional natural resource damage claims under federal statutes, it is worth noting that where national forest land is burned, thereby implicating the public domain, it may be worthwhile for the federal government to more thoroughly implement the NRDA framework by either including or deferring to trustees, and by seeking input from the responsible parties who can rely on scientific (ecological) experts.

3. The Multiplier Effect: The Moonlight Fire Settlement

On the heels of *CB & I*, the United States sued Sierra Pacific Industries and others to recover damages caused by the Moonlight Fire of 2007, which burned over 46,000 acres of land in two national forests. The federal government initially sought over $791 million in damages.[140] The government relied on the ruling in *Kelly v. CB & I Constructors, Inc.*, which held that California's Timber Trespass statute, Civil Code §3346,[141] was applicable to fire damages, thereby permitting a statutory multiplier for recovery of forest fire damages.[142] In *United States v. Sierra Pacific Industries*, the U.S. Attorney claimed that the double damage provision applied to "the full measure of compensable damages" to timber, trees, or underwood, which includes "the value of the lost timber, reforestation costs, environmental and ecological losses, and suppression costs."[143]

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127. 685 F.3d 827, 837, 42 ELR 20146 (9th Cir. 2012).
128. *Id.* at 839; Mary Loum, *The Verdict on Environmental Harm: Leave It to the Jury*, 40 Ecology L.Q. 385, 400 (2013).
129. *CB & I Constructors*, 685 F.3d at 831. The fire became known as the Copper Fire, resulting in extensive damage within the San Francisquito Canyon, and cost the government about $6.6 million in suppression costs.
130. *Id.* at 832.
131. *Id.* at 831-32.
132. *Id.* at 835.
133. *Id.* at 838.
134. *Id.*
135. *Id.* at 835; Nicholas Warden, *Compensating the Public for Damage to the Environment: Conflicting Economic Damages With Noneconomic Proof*, 56 APR Advocate (Idaho) 28, 29 (2013).
136. *CB & I Constructors, Inc.*, 685 F.3d at 832.
137. *Id.* at 836.
138. *Id.*
139. Warden, *supra* note 135, at 29-30.
140. Sierra Pac. Indus., *Questions & Answers: Moonlight Fire Settlement*, www.spi-ind.com/spi_news_documents/QA.pdf.
141. Cal. Civ. Code §3346(a) provides:

> For wrongful injury to timber, trees or underwood upon the land of another, or removal thereof, the measure of damages is three times such sum as would compensate for the actual detriment, except that where the trespass was casual or involuntary . . . the measure of damages shall be twice the sum as would compensate for the actual detriment . . . .

142. 179 Cal. App. 4th 442, 460, 463, 102 Cal. Rptr. 3d 32, 46 (2009) (court affirmed award of double damages because the "spread of a negligently set fire to the land of another constitutes a trespass" and "fire damage constitutes an 'injur[y]' to a tree"). Prior to the Copper Fire (*CB&I* cases), the law in California permitted recovery of forest fire damages under its separate liability statute (Cal. Civ. Code §13007) and Cal. Civ. Code §3346 did not apply to forest fires.
143. 879 F. Supp. 2d 1096, 1117 (E.D. Cal. 2012).

Although the court acknowledged the role of fair market value in calculating damages, it reiterated the recent trend that damages serve to fully compensate the plaintiff and, therefore, denied the defendant's motion for summary judgment to cap damages at pre-fire fair market value.[144] The court concluded that upon a jury determination of damages, the amount awarded for "injury caused by the negligent spread of fire" would be doubled.[145]

In light of the Copper Fire decision, Sierra Pacific Industries agreed to pay the government $55 million and convey fee simple title to 22,500 acres of land.[146] The company later issued a statement on the settlement and commented that the government's land and timber before the fire was valued at about $115 million.[147] After the fire, the government's land had a market value of about $96 million, meaning the fire reduced the value of the property by about $19 million.[148] Yet, the United States sought damages of more than 40 times the diminution in value of its land and close to seven times the pre-fire market value of its land.

Federal prosecutors described the Moonlight Fire as "a devastating fire that destroyed millions of trees and critical wildlife habitat," and stated that the settlement served to "mak[e] the public whole" as a result of the "damage suffered by National Forest land."[149] This type of characterization not only misleads the public into thinking that the fire was wholly destructive, it also ignores the integral role of fire as an ecosystem process.[150] Subsequent studies of the Moonlight Fire showed that the post-fire snag (that is, dead or dying trees) forest habitat resulting from areas of high-intensity fire supported a higher abundance of bird species compared with mature unburned forest.[151] One study noted that, "areas burned by wildfire, especially those with older high severity patches, may in some cases support equal or greater land bird diversity and total bird abundance [than unburned forest]."[152]

The "role of wildland fire as an essential ecological process and natural change agent" is one of the guiding principles for federal wildland fire management and policy.[153] Similarly, scientific knowledge about large-scale ecology should be informing how legal practitioners deal with forest fire damages.[154]

IV. Fire as an Ecosystem Process, *Not* a Natural Resource Damage

Why should we avoid characterizing fire, or more precisely, the effects of fire, as damage to natural resources? While fire certainly has a relationship with the natural environment and, depending on severity, may adversely impact some forest resources, it is also interrelated with key ecological functions. The law defines "damage" in terms of an actual injury, whereby the introduction of some foreign element causes an irreparable harm to a resource or results in destruction of the environment.[155] But because wildland fires are unique—an inevitable occurrence in forest ecosystems and a ubiquitous natural disturbance—it raises the question of whether there is an actual injury to the natural environment or loss of any ecological service following an unintentional forest fire that mimics a naturally occurring fire regime.

Wildland fire is a complex, dynamic, and incredible force that plays a pivotal role in many forested ecosystems. To understand the importance of the dynamic ecological role of fire, it is helpful to first understand how ecosystems interact with fire.

A. *The Ecological Role of Fire*

Fire is an integral, vital, and inevitable part of the functioning of most forest ecosystems. It is an ecological force that has influenced plant communities over time, and as a natural process, it plays an important role in maintaining the health of certain ecosystems. Fire helps clear away dead and dying plant matter, recycles nutrients into the soil, regulates vegetative succession, stimulates the growth of native species, and reduces the invasion of exotic species.[156] Most western forest ecosystems evolved under regimes of periodic forest fires.[157]

In its natural role, fire is not a disturbance that impacts ecosystems, rather it is an ecological process that is as integral to the environment as precipitation, wind, flooding, soil development, erosion, predation, carbon and nutrient cycling, and energy flow.[158] The diversity of plant and animal species and fundamental ecological processes are often dependent on conditions created by fire.[159] There are some plants that rely on fire to reproduce, by allowing

144. United States v. Sierra Pac. Indus., Inc., No. CIV S-09-2445 KJM-EFB, 2012 WL 1898945 *1, *3 (E.D. Cal. May 23, 2012).
145. 879 F. Supp. 2d at 1115-16.
146. Sierra Pac. Indus., *supra* note 140; *see also* Richard S. Linkert, *Are Defendants Getting Burned? Federal Wildfire Litigation Policy* 11, www.mathenysears.com/news/RSL%20Article.pdf (last visited Feb. 29, 2016).
147. Sierra Pac. Indus., *supra* note 140.
148. *Id*.
149. Lauren Horwood, *US Attorney's Office Reaches $122.5 Million Settlement for the 2007 Moonlight Fire*, July 17, 2012, www.fs.usda.gov/detail/r5/news-events/?cid=STELPRDB5380322.
150. J. Boone Kauffman, *Death Rides the Forest: Perceptions of Fire, Land Use, and Ecological Restoration of Western Forests*, 18 Conservation Biology 878, 879 (2004).
151. Ryan D. Burnett et al., U.S. Forest Serv., *Plumas Lassen Study 2009 Annual Report* (2010).
152. *Id*. at 31.
153. *See* U.S. Dept. of Interior, *2001 Federal Wildland Fire Management Policy: Guiding Principles, Policies, and Implementation Actions, in Review and Update of the 1995 Federal Wildland Fire Management Policy* (2001), *available at* https://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.
154. Fred Bosselman, *What Lawmakers Can Learn From Large-Scale Ecology*, 17 J. Land Use & Envtl. L. 207, 294 (2002).
155. *See, e.g.*, 33 U.S.C. §1321; 42 U.S.C. §9607.
156. U.S. Forest Serv., *Wildland Fire in Ecosystems: Effects of Fire on Fauna*, Gen. Tech. Rpt. RMRS-GTR-42-v.1 (2000).
157. Stephen F. Arno & Stephen Allison-Bunnell, Flames in our Forest: Disaster or Renewal? (2002).
158. Neil G. Sugihara et al., *Fire as an Ecological Process*, *in* Fire in California's Ecosystems (N.G. Sugihara et al. eds., 2006).
159. Reed F. Noss et al., *Ecology and Management of Fire-Prone Forests of the Western United States*, 1 Society for Conservation Biology Scientific Panel on Fire in Western U.S. Forests. (2006).

fire to break open the outside coating of some seeds and stimulate germination.[160]

Recurring fire disturbances are essential to the functioning of many ecosystems that are found throughout the United States. At a larger spatial scale, fire contributes to a mosaic of plant communities of different ages and species composition on the landscape and maintains biodiversity in forested ecosystems.[161] Since not every patch of landscape burns at once, different areas of a forest are in different stages of growth following a fire at any given time. This creates a diversity of habitats in which fire is a primary agent of biological diversity.

After a fire burns through a forest, a sequence of ecological responses, or succession, begins. In the first stage of ecological succession, fire cleans the ground of dead vegetation and breaks down organic matter into soil nutrients, and when followed by rain, these nutrients restore the soil environment and provide a fertile seedbed for plants, promoting regeneration of the ecosystem.[162] The bare ground is first colonized by grasses, followed by shrubs, and then by a young forest, and finally establishes into a mature forest.[163] The succession process begins quickly, but can take decades or even hundreds of years to move from early pioneer species that germinate and grow in direct sunlight to a closed canopy community of shade-tolerant species. Fire's role as a natural disturbance helps maintain native species and, historically, fire has kept many types of ecosystems in a constant state of ecological health.

B. *The Actual and Perceived Effects of Fire*

The effects of fire on natural resources are often difficult to assess and are commonly overstated. One reason is the general perception that burned landscapes with blackened trees and groundcover are considered unattractive. The general public tends to equate the ecological health of a forest by its appearance, and often forms an opinion in the absence of any ecological context for a fire event.[164] However, many plants recover quickly. For example, conifer species generally survive even with as much as 60% of their crown scorched.[165] Several species, such as grasses, aspen, and brush species, resprout vigorously in burned areas. Furthermore, wildlife (regardless of their size and mobility) are rarely killed by wildfires.[166]

Another reason that the effects of fire are overstated is because the reported burned area includes all acres within the fire's perimeter. However, even high-intensity crown fires are patchy, leaving a mosaic of burned or unburned patches. High-intensity fires, both small and large, create very diverse, ecologically valuable habitat, which often supports greater species richness and diversity compared with unburned old forest areas.[167] These types of fires play a significant role in the natural succession of most western U.S. forests, and many wildlife species evolved in relation to these patterns for habitat.[168]

Stand-replacement fire ecosystems account for about 42% of the landscape in the United States.[169] These ecosystems require periodic crown fires to regenerate the ecosystem.[170] In these landscapes, it is unlikely that stand-replacement forest ecosystems could suffer significant ecological damage from a high-intensity fire event.[171] In fact, from an ecological perspective, large fires, particularly in ecosystems dominated by stand-replacement fires, are well within an acceptable range of intensity.[172]

There is a growing body of scientific evidence to support the proposition that large, infrequent fire events are ecologically significant and not out of the range of natural variation.[173] One ecologist promotes the "naturalness" of severely burned forests: "The dramatic positive response of so many plant and animal species to severe fire and the absence of such responses to low-severity fire in conifer forests throughout the U.S. West argue strongly against the idea that severe fire is unnatural."[174] The amount of post-

160. Leonard F. DeBano, *The Effect of Fire on Soil Properties*, Gen. Tech. Rpt. INT-280, *in* U.S. Forest Serv., *Proceedings-Management and Productivity of Western Montana Forest Soils* (A.E. Harvey & L.F. Neuenschwander eds., 1991).
161. Noss et al., *supra* note 159, at 3-19.
162. Donna S. Ehle & William L. Baker, *Disturbance and Stand Dynamics in Ponderosa Pine Forests in Rocky Mountain National Park, USA*, 73 Ecological Monographs 543-44 (2003).
163. Sugihara et al., *supra* note 158, at 59.
164. Robert L. Ryan, U.S. Forest Serv., *Social Science to Improve Fuels Management: A Synthesis of Research on Aesthetics and Fuels Management*, Gen. Tech. Rpt. NC-261 (2005).
165. Kelsi Bracmort, Cong. Research Serv., RL34517, Wildfire Damages to Homes and Resources: Understanding Causes and Reducing Losses 8 (2012).
166. U.S. Forest Serv., *Wildland Fire in Ecosystems*, *supra* note 156.
167. Richard L. Hutto, *The Ecological Importance of Severe Wildfires: Some Like It Hot*, 18 Ecological Applications 1827, 1830-31 (2008) (black-backed woodpeckers strongly select high-intensity fire areas); Derek E. Lee & Monica L. Bond, *Occupancy of California Spotted Owl Sites Following a Large Fire in the Sierra Nevada, California*, 117 Condor: Ornithological Applications 228, 232 (2015) (California spotted owls continue to use post-fire habitat, even where large fires burned at high severity); Dominick A. DellaSala et al., *Complex Early Seral Forests of the Sierra Nevada: What Are They and How Can They Be Managed for Ecological Integrity?*, 34 Nat. Areas J. 310, 315 (high-intensity fire creates post-fire habitat that supports diverse plant and wildlife).
168. *See supra* note 161 (collecting sources).
169. Bracmort, *supra* note 165, at 7.
170. Stephen F. Arno, *Forest Fire History in the Northern Rockies*, 78 J. Forestry 460 (1980); Miron L. Heinselman, *Fire and Succession in the Conifer Forests of Northern North America*, *in* Forest Succession: Concepts and Applications (D.C. West et al. eds., 1981); Norbert V. DeByle et al., *Wildfire Occurrence in Aspen in the Interior Western United States*, 2 Western J. Applied Forestry 73 (1987); Stephen F. Arno, *Fire Regimes in Western Forest Ecosystems*, *in* Wildland Fire in Ecosystems: Effects of Fire on Flora (U.S. Forest Service Gen. Tech. Rpt. RMRS-GTR-42-v.2, J.K. Brown & J.K. Smith eds. 2000) (Severe fires constitute an important part of fire regimes associated with most western conifer forest types.).
171. Bracmort, *supra* note 165, at 7.
172. George Wuerthner, *Introduction*, *in* Wildfire: A Century of Failed Forest Policy xv (George Wuerthner ed., 2006).
173. Richard L. Hutto, *Toward Meaningful Snag-Management Guidelines for Postfire Salvage Logging in North American Conifer Forests*, 20 Conservation Biology 984, 986 (2006); David R. Foster et al., *Landscape Patterns and Legacies Resulting From Large, Infrequent Forest Disturbances*, 1 Ecosystems 497, 507 (1998); Monica G. Turner & Virginia H. Dale, *Comparing Large, Infrequent Disturbances: What Have We Learned?*, 1 Ecosystems 493, 494 (1998); William H. Romme, *Fire and Landscape Diversity in Subalpine Forests of Yellowstone National Park*, 52 Ecological Monographs 199, 217-18 (1982); Edward A. Johnson et al., *Towards a Sounder Fire Ecology*, 1 Frontiers Ecology & Env't 271, 272-75 (2003).
174. Hutto, *supra* note 173, at 987.

fire shrub growth, conifer regeneration, and growth of surviving overstory trees is often quite substantial in patches exposed to high-intensity fire.[175] Historic data and recent reconstructions of historic fire regimes indicate that high-intensity fire was common in most conifer forests of western North America prior to the era of fire suppression and logging, even in pine-dominated forests with frequent fire regimes.[176] Recent studies emphasize the dynamic nature of ecological systems in which fire disturbance is an essential element in maintaining biodiversity and productivity of forests.[177] Further, many species tolerate or benefit from the ecological changes resulting from severe fires.[178]

Humans have undoubtedly altered these processes, such as through federally mandated suppression policies or accidental ignitions, and the result can be that fire behavior and effects are outside the range of natural patterns.[179] There is a distorted perception among the general public that large wildfires are somehow abnormal or destructive.[180] Yet, large fires are as ecologically important to functioning and productive forest ecosystems as large predators are to wildlife.[181] "It was commonly assumed that areas with high-intensity fire, where large flames killed most trees, were fundamentally an unnatural result of fuel accumulations from decades of fire suppression"; and "thus began the 'catastrophic wildfire' paradigm."[182]

Every summer, it is a common storyline, in which the media portray images of monstrous flames scorching tree crowns, and reporters comment upon how many acres of forest were "destroyed" by yet another "catastrophic" fire.[183] This recurring storyline focuses primarily on the destructive nature of wildfires and neglects to provide any perspective on the ecological or historical role of fire on these landscapes.[184] Although the press often describes these fire events as "natural disasters," such negative treatment is counterproductive for those efforts to restore fire for its ecological benefits and to manage fuels.[185] The ubiquitous nature of fire is evidence of its critical role in maintaining natural ecosystems. Nonetheless, wildland fire is consistently treated as something that must be stopped and often perceived as some form of catastrophe.[186]

The misconception about fires as catastrophic has long overshadowed the ecological benefits, specifically the fact that high-intensity or stand-replacement fires actually create ecologically beneficial habitat.[187] This concept has consistently been overlooked in fire damage claims. If anything, the potential benefits created by high-intensity fires should be considered in assessing the environmental harm that results from a forest fire.[188] Traditionally, government plaintiffs have argued these forest fire damage cases as if fire *only* caused damage and have failed to take into consideration these ecological gains in environmental value as a factor for reducing damages.[189]

C. *Fire Regime: A Measure of Fire Frequency and Severity*

Wildland fire interacts with, and is influenced by, vegetation composition, fuel structure and moisture, stages of succession, human constructs and management actions, climate and weather patterns, terrain, and many other ecosystem components and processes over several scales of space and time.[190] While it may be relatively easy to consider the effects of a single fire on certain ecosystem properties, the importance of fire as an ecosystem process is "greatly amplified by the complex pattern of fire effects over long time periods, multiple fire events, and numerous ecosystem properties."[191] These patterns of fire events are characterized as *fire regimes*, and provide a foundation for understanding how the impacts of a fire are characterized.

A fire regime can be thought of as the spatial and temporal expression of fire, and is often described in terms of ignition, frequency, severity, seasonality, and spatial extent of fire occurring in a given area.[192] Some researchers have elaborated on this concept by categorizing fire into two distinct time frames: individual fires and repeated patterns of fire occurrence.

175. *See*, *e.g.*, Daniel C. Donato et al., *Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk*, 311 Science 352 (2006); Chad T. Hanson, Expert Report, *United States v. Union Pac. R.R. Co.*, No. 2:06-CV-01740 FCD/KJM, 2007 WL 2211261 (E.D. Cal. 2007); Jeffrey P.A. Shatford et al., *Conifer Regeneration After Forest Fire in the Klamath-Siskiyous: How Much, How Soon?*, J. Forestry 139, 140 (2007).
176. Chad Hanson, *The Myth of "Catastrophic" Wildfire: A New Ecological Paradigm of Forest Health* (2010), http://johnmuirproject.org/press/; William L. Baker et al., *Fire, Fuels and Restoration of Ponderosa Pine-Douglas Fir Forests in the Rocky Mountains, USA*, 34 J. Biogeography 251, 265 (2006); Paul F. Hessburg et al., *Re-Examining Fire Severity Relations in Pre-Management Era Mixed-Conifer Forests: Inferences From Landscape Patterns of Forest Structure*, 22 Landscape Ecology 5, 21 (2007); Walt Klenner et al., *Dry Forests in the Southern Interior of British Columbia: Historic Disturbances and Implications for Restoration and Management*, 256 Forest Ecology & Mgmt. 1711 (2008); Cathy Whitlock et al., *Long-Term Relations Among Fire, Fuel, and Climate in the North-Western US Based on Lake-Sediment Studies*, 17 Int'l J. Wildland Fire 72, 80-82 (2008); William L. Baker, Fire Ecology in Rocky Mountain Landscapes 93 (2009).
177. David B. Lindenmayer et al., *Salvage Harvesting Policies After Natural Disturbance*, 303 Science 1303 (2004).
178. Natasha B. Kotliar et al., *Avifaunal Responses to Fire in Southwestern Montane Forests Along a Burn Severity Gradient*, 17 Ecological Applications 491, 501 (2007).
179. Sugihara et al., *supra* note 158, at 62.
180. George Wuerthner, *Logging and Wildfire: Ecological Differences and the Need to Preserve Large Fires*, *in* The Wildfire Reader: A Century of Failed Forest Policy 179, 181 (George Wuerthner ed., 2006).
181. *Id*.
182. Hanson, *supra* note 176, at 1.
183. *See*, *e.g.*, William F. Jasper, *Burning Up the West: Feds, Greens Cause Catastrophic Fires*, New Am., Aug. 24, 2013, http://www.thenewamerican.com/tech/environment/item/16396-burning-up-the-west-feds-greens-cause-catastrophic-fires; Mark Freeman, *Catastrophic Wildfires Expected in Southern Oregon This Summer*, Mail Trib., Mar. 5, 2015, www.mailtribune.com/article/20150305/NEWS/150309767.
184. David M.J.S. Bowman et al., *Pyrogeography and the Global Quest for Sustainable Fire Management*, 38 Ann. Rev. Env't & Resources 57, 71 (2013).
185. *Id*. at 71-2.
186. Linkert, *supra* note 146, at 1-2.
187. *Id*. at 3.
188. *Id*.
189. *Id*.
190. Noss et al., *supra* note 159, at 17; Penelope Morgan et al., *Mapping Fire Regimes Across Time and Space: Understanding Coarse and Fine-Scale Fire Patterns*, 10 Int'l J. Wildland Fire 329, 330 (2001).
191. Sugihara et al., *supra* note 158, at 62.
192. James K. Agee, Fire Ecology of Pacific Northwest Forests (1993).

> Individual fires range from simple to extremely complex in their behavior, size, pattern of burning, and ecosystem effects. Individual fires in a limited area affect fuel dynamics, the physical attributes of the ecosystem, and the biological systems at the individual, species, population, and community levels. [. . .]
>
> Landscapes have repeated patterns of fire occurrence, fire magnitude, and fire type that vary over space and time. When fire is considered over centuries or millennia and on large landscapes, this repeated pattern of fire occurrence and its properties affect ecosystem function. Compounding the influences of individual fires, existing patterns greatly influence the dynamics of species composition, vegetation structure, and subsequent fire patterns.[193]

The concept of a fire regime provides an integrated means of classifying the impacts of these diverse spatial and temporal patterns of fire at an ecosystem or landscape level, as well as a generally accepted categorization for scientific and management purposes.[194] A natural or historical fire regime is a general classification of the role fire would play across a landscape in the absence of modern human intervention, but including the influence of aboriginal burning, and serves as the "reference condition."[195] Because fire regimes describe the historical ecological role of fire in establishing and maintaining certain vegetation communities, they provide a valuable method for determining a historical range of variation. The attributes of these historic fire regimes (for example, length of fire return interval, severity of fire effects, size of area burned) provide a biophysical baseline against which current conditions and proposed management can be compared, and from which ecological deviations can be calculated.[196]

Forests are incredibly diverse, varying by species composition, density of growth, elevation, geology, and climate, as well as temperature and rainfall patterns.[197] All of these factors influence and shape the nature of a fire in a forest.[198] And these ecological characteristics—climate, terrain, vegetation composition, and even needle size—combine to determine the fire regime for a particular forest or region.[199] At a minimum, in determining the extent of harm (that is, damage) caused by a forest fire, an understanding of both historic and current fire regimes, and knowledge about the ecosystem's characteristics, should be factors to consider in the assessment.

193. Sugihara et al., *supra* note 158, at 58.
194. *Id.* at 63; The Landscape Ecology of Fire (D. McKenzie et al. eds., 2011).
195. Sugihara et al., *supra* note 158, at 63; James K. Brown, *Fire Regimes and Their Relevance to Ecosystem Management*, *in* Proceedings of Soc'y of Am. Foresters Nat'l Convention (1994).
196. U.S. Forest Serv., *Proceedings of the Third International Symposium on Fire Economics, Planning, and Policy: Common Problems and Approaches*, Gen. Tech. Rpt. PSW-GTR-227 (2009).
197. Cristina Santiestevan, American Forests, *Burning Hot: The Evolution of Eastern and Western Fires* (2012), www.americanforests.org/our-programs/american-forests-publications/forest-files/forest-files-may-2012/burning-hot-the-evolution-of-eastern-and-western-fires/.
198. *Id.*
199. *Id.*

V. Seeing the Forest Through the Trees

Natural resource damage cases have traditionally been associated with oil spills or releases of hazardous chemicals. These types of cases are premised on damages resulting from the unpermitted release of potentially toxic materials—harmful substances considered foreign to the environment.[200] With respect to traditional natural resource damage cases, the degree of harm is determined relative to a "but for" argument that represents the environmental conditions in the absence of the release.[201] But what if the damage is associated with a natural disturbance event such as fire that reflects a combination of natural and man-made factors and has a natural cycle and trend?[202] Forests have evolved with fire and therefore present a much different scenario compared with an oil spill.

A. *Slop-Over[203]: Can Habitat Equivalency Analysis Be Applied to Forest Fire Damages?*

1. Determination of Pre-Fire Forest Baseline

One of the most important and controversial elements of a natural resource damage assessment is determination of the baseline condition. These assessments are framed around the concept of a service level baseline: It is the comparative basis against which injuries associated with both primary and compensatory restoration are measured, and is the basis for all calculated damages.[204] "HEA involves determining a baseline for habitat services that would have occurred in the *absence* of the fire, and determining the lost services from the time of the incident until ecosystem functions have been recovered to baseline conditions."[205] But in a fire-dependent ecosystem, plant species have adapted to a point that they would not exist without the *presence* of fire.

A factually sound baseline for the HEA assessment must recognize these dynamics and properly address any potentially impaired conditions of the forest and the substantial risks to its resources.[206] Any proposed baseline condition attributed to the pre-fire condition should consider changes in stand conditions based on natural growth and succession, as well as any planned management practices (such as fuel reduction or prescribed burns).[207] In fact, federal wildland fire policy states that fire should "be incorporated into the planning process" and requires land and resource management plans to establish "objectives for the use and desired future condition" of certain public lands.[208]

200. Cantor et al., *supra* note 14.
201. *Id.*
202. *Id.*
203. Slop-over is "[a] fire edge that crosses a control line or natural barrier intended to contain the fire." U.S. Forest Serv., *Fire Terminology*, http://www.fs.fed.us/nwacfire/home/terminology.html#C (last visited Dec. 13, 2015).
204. Rick Bodishbaugh, Exponent, *NRDA Baseline "But For . . .?"*(2010).
205. Hanson et al., *supra* note 6, at 166 (emphasis added).
206. Cantor et al., *supra* note 14.
207. Hanson et al., *supra* note 6, at 171.
208. *See* U.S. Forest Service et al., Guidance for Implementation of Federal Wildland Fire Management Policy 8 (2009), *available at* http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.

Given that these management plans are "developed consistent with both ecological conditions and fire regime dynamics,"[209] it is reasonable to suggest the same approach for determining a pre-fire baseline—one based upon an established fire regime or desired condition class, rather than the existing physical condition preceding a fire event (or the conditions that would have existed had the fire not occurred). Further, the goals of restoring a burned area to achieve pre-fire or baseline conditions are not necessarily the same; since pre-fire conditions are likely to be drastically different from any desired forest conditions.[210]

2. Factors Influencing Forest Baseline

Significant areas of uncertainty for natural resource estimates for fire damages include the proper recognition of services provided by complex ecosystems such as forests and the appropriate definition of the baseline conditions for highly dynamic environments, the conditions that influence the probability of fire ignition and spread, the natural fire cycle, and the methods for quantifying damages.[211] And because of the dynamic nature of forested ecosystems, the precondition state will likely involve a dynamic or changing baseline. Therefore, a proper damage assessment should consider the condition of the forest immediately before the fire at issue and document any available evidence indicating the environmental health and condition of the forest that burned.[212]

a. Fire as a Natural Disturbance

Disturbance events are recognized as important drivers of ecological diversity by stimulating renewal processes and enhancing forest productivity. Large-scale disturbances, particularly fire, may move an ecosystem to a new state of succession from which it may, or may not, return to its pre-disturbance condition.[213] Therefore, measuring the impacts to ecosystem resources and services and the resulting natural resource damages is complicated by the positive ecosystem benefits that large-scale fire disturbances often provide.[214]

There can be adverse and beneficial effects both within and among ecosystem service functions.[215] An area exposed to moderate- or low-intensity fire can result in an ecosystem gain while other areas that experienced high-intensity fire are more likely to result in a net ecosystem loss.[216] An HEA metric for fire events should account for any potential environmental gains and losses.[217] Further, the recovery period for a fire, otherwise attributed to a natural successional stage, could span a temporal scale of multiple generations and may take a century or more for old growth forests.

Application of HEA to fire damages should also address the problem of replacing trees that were contributing to increased fire risk and diminished ecological services within the forested area before the fire.[218] This means that to determine a reasonably fair baseline, it is important to first recognize and address any highly impaired conditions of the forest and the potential risk to its resources in its pre-fire state.[219] Because a replacement approach overlooks these factors, it results in an unreasonable goal to replace all lost trees regardless of their diseased and overcrowded state before the fire.[220]

b. Fire-Risk Variables: Weather and Climate Conditions, Fuel Conditions, and Topography

Fire risk and the size and severity of a fire are influenced by three significant variables: weather and climate conditions; fuel conditions; and topography. Weather and climate conditions affect the level of moisture, provide a source of ignition (for example, lightning), and influence where and how quickly a fire will spread.[221] Fuel conditions, particularly the type and amount of fuel on the ground, such as the size of dead and down trees, and the extent to which fuels form a continuous ladder into the forest canopy, impact flame lengths and the possibility for fire to move from the ground into the canopy.[222] Topography can affect fire-suppression efforts, modify general weather patterns, and influence the type of vegetation.[223] Of the three variables, topography is the only one that remains relatively stable over time and can be assumed to stay constant when defining the baseline condition.[224] In contrast, weather and climate and fuel conditions are dynamic elements that need to be accounted for in determining the baseline.[225]

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209. *Id.* at 10.
210. Hanson et al., *supra* note 6, at 171. For example, Union Pacific, through its experts' declarations, disputed the scientific basis of the U.S. Forest Service's HEA: "[T]he HEA assumed that the pre-burn baseline habitat is 100% and that fire dropped the resource service level to 0%. This methodology does not include any discussion of how much of the pre-burn habitat was less than that baseline of 100%." Monica L. Bond, Expert Report, *United States v. Union Pac. R.R. Co.*, No. 06CV01740, 2007 WL 2211257 (E.D. Cal. 2007). Similarly, it was noted that "the low severity areas [resulting from] the Storrie Fire . . . would have converted such areas into [a preferred condition class], saving the Forest Service millions of dollars [for fuel reduction projects]." Chad T. Hanson, Expert Report, *United States v. Union Pac. R.R. Co.*, No. 2:06-CV-01740 FCD/KJM, 2007 WL 2211261 (E.D. Cal. 2007).
211. Cantor et al., *supra* note 14.
212. *Id.* This would be feasible since the National Forest Management Act requires every national forest to have a forest management plan that provides a detailed inventory of forest lands and renewable resources. *See* 16 U.S.C. §§1603-1604.
213. Cantor et al., *supra* note 14.
214. *Id.*
215. Hanson et al., *supra* note 6, at 168.
216. *Id.*
217. *Id.*
218. Cantor et al., *supra* note 14.
219. *Id.*
220. *Id.*
221. Hanson et al., *supra* note 6, at 171.
222. *Id.*
223. *Id.*
224. *Id.*
225. *Id.*

c. Dynamic Ecosystems

The view of a forest as a static inventory of trees is no longer consistent with current concepts of forest management.[226] The natural disturbance of fire is now regarded as a natural and essential process for healthy and productive forest ecosystems. A representation of the forest as merely an inventory of trees that existed prior to a fire implies a static forest ecosystem in which more rather than fewer trees are preferred.[227] Yet, in dynamic forest ecosystems, fire disturbances that mimic a natural fire regime can result in improved resources and higher use values.[228] A simplistic analysis on the trees allegedly killed by the fire fails to reflect the post-fire changes of the economic value of a forest ecosystem that might be supporting live trees more effectively and with reduced fire risk.[229]

3. The Use of HEA for Forest Fire Damages

In fire litigation cases, the federal government has relied on HEA as one method for valuing damages caused by forest fires. However, this approach aims to simplify the analysis by correlating damages with the loss of some measurable resource such as fire-killed trees, even though many of these dead and dying trees subsequently provide valuable habitat. HEA serves the purpose of comparing estimates of ecosystem losses as a means to determine compensatory restoration. It is a method that works best when there is one source of injury, a relatively short injury period, one impacted service, and a relatively certain compensatory restoration period.[230]

Because HEA is a modeling method suited to when the material properties are known and there is no randomness, it is therefore limited in its ability to factor in the numerous variations attributed to fire. The authors of these studies demonstrate that "sound economic principles and the facts of a typical large-scale wildfire do not support the HEA approach as a means of measuring the lost interim uses of natural resources."[231] This method often results in a gross overestimation of the damages from forest fires by not accounting for the expected higher economic values of forest ecosystems that have benefited from wildfires.[232]

Compared with traditional natural resource damage claims under CERCLA and the Oil Pollution Act (OPA), trustees utilize the HEA method in cooperative settlement-type approach alongside the responsible parties, whereby the responsible parties are given an opportunity to comment on both the assessment framework and the individual metrics used in making damage calculations.[233] By contrast, in forest fire litigation cases, the HEA analysis has been prepared in a confrontational setting without the benefit of any information exchange between experts.[234]

B. *Backfire*[235]*: Why Nonuse Values Are Not Appropriate for Forest Fires*

When there is an event, such as an oil spill or release of hazardous waste, these substances have a detrimental impact on the natural environment resulting in actual harm or injury. Under these circumstances, the ecosystem is not evolved to adapt to the presence of these foreign materials.[236] When the natural environment has sustained an injury that is a "measurable adverse change in a natural resource that is either directly or indirectly the result of a [chemical] discharge,"[237] our legal system recognizes that compensable damages should be recovered. Federal statutes explicitly provide that "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."[238] These types of situations favor an assessment of damages for nonuse values that seek to deter potential polluters and protect the environment.

But fire is different. Fire is natural. Fire promotes ecological restoration.

While the law is supportive of compensating for environmental harms, the current approach reflects an anthropocentric understanding of nature—one that focuses on the value of nature as a resource to humans—and is inconsistent with the principle of ecological dynamics such that natural disturbances do not always result in destruction and damage of the environment.[239] It is undeniable that forests have value, but fire contributes to that value, and in many cases, even defines that value.[240] The fundamental problem with including nonuse values in a forest fire damage claim is that it undermines ecological principles currently being implemented by the U.S. Forest Service: "When we see fire, our first response is to put it out," the agency acknowledges, "[b]ut science has changed the way we think about wildland fire and the way we manage it"; accordingly, "we understand that fire has a role in nature—one that can lead to healthy ecosystems."[241]

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226. *See generally* Robert B. Keiter, *Ecological Concepts, Legal Standards, and Public Land Law: An Analysis and Assessment*, 44 Nat. Resources J. 943, 967-72 (2004).
227. Cantor et al., *supra* note 14.
228. *Id.*
229. *Id.*
230. Richard W. Dunford et al., *The Use of Habitat Equivalency Analysis in Natural Resource Damage Assessments*, 48 Ecological Econ. 61, 68 (2004).
231. Cantor et al., *supra* note 14.
232. *Id.*
233. Hanson et al., *supra* note 6, at 176.
234. *Id.*
235. A backfire is "[a] fire set along the inner edge of a fireline to consume the fuel in the path of a wildfire and/or change the direction of force of the fire's convection column." U.S. Forest Serv., *Fire Terminology*, http://www.fs.fed.us/nwacfire/home/terminology.html#C (last visited Feb. 26, 2016).
236. Thomas L. Deardorff, Exponent, *Wildland Fires: Changing Ecological and Legal Landscapes*, at 36 (2011-2012), announce.exponent.com/feature/wildlandfire/Ecological.pdf.
237. *See* 43 C.F.R. §11.14(v) (1998). Section 11.14(v) also provides that "injury encompasses the phrases 'injury,' 'destruction,' and 'loss.'"
238. 43 C.F.R. §11.83(c)(1) (2008).
239. Judith I. McGeary, *A Scientific Approach to Protecting Biodiversity*, 14 J. Nat. Resources & Envtl. L. 85 (1999); Bosselman, *supra* note 154, at 254-57.
240. Robin E. Russell et al., *Habitat-Suitability Models for Cavity-Nesting Birds in Postfire Landscape*, 71 J. Wildlife Mgmt. 2600 (2007) (many species of birds are dependent on post-fire habitat for nesting and foraging).
241. U.S. Forest Serv., *Fire*, http://www.fs.fed.us/science-technology/fire.

Awarding forest fire damages for nonuse values further perpetuates the misconception that fire is unnatural and something that injures the ecosystem. It also reinforces the notion that large fires are destructive and these determinations will be highly susceptible to valuation based on aesthetic perceptions that a healthy forest is a green forest. Although the amount of damages awarded is a decision for the jury, any evidence of "intangible environmental damages" caused by a fire should be premised on a foundation of ecological principles.

C. The Limits of Tort Liability

In considering the many shortcomings of the current approach to recovery of fire damages, it is worth asking whether common tort law is appropriate for assigning liability for unintentional forest fires. The tort law governing fire is based on the general principles of common law and adapted to the particular context of a fire.[242] However, there are two particularly troublesome elements that arise from the common-law notion that "a plaintiff is entitled to be made whole"[243] and run counter to the theory of natural resource damages.

First, tort law is essentially geared toward corrective justice by compensating the injured *individual*. The primary purpose of damages in tort law is "compensation of individuals, rather than the public, for losses which they have suffered within the scope of their legally recognized interests."[244] Because the tort system is tailored to remedy individual harms, it is not ideal for addressing landscape-scale damages, particularly those which are public resources held in trust.[245] Furthermore, any potential benefit to the natural environment that may be achieved through a tort remedy is likely to resemble something of a secondary consideration since it essentially operates retrospectively, as opposed to the preventative regulations imposed under federal environmental statutes.[246]

Second, tort law's goal of making the victim whole simply means placing the victim in the position he would have been in had the damage not occurred. However, this is in conflict with basic principles of ecology, especially in fire-dependent landscapes where fire plays an integral role in dynamic ecological processes, and should be occurring on both spatial and temporal scales. This is equivalent to saying that at some point, every part of the landscape should experience fire—an ecological imperative consequently undermined by the premise of making the environment whole.

This tort-based concept has been the primary justification for recovering nonuse, subjective values associated with environmental damages on the basis that such values are necessary to fully compensate the public for loss of natural resources.[247] But the tort-based concept begs the question of what is lost or damaged when fire is meant to naturally occur. It overlooks fire's role in ecological systems and distorts the perception that the effects of fire are catastrophic and destructive, when the presence of fire is oftentimes restorative and beneficial to ecosystems.

Nonetheless, the tort system could continue to play a role as a means to effectively deter negligent behavior. In the context of a tort action for the negligent failure to take reasonable measures to prevent fire-related damage, the threat of tort liability may be successful in getting individuals to take more care. Alternatively, it could serve as a foundation upon which to develop a separate standard of liability for forest fires.

VI. Conclusion

One goal of this Article was to address the scientific complexities of litigating forest fire cases as natural resource damage claims. Part IV presented an overview of how fire functions as an ecological process and distinguished the effects of fire from the more traditional perception of natural resource damages, such as those attributed to oil spills or hazardous substances. Part V provided a more in-depth analysis and highlighted numerous areas of uncertainty in establishing a pre-fire baseline and the potential for damages to be overestimated. While natural resource damages have gained importance in liability law, it is apparent that the current framework does not adequately incorporate or account for ecological functions.

Ecological change caused by a natural disturbance such as fire is not only inevitable but also necessary to maintain ecological processes—those that support ecosystem services and consequently the same resources that are valued under natural resource damage claims. And because the ability of the federal government to recover damages caused by wildfires is governed by the law of the state in which the fire occurred, subsequent litigation has become unpredictable with respect to the types of damages claimed and amount of costs that can be recovered. While a handful of western states have made an effort to remedy this situation by amending their laws pertaining to liability for damages caused by forest fires, the lack of an appropriate statutory framework for assessing damages will continue to create problems within the law of forest fire claims.

While claims for natural resource damages recognize the importance of compensating for environmental harms,

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242. Richard A. Epstein, *Common Law Liability for Fire: A Conceptual, Historical, and Economic Analysis*, *in* Wildfire Policy: Law and Economics Perspectives 1 (Karen M. Bradshaw & Dean Lueck eds., 2012).

243. Kevin M. Ward & John W. Duffield, Natural Resource Damages: Law and Economics §3.12 (1992).

244. W. Page Keeton et al., Prosser and Keeton on the Law of Torts §1, at 5-6 (5th ed. 1984) (stating that full compensation is the function of tort law); Restatement (Second) of Torts §901(a) (1977); Keitges v. VanDermeulen, 483 N.W.2d 137, 141 (Neb. 1992); Denoyer v. Lamb, 490 N.E.2d 615, 619 (Ohio Ct. App. 1984) ("The cardinal rule of the law of damages is that the injured party shall be fully compensated.").

245. *See generally* Sanne H. Knudsen, *Remedying the Misuse of Nature*, 2012 Utah L. Rev. 141, 178-83 (2012).

246. Mark Latham et al., *The Intersection of Tort and Environmental Law: Where the Twains Should Meet and Depart*, 80 Fordham L. Rev. 737, 754 (2011).

247. Richard B. Stewart et al., *Evaluating the Present Natural Resource Damages Regime: The Lawyer's Perspective*, *in* Natural Resource Damages: A Legal, Economic and Policy Analysis 171 (Richard B. Stewart ed., 1995).

subsequent litigation has demonstrated the challenge of placing an economic value on natural resources. Hence, the adoption of valuation methods such as HEA and contingent valuation in recent forest fire cases. But HEA is unreliable for addressing the circumstances of "when a large-scale disturbance such as wildfire combines with the dynamics of the ecosystem services to generate substantial offsetting damages and benefits" simultaneously.[248] The principles of fire ecology are not being incorporated into fire damage assessments, and yet the knowledge and tools are available to modify the HEA model and support a more ecologically sound approach.

Further, it seems irresponsible to rely on contingent valuation methods that allow uninformed laypersons to quantify natural resource values, without reference to historic fire regimes, severity, or an understanding of natural forest conditions.

In order to properly value ecological principles and recovery from disturbances that mimic natural process, the framework for assessing resource damages should include not only levels of ecosystem services, but also their dynamics.[249] Therefore, when it comes to fire in its role as a natural ecological process, the resulting damages should be evaluated under a framework that factors both beneficial and adverse impacts into the recovery.

248. Cantor et al., *supra* note 14.

249. *Id.*