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Phelps, Jacob, Aravind, Sakshi, Cheyne, Susan, Dabrowski Pedrini, Isabella, Fajrini, Rika, Jones, Carol A, Lees, Alexander C, Mance, Anna, Nagara, Grahath, Nugraha, Taufiq P, Pendergrass, John, Purnamasari, Umi, Rodriguez, Maribel, Saputra, Roni, Sharp, Stuart P, Sokolowki, Amir and Webb, Edward L (2021) Environmental liability litigation could remedy biodiversity loss. *Conservation Letters*, 14 (6). e12821. ISSN 1755-263X

DOI: <https://doi.org/10.1111/conl.12821>

Publisher: Wiley

Version: Published Version

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Environmental liability litigation could remedy biodiversity loss

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Abstract

Many countries allow lawsuits to hold responsible parties liable for the environmental harm they cause. Such litigation remains largely untested in most biodiversity hotspots and is rarely used in response to leading drivers of biodiversity loss, including illegal wildlife trade. Yet, liability litigation is a potentially groundbreaking conservation strategy to remedy harm to biodiversity by seeking legal remedies such as species rehabilitation, public apologies, habitat conservation and education, with the goal of making the injured parties ‘whole’. However, precedent cases, expert guidance, and experience to build such conservation lawsuits is nascent in most countries. We propose a simplified framework for

developing conservation lawsuits across countries and conservation contexts. We explain liability litigation in terms of three dimensions: (1) defining the harm that occurred, (2) identifying appropriate remedies to that harm, and (3) understanding what remedies the law and courts will allow. We illustrate the framework via a hypothetical lawsuit against an illegal orangutan trader in Indonesia. We highlight that conservationists' expertise is essential to characterizing harm and identifying remedies, and could more actively contribute to strategic, science-based litigation. This would identify priority contexts, target defendants responsible for egregious harm, propose novel and meaningful remedies, and build new trans-disciplinary collaborations.

KEY WORDS

civil law, compensation, conservation litigation, environmental governance, justice, lawsuit, natural resources

1 | INTRODUCTION

Biodiversity loss, driven by actions such as illegal wildlife trade, deforestation, pollution and mining, causes cascading ecological, social and economic harm (Díaz et al., 2020). These impacts place growing demands on legal systems to not only tighten regulations and strengthen enforcement, but also hold responsible parties liable for the harm they cause.

Although laws, procedures and practices vary among countries, many provide a legal right to remedy when the environment is harmed – including Brazil, China, Democratic Republic of Congo, European Union members, India, Indonesia, Mexico, Philippines and the United States (Jones et al., 2015; Rajamani, 2007). Yet, environmental liability litigation is virtually absent from practice across much of the Global South, including in many biodiversity hotspots. Moreover, such litigation is most familiar in the context of remedying pollution: Landmark cases, such as the 1989 Exxon Valdez and 2010 Deepwater Horizon oil spills, held responsible parties liable for remedying harms to both the general public and private parties by undertaking clean-up, habitat restoration and financial compensation (Cruden et al., 2016). However, these legal remedies have rarely been used to address key drivers of biodiversity loss, including illegal harvest, use and trade. We highlight how strategic liability litigation has groundbreaking potential to better safeguard biodiversity.

The body of precedent cases, expert guidance, and experience to build such conservation lawsuits is nascent in most countries. Characterizing environmental harm and identifying corresponding legal remedies is a long-standing challenge (BIOVAL, 2021; Boyd, 2010; Mazzotta et al., 1994; White & Heckenberg, 2011), alongside difficul-

ties in identifying defendants and establishing causal connections between their actions and the harm experienced (Bergkamp, 2001; Ruda González, 2006; Bentata & Faure 2012). These are exacerbated by gaps between law and conservation; most conservationists lack legal training and are disengaged from legal discussions, beyond supporting criminal investigations of illegal trade (e.g., WCS, 2020). Moreover, litigation-related scholarship is published overwhelmingly in legal journals, and existing litigation is usually instigated by a small number of actors (e.g., Rajamani, 2007).

We explain how environmental liability litigation can be operationalized to serve biodiversity conservation in terms of three dimensions: (1) defining harm, (2) identifying appropriate remedies to that harm, and (3) understanding what remedies the law and courts will allow (Figure 1). We explain how litigation can help make injured parties 'whole' by providing remedies that return the harmed system as closely as possible to its baseline – its condition

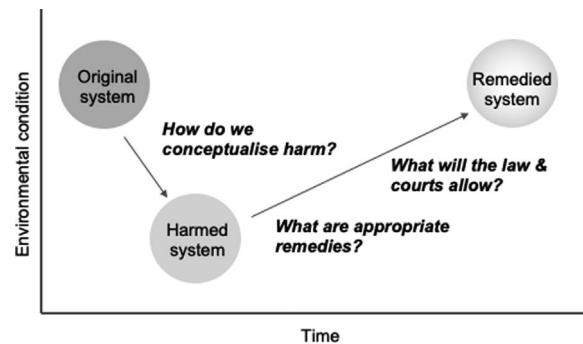


FIGURE 1 Environmental liability litigation involves recognizing and evaluating harm, and then proposing remedies that laws and courts are able and willing to provide

TABLE 1 Example verdicts of criminal cases* for illegal wildlife trade in Indonesia that include orangutan (*Pongo spp.*) (Indonesia Supreme Court Database, <http://putusan3.mahkamahagung.go.id/>)

Case number	Province, year	Criminal sentence ^a
Pontianak First Instance Court Decision No. 1006/Pid.Sus/2017/PN Ptk. ^c	W. Kalimantan, 2017	Imprisonment: 8 months Fine: \$333
Pekanbaru First Instance Court Decision 55/Pid.Sus-LH/2016/PN Pbr. ^b	Riau, 2016	Imprisonment: 2 years 6 months Fine: \$5,333
Singkawang First Instance Court Decision No. 137/Pid.Sus-LH/2016/PN Skw. ^d	W. Kalimantan, 2016	Imprisonment: 9 months and 10 days Fine: \$3,333
Medan First Instance Court Decision 3274/Pid.Sus-LH/2016/PN MDN. ^e	Medan, 2016	Imprisonment: 1 year Fine: \$6,666
Aceh 190/Pid.Sus/2015 /PN Lgs. ^f	Aceh, 2015	Imprisonment: 2 years Fine: \$3,333
Garut First Instance Court Decision No. 116/Pid.Sus/2015/PN Grt. ^g	W Java, 2015	Imprisonment: 1 year 6 months Fine: \$333

*Involve Law No. 5/1990 Art 21 related to 'keeping, possessing, maintaining, transporting and trading a protected animal' alive (Art. 21(2)a or dead 21(2)b).

^a1 USD = Indonesian Rp. 15,000.

All sentences included an option to substitute the fine for further imprisonment of 1–3 months.

Latin species names have been added where possible, but were missing from the court verdicts.

^bThree live baby orangutans (*Pongo spp.*), of which two died during the court proceeding and one was placed in care of the Sumatran Orangutan Conservation Program.

^cThree live orangutans (*Pongo spp.*) placed in care of Yayasan Inisiasi Alam Rehabilitasi Indonesia.

^dThree orangutan skulls (*Pongo spp.*); 2 Sunbear (*Helarctos malayanus*, two skulls, one hand bone, one fang, 24 claws), two hornbill beaks (Bucerotidae); two pairs of antelope horns, one 'sheet' of pangolin scales (*Manis spp.*), one taxidermy baby pangolin (*Manis spp.*); one taxidermy turtle, one green turtle shell (*Chelonia mydas*), nine pairs of deer antlers, 111 porcupine quills (*Hystrix spp.*) – all sent for destruction by the W. Kalimantan Conservation Agency.

^eFour live orangutans (*Pongo spp.*) sent to the North Sumatra Conservation Agency.

^fThree live Sumatran orangutans (*Pongo abelii*) one of which was ill, two Brahminy kite (*Haliastur indus*), one great argus (*Argusianus argus*) – all sent for reintroduction. One clouded leopard skin (*Neofelis nebulosa*) that was destroyed.

^gOne live Sumatran orangutan (*Pongo abelii*), one cuscus (*Spilocuscus spp.*), one Pesquet's parrot (*Psittichas fulgidus*), one salmon-crested cockatoo (*Cacatua moluccensis*), one black-capped lory (*Lorius lory*), one sunbear (*Helarctos malayanus*), one forest cat (*Felis spp.*), two tarsier (*Tarsius spp.*), two white cockatoo (*Cacatua alba*), three Sulawesi crested black macaques (*Macaca nigra*), three Azure-rumped parrots (*Tanygnathus sumatranus*), three palm cockatoo (*Probosciger aterrimus*), four sulphur-crested cockatoo (*Cacatua galerita*), one yellow-crested cockatoo (*Cacatua sulphurea*), one black hornbill (*Anthracoceros malayanus*), two blyths hornbill (*Rhyticeros plicatus*), two knobbed hornbill (*Aceros cassidix*), three rhinoceros hornbill (*Buceros rhinoceros*)—all were returned to the West Java Conservation Agency.

as though the harm had not occurred, and compensating for losses in the interim. Depending on jurisdiction, lawsuits can be brought by government agencies, individuals, NGOs and corporate plaintiffs, and seek remedies for harm experienced by both private parties (citizens, NGOs, companies, communities) and public resources (threatened species, protected areas, waterways). We explain how remedy-focused liability litigation is an important conservation strategy that creates new avenues for justice, and financial support for conservation. We propose a simplified framework that could help operationalize lawsuits across countries and contexts, illustrated through a hypothetical lawsuit against an illegal orangutan trader.

1.1 | Liability litigation complements traditional conservation law approaches

The conservation law toolkit includes a number of criminal, civil and administrative law responses, which vary spatiotemporally (e.g., Jones et al., 2015; Johnson et al., 2020).

Conservation typically draws on public law (i.e., administrative, criminal, constitutional, procedural law): government authorities dictate stakeholder obligations and prohibit certain acts, and impose fines and/or imprisonment sanctions designed to punish and deter (Cohen, 1991). For example, there has been a series of criminal case verdicts against the illegal trade of orangutan (*Pongo spp.*) in Indonesia (Table 1). However, fines and imprisonment often weakly reflect the harm that occurs in these cases, and sanctions are often considered too small to be deterrent, prompting efforts to strengthen sanctions and enforcement (e.g., UK, 2019, although see Wilson & Boratto, 2020). Moreover, criminal justice systems often operate with their structural inequities undisturbed, disproportionately targeting poorer defendants against whom additional enforcement is unlikely to be proportionate, justified or effective (Wilson & Boratto, 2020).

The conservation law toolkit also includes lawsuits (typically via civil or administrative law) in which individuals, NGOs or government agencies sue responsible parties in order to stop harmful actions (injunctions). Lawsuits may

also be used to compel government agencies to take action, such as NGOs and citizens suing the US Fish and Wildlife Service to order enforcement of the Endangered Species Act (Brosi & Biber, 2012).

In contrast, environmental liability litigation is distinct because it focuses on remedying harm (Figure 1). Liability lawsuits uphold the principle that the person who causes a loss must bear the burdens of compensating the party that suffers it, as in the ‘polluter pays’ principle. Through litigation, plaintiffs can ask courts to order responsible parties to provide remedies such as habitat restoration, public apologies, species reintroduction, and financial compensation. These types of remedial actions are often possible under countries’ civil law code, or administrative and criminal law in some jurisdictions. Importantly, liability litigation complements traditional criminal prosecutions, administrative sanctions, injunctive relief and orders to act, and defendants can be subject to overlapping legal processes. Moreover, liability litigation can be used strategically, focused on defendants who are most likely to command and sustain harm to biodiversity (e.g., organized criminal trafficking), and with the financial means to provide remedies.

We illustrate the potential for liability litigation to support conservation aims through a hypothetical liability lawsuit in Indonesia: A repeat, commercial wildlife trader was arrested for possessing and attempting to sell an infant, female Bornean orangutan (*Pongo pygmaeus*) that he procured and purchased from a rural farmer in West Kalimantan, Indonesia. The confiscated orangutan was transferred to a rehabilitation centre for future reintroduction into a managed population. The trader faces criminal sanctions for his illegal behaviour (fine, imprisonment, cf. Table 1), but a successful liability lawsuit would further force him to remedy the harm he caused. The scenario mirrors numerous criminal prosecutions against illegal wildlife traders, but lawsuits in this type of situation are virtually non-existent (but see Marseille, 2020).

1.2 | What is harmed when biodiversity is injured?

Harm to biodiversity often involves impacts on individual plants, fungi and animals through acts such as wildlife trade or habitat destruction. Liability litigation involves identifying and explaining that harm. This can be challenging because biodiversity is multidimensional and impacts are often non-linear, cumulative and subject to time-lags (see Whitehead et al., 2017). Harm is also experienced as a function of the scale and nature of the illegal act, and how it affects species with different attributes (e.g., rarity, functional redundancy). Characterizing harm is further com-

plicated because the linkages among biodiversity, ecosystems and human wellbeing are implicitly understood, but can be difficult to characterize and quantify for use in specific policy purposes (e.g., payment for ecosystem services, Hinsley et al., 2015). This is especially true when considering plural values for biodiversity, including those of Indigenous and traditional communities (e.g., Diaz et al., 2020), and plaintiffs’ diverse eco-philosophical orientations, ontologies and approaches to justice (see Brisman & South 2018). There are also growing demands for new forms of legal rights, including the rights of nature (see Gordon, 2018). This complexity presents challenges for explaining harm, and thus developing lawsuits.

We illustrate four broad types of harm likely to occur when biodiversity is injured (Table 2). These include a range of public and private costs, and impacts that are financial and non-financial, material and intangible, proximate and more distal. A clear understanding of the types of harm incurred is a step in evaluating whether and how litigation can be pursued.

1.3 | What remedies correspond to different harms?

Liability litigation explicitly focuses on identifying appropriate, fair remedies to the identified harms (Table 2). Traditionally, private civil lawsuits have attempted to ‘make whole’ through direct restoration, replacement of damaged property, and/or by providing compensation based on the monetary value of the losses suffered by the plaintiff (e.g., related to injuries at work, car accidents, damaged property; Landes & Posner, 1984). Developing lawsuits for harm to public goods such as biodiversity is more challenging, but the same legal concepts apply, with plaintiffs requesting remedies from defendants.

We highlight two broad approaches, and six possible methods to conceptualising harm to inform remedies (Table 3), which vary in adequacy of their response. For example, in the hypothetical orangutan case, the lawsuit might seek financial compensation based on proxies for total value, such as the animal’s monetary value as a pet on the black market (Table 3, row 1), or a default value from the literature (row 3). However, such direct economic valuation of the harmed resource may not equate to meaningful remedy. For example, one orangutan’s market value (whether hundreds or thousands of dollars) is a very poor reflection of its value as a critically endangered species. Alternatively, one could quantify the orangutan’s value by identifying and valuing the ecosystem goods and services it provides (row 4). However, this approach can simultaneously be difficult to implement, particularly because data are lacking, and yield partial and uncertain results. These

TABLE 2 Types of harm incurred when biodiversity is injured. Each element of harm is described and given a concrete example from the orangutan scenario. Not all types of harm occur in each case, and not all jurisdictions recognize every type of harm in their legislation

Types of harm	Description	Orangutan example
Harm to the environment		
Harm to individual plants, fungi or animals affected by the case		<ul style="list-style-type: none"> Injury to individual's wellbeing (physical and other)
Harm to species survival		<ul style="list-style-type: none"> Reduction in survival probability of a Critically Endangered species when reduced by one individual, especially a female of a slow reproducing species. Even if reintroduced, it will not be into its original population.
Harm to public ecosystem goods and services and to broader human wellbeing		<ul style="list-style-type: none"> Reduced existence, intrinsic and bequest values, both domestically and internationally Reduced ecotourism potential Losses for scientific research potential Impaired seed dispersal services
Harm to the state		
Loss in state revenues		<ul style="list-style-type: none"> Reduced national park revenues
Loss in reputation and/or trust		<ul style="list-style-type: none"> Domestic and international reputational harm as trust in government's ability to conserve its protected species, effectively manage protected areas, and maintain control over illegal activities is reduced.
Harm to private economic interests		
Loss in income or property value		<ul style="list-style-type: none"> Reduced orangutan tourism Reduced ecotourism overall
Increased private costs of accessing goods and services		<ul style="list-style-type: none"> NA
Extraordinary burdens of undertaking legal action to remedy harm		
		<ul style="list-style-type: none"> Administrative costs, such as DNA tests for genotyping and proving origin, required fieldwork and, hiring species experts Litigation costs associated with the public prosecutor or private lawyers. Court costs of ensuring their verdict/court order is enforced

limitations can present challenges for liability litigation, where demanding processes and scientific uncertainty can both create unintended barriers to justice (see Green et al., 2015), and overlook non-monetized values (Foster, 2007). Most pressingly, while these approaches might facilitate monetary compensation, they do not provide clear proposals for how the lawsuit could result in actions that meaningfully remedy harm to biodiversity.

In contrast to focusing on the monetary valuation, a more appropriate approach focuses on identifying the actions needed to fully remedy the harm, returning the harmed resource, insofar as possible, to baseline conditions. These are often referred to as actions to 'make the injured party whole' (see Mazzotta et al., 1994; Jones & Di Pinto 2018). Once remedial actions are identified, a lawsuit can then request that the defendant undertake those actions, or cover the costs for an expert or government agency to undertake them, based on their procurement

cost (row 5; Boyd, 2010). Environmental liability lawsuits, therefore, are best served if the focus is on the actions needed to remedy the affected ecosystems or species rather than placing a monetary value on nature itself.

A lawsuit can further seek restorative justice (row 6), requesting a defendant to undertake actions to make amends, such as issuing an apology, providing restitution or demonstrating generosity (Van Ness & Strong, 2014). These remedies can sometimes serve to capture intangible impacts on human wellbeing, such as cultural losses and moral harm. Remedies can involve symbolic financial compensation, (e.g., for the social damage caused by corruption, Garcia et al., 2010). They can also involve non-financial, culturally embedded resolutions such as apologies (see Zwart-Hink et al., 2014). In some cases, remedies have also employed procurement costs in these contexts, such as the cost of developing a cultural site or educational program that remedies specific harms (e.g., development

TABLE 3 Different approaches to remedies for harm

Approach	Explanation	Relationship to remedying harm	Orangutan example
Focused on monetary valuation of harmed resources			
Market value	Value of individuals on the legal or black market	<ul style="list-style-type: none"> Not directly linked to identifying remedies Provides a monetary value Likely to vastly undervalue biodiversity 	<ul style="list-style-type: none"> Price of a pet orangutan on black market
Deterrent number	Large amount selected to deter future action (cf. fine)	<ul style="list-style-type: none"> Not directly linked to identifying remedies Arbitrary, and contestable, not always permitted Can send a strong message, focused on behaviour change 	<ul style="list-style-type: none"> 10 times the black market price
Default value	Standard value selected from the literature and applied to future cases	<ul style="list-style-type: none"> Not directly linked to identifying remedies Acceptable if science-based and applicable to context Simple to implement 	<ul style="list-style-type: none"> No research-based values exist in the literature
Natural capital accounting	Valuation of all ecosystem goods and services affected in a case	<ul style="list-style-type: none"> Not directly linked to identifying remedies Can draw on many environmental accounting and economic methods Data-intensive and high uncertainty Short-term links between biodiversity and ecosystem goods/services are often tenuous 	<ul style="list-style-type: none"> Ecosystem services and goods of orangutan are not well quantified or valued
Focused on remedial actions to remedy harmed resources			
Procurement costs of undertaking remedies	Cost of undertaking specific actions needed to remedy the harm in a case	<ul style="list-style-type: none"> Directly linked to identifying remedies Requires case-specific data More complex to implement than default or market values. However, price schedules can be developed for common actions (e.g., cost of hiring an expert) 	<ul style="list-style-type: none"> Cost of providing care for the infant animal and protecting the species (see Table 4)
Restorative justice	Other actions requested by the affected parties that make amends	<ul style="list-style-type: none"> Directly linked to identifying remedies Recognizes diverse types of values Accommodates non-financial remedies Better suited to dealing with intangible values 	<ul style="list-style-type: none"> Issuing a public apology (see Table 4)

of a traditional medicinal plant garden on polluted indigenous land, Forde, 2014). These types of remedies can be more meaningful and deterrent than monetary compensation (Carroll & Witzleb, 2011), especially in the context of diverse human–nature relationships.

By clearly identifying the harm incurred (Table 2), it is possible to assign appropriate remedial actions. We used this approach to identify remedies corresponding to different types of harm (Table 4; see Jones et al., 2015; Jones and Di Pinto 2018). As in the orangutan example, remedies can include the defendant undertaking actions themselves (e.g., apologies) and payments for others to undertake actions such as rehabilitation, protecting affected populations, and restoring habitat to enhance species recovery (Table 4). Notably, these can enable both non-financial remedies and compensation that carries financial implications orders of magnitude greater than criminal sanctions.

1.4 | What will the law allow?

Many countries allow lawsuits in response to many types of harm and to request diverse remedies available (Jones et al., 2015), possible under different areas of law across countries (e.g., Civil Code, specialized environmental law, but also administrative and criminal law). This allows litigation to explore the limits of liability, and so uses existing laws in new ways (Garmestani et al., 2019). Indeed, scholars and practitioners are already testing and re-shaping the boundaries of law in other contexts, including lawsuits over the harm caused by climate change (Setzer & Vanhala, 2019). Nevertheless, legal factors circumscribe whether and how litigation may seek and receive legal remedies (see Fon & Parisi, 2003; Rajamani, 2007). We highlight seven core legal constraints that shape lawsuit development (Table 5).

Litigation can only be pursued if the law in the relevant jurisdiction specifically includes liability for harm to biodiversity, or if existing law can be adapted to allow for such a lawsuit (legal basis, Table 5A). The scope of liability for harm is typically described in law, sometimes restricted to harm resulting from unlawful acts (e.g., illegal trade) but potentially also harm due to negligence, inaction, or legal activities that nevertheless caused injury or were inherently dangerous (e.g., handling toxic material). For example, the EU Environmental Liability Directive (2004, Art. 2.3) defines legally recognized harm as harm caused to protected species and natural habitats listed in the EU nature protection laws, with some states adopting more expansive domestic concepts of harm. Harm may also be limited based on the activity that caused it (Art. 3.1) and illegal trade is not currently an activity covered by the ELD. In contrast, Indonesia defines legally recognized harm based

on whether harm exceed minimum thresholds (e.g., pollution standards) and can include harm caused by illegal trade.

Once the legal basis for litigation is established, the next steps involve determining whether the proposed plaintiff has a legal right to bring the lawsuit. This is a function of whether the country allows different types of stakeholders to bring suits (Table 5B, plaintiff standing). In some countries this right is reserved for government agencies acting on behalf of the public interest. Elsewhere, NGOs, individuals and groups affected by the case may also file lawsuits (Noble, 2002; Jones et al., 2015). These plaintiffs must usually have experienced an identifiable injury (Table 5C). This is typically a private injury, such as loss of income or reputation, but in some countries includes harm to the public interest, although this still requires a link between the plaintiff and the impairment of a right (Fogleman, 2013).

Moreover, the lawsuit must demonstrate causation between the defendant's action and the purported harm to the plaintiff (Table 5D). Those impact pathways must be clear and direct, which can be challenging in contexts of cumulative, non-linear, widespread or latent impacts (Faure, 2007). For example, the defendant in the orangutan case may be responsible for not only harming the individual animal, but also for impacts on overall species survival, an argument the lawsuit would need to make. Importantly, attribution science and socially accepted standards for what constitutes direct or proximate harm shift over time, including as a result of novel litigation – as occurred in the case of smoking cigarettes and cancer (e.g., Mather, 1998). Similar shifts may be possible for biodiversity through liability lawsuits.

The plaintiff must demonstrate that the proposed remedies appropriately and fairly address the harm (redressability, Table 5D). For example, although our hypothetical orangutan trader may be liable for harming species survival, they cannot be held responsible for the fate of the entire species. There may also be legal constraints on the types and scope of remedies that courts can order (Bergkamp, 2001), although this is typically defined by norms, and the number of approaches almost equals the number of authors discussing it (Persson, 2013). There are nevertheless often restrictions on the types of remedies that different plaintiffs can request. For example, in Indonesia, NGO plaintiffs can only request financial compensation for the out-of-pocket expenses they incurred as a result of the case (e.g., paying for orangutan rehabilitation), and may not seek to enrich themselves through the case. They can, however, request that the defendant undertake a wide range of actions to remedy harm (e.g., reforestation, apologies).

TABLE 4 Categories of remedies that correspond with each type of harm (see Table 2), focused on remedies associated with restoration or ‘making whole’ as opposed to monetary value for loss (see Table 3). Last column shows examples of remedies for the harm caused in a hypothetical case against a defendant found attempting to illegally sell a single infant orangutan (see text)

Type of harm (Table 2)	Category of remedy	Elements	Orangutan example: Proposed remedies (procurement cost)
Harm to the environment, including to: individual plants, fungi or animals affected; species survival, and harm to public ecosystem goods and services	1. Compensation for cost of countermeasures or mitigation actions to avoid further harm	<ul style="list-style-type: none"> 1a. Cost of dealing with dead biological material (e.g., destroying, freezing, sampling) 1b. Cost of transporting and caring for live individuals following seizure until case closure 	<ul style="list-style-type: none"> • NA • Rescue team, including porters, veterinarian and expenses for 2 days. (\$1000) • Six years of care, including quarantine, rehabilitation, food, veterinarian, medicine and facility (\$18,000)
	2. Compensation for the cost of undertaking restoration and/or replacement of ecosystem goods and services, to the baseline level	<ul style="list-style-type: none"> 2a. Cost of long-term, captive care of live individuals 2b. Cost of reintroducing live individuals into wild or semi-wild populations, if deemed appropriate 	<ul style="list-style-type: none"> • Reintroduction into a managed population, including staff and operational costs and 2 years of post-release monitoring (\$34,000) • Support towards reforestation of degraded forest in prime orangutan habitat in West Kalimantan (\$12,000^a)
		<ul style="list-style-type: none"> 2c. Cost of undertaking actions to increase the wild population to the baseline level (e.g., translocation, habitat restoration, additional monitoring, additional patrolling, increase in protected area). Additional cost of undertaking monitoring actions to evaluate changes in the species population. 2d. Costs of specific, time-bound pilot projects necessary in order to enable specific remedies (e.g., where a restoration process is uncertain). 	<ul style="list-style-type: none"> • NA • NA

(Continues)

TABLE 4 (Continued)

Type of harm (Table 2)	Category of remedy	Elements	Orangutan example: Proposed remedies (procurement cost)
	3. Compensation and nonfinancial remedies for losses in public, direct and passive uses of ecosystem goods and services, from the time of injury until recovery (interim loss). This includes uncompensated losses, where affected parties cannot be directly remedied through conventional means (e.g., financial compensation, restoration actions).	3a. Compensation for cost of lost direct and passive use values (e.g. reduced food access, cultural losses, education losses, recreational losses, spiritual losses, scientific losses), or cost of cost of undertaking additional restoration/replacement actions to represent those losses 3b. Orders to make public amends (e.g., via apology, public prayer)	• NA • Issue a public apology via newspaper advertisement (four newspapers, four times) (\$1,920)
Harm to the State	4. Compensation for financial losses to the State	3c. Compensation for the cost of interventions that raise awareness of wildlife values (e.g., education or cultural activities)	• Support campaign against illegal wildlife trade via newspaper advertisement (as previous)
	5. Compensation for harm to reputation and/or public trust	4a. Loss of taxes and/or revenues (e.g., protected area revenues, revenue from legal wild harvest, taxes on timber)	• NA • NA
Harm to private economic interests	6. Compensation for private economic losses	6a. Losses in income and/or property value (e.g., declines or projected declines in ecotourism, decline in legal wildlife harvest)	• NA
Harm associated with the extraordinary burdens of undertaking legal action	7. Compensation for extraordinary financial costs of preparing the claim and bringing the case	6b. Increased private costs of accessing ecosystem goods and services (e.g., food, traditional medicine) 7a. Plaintiff's extraordinary costs for conducting scientific assessments needed for the case	• NA • DNA test and hiring experts to prepare evidence (\$4,900)
		7b. Plaintiff's additional costs (e.g., prosecutor, lawyer fees, court fees)	• NA ^b
	8. Compensation for monitoring implementation of the court order		• C
Total procurement cost			\$71,820

Further description of the proposed remedies and estimated procurement costs are in Supporting Information Table S1.

^aEquates to, recognizing that defendant has shared, but not exclusive responsibility.

^bNot claimable in Indonesia, but is in other countries.

^cPlaintiff demands an injunction from the court ordering that the defendant and Conservation Agency provide progress reports on the court and agency websites, twice a year until remedies are complete.

TABLE 5 Key legal constraints that shape liability litigation (from the authors, see Bergkamp, 2001)

Constraints	Orangutan example
A. Can the harm be recognized by current national legal practices? (Legal basis)	<p>Legal scope of harm: Whether the harmful act is legally recognized as a type that can receive remedy via a lawsuit. This may be determined by many factors, such as whether harm infringed on a constitutionally-enshrined right; whether harm was caused by a designated unlawful act listed in the law (e.g., harm that resulted from pollution); whether it exceeded a legal threshold (e.g., conservation status, pollution standard), or whether it affected specific resources (e.g., protected species, certain habitat types). The scope is typically contained in the legal definition of environmental harm or damage and varies across countries.</p> <p>Types of liability: Whether the law establishes a duty of care on the part of the defendant, that has been breached (intentional or negligence). Whether the defendant is liable by the mere fact that their action caused harm, regardless of intention (strict liability). Whether the law limits this strict liability to contexts it considers “inherently dangerous” (e.g., harm to protected species, handling hazardous materials). Whether the law established an overarching right that merits protection.</p>
B. Who can bring a civil lawsuit? (Plaintiff's standing)	<p>Plaintiff: Who is allowed to bring the suit (e.g., NGOs, government, individuals, trustees, individuals directly affected, individuals with direct or indirect interests, anyone).</p> <p>Statute of limitations: Whether there is a limited period within which the right to bring a case expires.</p>
C. What type of identifiable harm is there to the plaintiff? (Injury in fact)	<p>Personal Interest: Whether the plaintiff experienced specific, identifiable harm.</p> <p>Public interest: Whether the law allows the plaintiff to pursue a suit based on the public interest.</p>

Individuals, NGOs and groups can make a claim based on personal interest in the case, here most likely an animal rehabilitation centre.
 Individuals, groups of people, NGOs and government who have a specific vested interest in the case (private, public, or the environment itself) can pursue a claim.

(Continues)

TABLE 5 (Continued)

Constraints	Orangutan example
D. Who can be held responsible for the harm? (Causation, defendants)	<p>Type of defendants: Whether that law allows suits against individuals, corporations, the state, informal groups, co-operators, instigators, intellectual actors or beneficial owners.</p> <p>Relationships to harm: Whether the defendant's action caused the harm, and whether impacts were cumulative and the result of other actions not necessarily at the same time. Different countries have different standards/expectations for what constitutes a legally proximate cause of the harm. Notably, attribution science and socially accepted standards for what constitutes harm shift over time, especially as a result of novel litigation.</p> <p>Burden of proof: Whether the law places this burden to demonstrate the harm and causation on the plaintiff or defendant.</p>
E. Do the proposed remedies address the injury? (Redress)	<p>Degree of responsibility: Whether all individuals who contributed to the harm are responsible (apportionment under joint liability) or only in relation to the harm they caused (several liability). Whether the plaintiff may recover remedies from any of the defendants regardless of their individual share of the liability (joint and several liability). Whether law allows defendants to bring in co-defendants who might share their liability.</p>
F. In what legal forum can the case be brought? (Jurisdiction)	<p>Types of remedies: Whether law limits the nature of remedies that plaintiffs can request (e.g., injunction, compensatory but only via restoration, compensation via financial payments, non-financial remedies).</p> <p>Limitations of plaintiffs' remedies: Whether law restricts certain types of plaintiffs to claiming specific types of remedies.</p> <p>Redressability: Whether the proposed remedies provide suitable relief to the plaintiff based on the harm that occurred, often with the proviso that the plaintiff not receive 'unjust enrichment' (although this is often very subjective).</p> <p>Bringing the defendant to trial: Whether you have jurisdiction over the individual (e.g., national or a foreign national, a diplomat, is out of the country). If not, whether there is Mutual Legal Assistance (e.g., extradition treaty) associated with action.</p>

(Continues)

TABLE 5 (Continued)

Constraints	Orangutan example
Specific jurisdiction: Whether the court has jurisdiction over this type of issue, based on its competence (e.g., administrative court may not be able to hear a civil suit), the type of act (e.g., some acts fall under specific jurisdictions (e.g., fisheries court, environmental court), or the remedies the court can grant (e.g., size of claim)) General jurisdiction: Whether the court has jurisdiction over the plaintiff/defendant based on the geography of where the suit can be brought (e.g., based on where the defendant lives, or where the plaintiff is from); the status of defendant (civilian, diplomat, civil servant, politician, enforcement agent).	<ul style="list-style-type: none"> The specific jurisdiction for the illegal wildlife trade case is in general court. The panel of judges adjudicating the case should be led by a judge with an Supreme Court Environmental Judge Certification General jurisdiction based on where the defendant lives/is registered (not where the unlawful act occurs). If that is unknown, then jurisdiction is based on where the plaintiff lives
G. What types of evidence can be used? (Evidentiary requirements)	<p>Types of evidence: Whether the law places restrictions on what can be presented in court (evidentiary requirements, e.g., evocative evidence; designation of official data sources). Whether other types of evidence become admissible and relevant if the defendant has been involved in an organized criminal enterprise (e.g., financial transactions; other records of communication like email, phone records; evidence gathered in a police investigation).</p> <p>Types of witness: What types of witness expertise the court recognizes and limits (e.g., preference for academic experts), and how different types of evidence are weighed by the courts.</p> <p>Types of data: Whether certain types of data are accepted (e.g., contingent valuation)</p>
	<ul style="list-style-type: none"> Indonesia's Civil Procedural Law lists 5 types of evidence: documents, witness statements, presuppositions, confession and oaths. Formal authorized documents (e.g., lab tests) have the highest evidentiary power. The Electronic Transaction and information Law further recognizes electronic data and documents as evidence. Supreme Court Guideline on Environmental Cases (Chief Justice Decree No. 36/KMS/SK/II/2013) states that experts should have formal academic credentials, but this is a guide for judges rather than a legal requirement. Law allows diverse types of methods and scientific data, but courts are inexperienced with many environmental datasets

Note: Second column addresses each constraint for the hypothetical orangutan lawsuit (see text), based on Indonesian law.

Liability litigation is constrained by the jurisdiction and legal forum where the case can be filed (Table 5F). Factors like the place where the harm occurred, the type of action, or the identity and status of the defendant can determine the court venue. There are also nuanced procedural requirements for what and how evidence is presented, including what types of evidence can be used, must be used (different burdens of evidence), and how it is presented (Table 5G).

In practice, litigation is also heavily shaped by legal, cultural, social and political norms (Peel & Osofsky, 2015; Robinson, 2018). These can influence the types of cases likely to succeed in a given moment, and are shaped by advances in science and attribution, scientific consensus, public sentiment, and the court's willingness to accept various types of evidence, and grant certain types of remedies (Peel & Osofsky, 2015). Importantly, pioneering litigation could shape these norms across much of the world.

2 | CONCLUSION

Environmental liability litigation offers potentially ground-breaking advances for safeguarding biodiversity, using legislation that already exists in many countries. The strategy remains a largely unexplored opportunity in many high-biodiversity countries, and is especially overlooked in its potential to address threats such as illegal wildlife trade. This is likely because liability litigation differs from the well-established approaches to conservation enforcement and involves complex legal technicalities with which most conservationists are inexperienced. Moreover, lawsuits can involve high transaction costs and technical barriers, lengthy court proceedings, and can offer uncertain returns for plaintiffs – all of which can discourage suits (Stech et al., 2009). The burdens on plaintiffs are exacerbated by violence against environmental activists, including those acting via the courts (Greenfield & Watts, 2020). Moreover, as with other governance processes, court actions face widespread governance challenges that often affect how stated law is actually practiced (e.g., lax enforcement, corruption, resource and capacity limitations; Pinheiro et al., 2020). These barriers can impact which cases are litigated, how judges make decisions, and whether court orders and remedies are ever effectively executed on the ground.

Nevertheless, strategic litigation may challenge existing governance barriers and create new opportunities for conservation: placing new burdens on high-profile defendants in ways that may deter future harm; creating new pathways for environmental justice, funding conservation

actions, and raising public awareness about the diverse values of nature. Importantly, in many countries, litigation offers opportunities and incentives for increased legal action – not only by the state, but also among citizens and NGOs, which is especially important in the context of weak government enforcement. Thus, there is a broad need to experiment with liability litigation across jurisdictions, notably in biodiversity hotspots where courtrooms may offer a forum of 'last resort' (see Rajamani, 2007). This would help legal systems and practitioners continue to learn, with new cases, court verdicts and experiences motivating both future lawsuits and progressive verdicts (see Fon & Parisi, 2003).

Such developments would be impossible for lawyers or enforcement agencies alone, and require the engagement of conservation scholar-practitioners. It is valuable for ecologists and conservationists to recognize that their understanding of biodiversity, ecosystems and their links to human wellbeing is essential to define and characterize harm and identify corresponding remedies. Application of conservation knowledge in lawsuits is multifaceted, integrating both case-specific evidence and fundamental ecological principles into legal frameworks, as demonstrated in the orangutan example, which illustrates how future cases might be conceptualized across contexts. Conservationists have scope to bridge the gap between their sciences and the law, proactively reaching out to lawyers, investigators, NGOs and various plaintiffs in high-biodiversity countries to develop lawsuits. Conservation science is thus a core component of a strategic science-based approach to litigation that identifies priority contexts, targets defendants responsible for egregious harm, works within favorable legal systems, proposes novel and deterrent remedies, and builds new transdisciplinary collaborations.

ACKNOWLEDGEMENTS

Funded by the UK Government through the Illegal Wildlife Trade Challenge Fund. Thank you to the Glass Family of Low Annat Walls, Andri Gunawan, Bambang Hero, Rosa Agustina, Arif Yogiawan, Rasio Ridho Sani, International Animal Rescue Indonesia, Indonesia's Directorate General of Law Enforcement, Ministry of Environment and Forestry, and the Natural Resource Conservation Unit Offices of West Kalimantan and North Sumatra.

AUTHOR CONTRIBUTIONS

All of the authors contributed to conceptualizing and writing the article.

ETHICS STATEMENT

No institutional ethics review was required for this article. The work was conducted under a Foreign Research Permit for J.Phelps from Indonesia's Ministry of Research, Technology, and Higher Education.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA ACCESSIBILITY STATEMENT

There is no additional data set associated with this article.

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How to cite this article: Jacob Phelps, Sakshi Aravind, Susan Cheyne, Isabella Dabrowski Pedrini, Rika Fajrini, Carol A. Jones, Alexander C. Lees, Anna Mance, Grahat Nagara, Taufiq P. Nugraha, John Pendergrass, Umi Purnamasari, Maribel Rodriguez, Roni Saputra, Stuart P. Sharp, Amir Sokolowski, Edward L. Webb. Environmental liability litigation could remedy biodiversity loss. *Conservation Letters*. 2021;e12821. <https://doi.org/10.1111/conl.12821>