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Managed burning of forests: Balancing economic incentives, risks, and liability

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Abstract

Managed burning of forests can provide benefits to society including mitigated wildfire risk, improved habitat, and more. However, adverse outcomes of escaped fire or smoke pose risks. I reviewed the evolution of the law regulating forest management burns, explored the current legal architecture, and analyzed the economic incentives for involved actors, in order to identify policy options. Liability standards through most of the twentieth century increasingly placed risk burden on landowners and burners, but increased recognition of the benefits of burns led many States to reverse this trend and limit the liability for a subset of qualified burns. Still, there is broad uncertainty about the liability, which can lead to increased costs for all sides. In view of the societal benefits of burning, States may consider how best to provide legal clarity, how to balance associated risks, and where to place the liability burden.

Keywords

Forest management burns, prescribed fire, smoke, liability, negligence

Introduction

On April 6, 2022, United States Department of Agriculture Forest Service (USDA FS) employees ignited a burn in Santa Fe National Forest (NF), New Mexico (NM) in order to reduce dense vegetation.[1] The goal was to burn this fuel load under favorable weather conditions and oversight, to lower the risk of future wildfire under unfavorable conditions. Such use of low-intensity forest management burning to mitigate the risks of potential high-intensity wildfire has been advocated by forestry professionals,[2] and the scientific literature

1. Simon Romero, 'The Government Set a Colossal Wildfire. What Are Victims Owed?' *New York Times* (New York, NY, June 21, 2022) <https://www.nytimes.com/2022/06/21/us/new-mexico-wildfire-forest-service.html>.
2. Society of American Foresters, 'Position Statements: Use of Prescribed Fire in Forest Management' (2021) <https://www.eforester.org/Main/Issues_and_Advocacy/Statements/Use-of-Prescribed-Fire-in-Forest-Management.aspx> (accessed 3 October 2023).

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broadly agrees about its effectiveness.[3] However, the conditions at Santa Fe NF were not as favorable as thought at the time, and the burn escaped its intended boundaries, merging with another escaped burn, and eventually turning into the largest wildfire recorded in NM. The "Calf Canyon/Hermit's Peak" fire destroyed hundreds of homes and untold other timber and property.[4]

After a 90-day pause to reassess, "prescribed burns" resumed on USDA FS National Forest System (NFS) lands. Just a few months later, on October 19, another burn escaped its boundaries, this time in Malheur NF, Oregon. Although the magnitude of the destruction was much less than in NM, it resulted tensions between local residents and NFS employees and the arrest of the NFS burn manager, shocking the prescribed burn and forestry professions.[5] These two incidents in the western U.S. demonstrate the potential risks of forest management burns and the tensions that can arise between neighbors, as well as among different factions in the public, surrounding its use or nonuse.

Fire has played an important role in North American ecosystems since prehistoric times. It is widely recognized that prior to European colonization, the Indigenous Peoples in many parts of the continent ignited fires frequently and over large areas for ecosystem, wildlife, and land management purposes,[6] and species and ecosystems that were adapted to those conditions thrived. Suppression of fires since European colonization resulted in ecosystemic changes and conditions favoring larger, more intense wildfires. Over the past several decades, there has been an increased recognition that periodic burning is important in many ecosystems for numerous reasons, including mitigation of risk of future catastrophic wildfires by reducing the fuel load, restoration of habitat for certain species, and decrease in vectors for transmission of disease.[7]

However, intentional burning of forests inherently carries risk. First is the risk that a burn can escape from its boundaries and unintentionally burn wildland areas or property, or most seriously, put in jeopardy the health or life of humans. Second, smoke from forest management burns can impact human health directly when respired[8] and reduce visibility impacting enjoyment in scenic areas or creating hazardous conditions for vehicular travel.

Given the benefits of forest management burning together with its inherent risk, a key question has become: how can forestry burning be incentivized to maximize benefits, while also minimizing risk and compensating those who suffer damages? Over time, an overlapping tapestry of environmental statutes, regulations, and common and case law implicating private forest burning has evolved, including a limited amount of overarching federal regulation, but overall varying considerably from State to State. This manuscript has the following objectives, focusing primarily on private actions on private lands:[9]

1. Create a theoretical framework to analyze the economic incentive structure in terms of the costs, benefits, and liability for involved actors.

3. Molly E. Hunter and Marcos D. Robles, 'Tamm review: The effects of prescribed fire on wildfire regimes and impacts: A framework for comparison' (2020) 475 (118435) *Forest Ecology and Management* 5.
4. Romero (n 1).
5. Mike Baker, 'Prescribed Burns Are Encouraged. Why Was a Federal Employee Arrested for One?' New York Times (New York, NY; October 28, 2022) <https://www.nytimes.com/2022/10/28/us/oregon-prescribed-burn-boss-arrested.html>.
6. William M. Denevan, 'The pristine myth: the landscape of the Americas in 1492' (1992) 82 *Annals of the Association of American Geographers* 371; A. Sydney Johnson and Philip E. Hale, *The historical foundations of prescribed burning for wildlife: a southeastern perspective* (Newtown Square, PA, U.S. Department of Agriculture, Forest Service, Northeastern Research Station, 2000), 12; Kevin C. Ryan, Eric E. Knapp and J. Morgan Varner, 'Prescribed fire in North American forests and woodlands: history, current practice, and challenges' (2013) 11 *Frontiers in Ecology and the Environment* e17.
7. Ryan, Knapp, and Varner (n 6).
8. Benjamin A. Jones and Robert P. Berrens, 'Prescribed burns, smoke exposure, and infant health' (2021) 39 *Contemporary Economic Policy* 292–309.
9. The leading examples above, while focused on public lands, were intended primarily to be illustrative.

2. Explore the existing legal architecture for managing the risks, costs, and benefits.
3. Understand the historical evolution of the law with regard to the two points above.
4. Identify policy options.

The manuscript is structured according to the objectives above, as well as a section on the methods used for objectives 2 and 3.[10]

Theoretical framework: Actors, cost–benefits, and liability

Forest management burning comes with risk. Who bears that risk is a matter that the law determines. This section describes a framework for understanding the risks and incentives presented by burning, and the nature of those implicit in various policy formulations.

Risk and externalities

Yoder and others[11] described the decision of whether or not to burn on private land as a benefit–cost decision made by the landowner. If liability for the risk of damage or injury, or indeed any cost or benefit, is borne by the landowner/decision-maker, then it is encapsulated in the decision-making process. On the other hand, if a cost or benefit is borne by someone other than the decision-making landowner, then it is an "externality."[12] The most commonly described externalities are usually "negative" in which a private party taking an action receives a benefit but imposes a cost on the public. Examples might include pollution from manufacturing or a neighbor's loud party. Also widely recognized are "positive" externalities in which an individual provides some public benefit and pays some cost or opportunity cost, but receives no compensation. These are frequently seen in the provision of ecosystem services, such as forests that provide clean water for the public but receive no monetary compensation. The problem with externalities, then, is that individual actors are incentivized to overproduce negative externalities relative to the social optimum, and underproduce positive ones.

Economists have long known, in theory, how externalities can be resolved. Two broad options are favored by economists—Pigouvian taxes and subsidies or Coasean market transactions. Pigou[13] formulated a system in which negative externalities could be taxed and positive ones subsidized by the government.[14] Coase[15] reformulated the question as one of property rights and theorized that, as long as individuals know who has the right to do what and transaction costs are minimal, they can negotiate an efficient solution.[16]

10. Notes on terminology used throughout the manuscript: "Prescribed burn" or "prescribed fire" in the forest and rangeland literature generally refers to an intentional, planned, and controlled burn under appropriate weather conditions and sufficient resources, to accomplish ecosystem management goals. However, in the law, "prescribed burn" or sometimes "certified prescribed burn" refers only to a subset of those which meet the rules and requirements to receive favorable legal treatment (generally, limited liability). In this manuscript, I use "forestry burn" or "forest management burn" to refer to the former, and "prescribed burn" for the latter. "Open burn" refers to any intentional outdoor burning, which can include agricultural fields or piled forestry or agricultural waste. "Wildfire" is an unintended burn. "Escaped fire" is a forestry burn that escapes its boundaries and becomes a wildfire.
11. Jonathan Yoder and others, 'Economics and prescribed fire law in the United States' (2003) 25 *Review of Agricultural Economics* 218–233.
12. Paul A. Samuelson, *Economics* (10th edn, McGraw-Hill, 1976).
13. Arthur Cecil Pigou, *The Economics of Welfare* (Macmillan 1920).
14. An example of a Pigouvian tax would be to tax traffic congestion by charging drivers who enter certain zones of a city at certain times of day. An example of a Pigouvian subsidy would be government paying a portion of the cost for home solar panels.
15. Ronald Coase, 'The Problem of Social Cost' (1960) 3 *Journal of Law and Economics* 1–44.
16. For example, if a polluter of a river has the right to pollute, other users could negotiate and pay the polluter to restrict the polluting use. If the other users have a right to a clean river, the polluter could pay them to accept some level of pollution.

Aside from these two options, and various hybrid approaches, "command and control" regulations are an alternative but are generally regarded as less economically efficient.

The challenge with creating a policy structure for forest management burns is that they present an unusual set of costs and benefits, which contain elements of both positive and negative environmental externality simultaneously.[17] In fact the positive externality produced, at least in part, is just a reduction of potential future negative externality that is qualitatively the same.[18] Like the positive externalities of ecosystem services generated by forests, forest management burning provides substantial public benefits (wildlife habitat, wildfire mitigation) and private costs (the cost of conducting the burn). Like a negative externality, the forest management burning also has the risk of imposing severe costs (nuisance, damage, injury, or death) upon private individuals not involved in the decision-making process. These facts are recognized implicitly by Yoder[19] and Engel[20], but to my knowledge have not been previously described in an explicit manner. Being clear about the unusual structure of the costs and benefits of burns can help define the policy options.

Incentive structure

Let us consider then, that in order to have a burn policy which results in the socially optimal level of burning, rather than two parties as considered under a traditional Coasean framework,[21] we have three parties, each with a different set of costs and benefits: (1) landowners and their burn managers, (2) individual members of the public who might be harmed, and (3) society at large, represented by the State. Most existing literature has explored the incentives of the first, or the first and third parties[22]; while literature by Yoder[23] has focused on the first and second. Past literature on the topic of forest management burn liability has tended to focus more on escaped fire than on smoke, but the incentive structure is similar.[24]

Figure 1 displays a schematic of the dual externality. In this figure and the series that follows, costs and benefits are represented by the boxes with dashed border. If those are not transferred to another party, they are internal costs or benefits. Arrows represent a transfer (thus becoming external costs or benefits) and can be positive or negative. A positive transfer (income) in one direction can be offset either by a negative transfer (cost) in the same direction or a positive transfer in the opposite direction. In the scenario in Figure 1, the landowner pays the financial costs of administering and implementing the burn and bears some risk for potential unplanned damage to the landowner's own property, and in return achieves a concentrated and localized subset of the benefits—their individual property has enhanced ecological benefits and lower risk of wildfire. These are internal to the decision-making process. The landowner transfers to the general public the benefits of long-term lower wildfire risk and wildlife habitat improvement. These benefits are positive externalities. These are low and diffuse for any individual, but can sum to a meaningful value

17. See Kirsten H. Engel, 'Perverse incentives: The case of wildfire smoke regulation' (2013) 40 *Ecology Law Quarterly* 642, who calls prescribed fire a "'good' environmental 'bad'".
18. That is, forest management burns can reduce incidence of large, mega-wildfires (one of the positives), but themselves produce risk of the same downsides as a wildfire (the negative), although to a much smaller degree.
19. Jonathan Yoder, 'Liability, regulation, and endogenous risk: the incidence and severity of escaped prescribed fires in the United States' (2008) 51 *The Journal of Law and Economics* 297–325.
20. Engel (n 17) 623–672.
21. Coase (n 15).
22. See, e.g., John R. Weir and others, 'Liability and prescribed fire: Perception and reality' (2019) 72 *Rangeland Ecology & Management* 533–538; Carissa L. Wonkka, William E. Rogers and Urs P. Kreuter, 'Legal barriers to effective ecosystem management: exploring linkages between liability, regulations, and prescribed fire' (2015) 25 *Ecological Applications* 2382–2393.
23. Jonathan Yoder, 'Playing with fire: endogenous risk in resource management' (2004) 86 *American Journal of Agricultural Economics* 933–948; Yoder (n 1982).
24. A potential difference is that escaped fire is most likely to affect nearby/neighboring property owners, whereas smoke can travel significant distance and/or impact passers-by such as motorists on an adjacent highway.

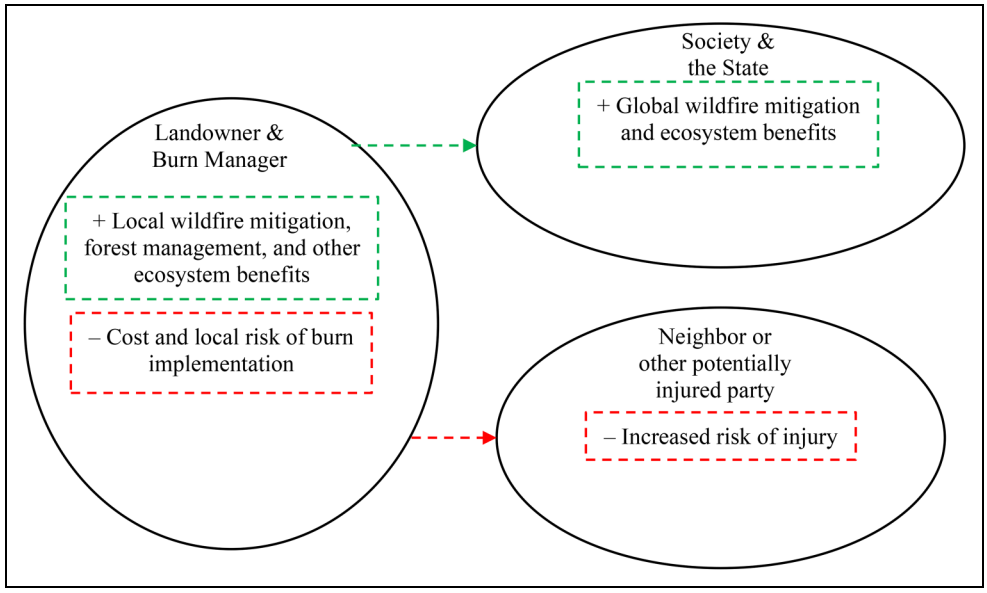

Figure 1. Costs and benefits for forest management burning in a baseline scenario with no liability for burners. Boxes with dashed borders represent benefits (green border, with "+") and costs (red border, with "–"), where those associated with dashed arrows represent transfers to other actors (externalities). In this case, burners not only transfer some benefits of fire to society at large but also transfer the cost of injuries or damages to individuals.

when aggregated over society. However, individual members (especially neighbors, due to proximity, but also others perhaps at random based on the mere fact that they were driving on the wrong road at the wrong time) face a risk of potentially severe costs ranging from nuisance to death. These are negative externalities. Like for the landowners, for any particular member of the public, the risks are small and prescribed fire overall is likely a net benefit. However, for a very small number of individuals, there could be extreme negative consequences. Figure 1 is essentially a "no liability" scenario for burners, since the landowner/burner does not have to compensate for injury. If a no liability (or limited liability) rule favors landowners/burners, members of the general public would not be able to sue if injured, and will bear the risk.

On the other hand, if there is liability for burners, they must compensate injured parties. Figure 2 includes a representation of a strict liability rule. The negative transfer of risk to members of the public is offset by a positive transfer of compensation in the same direction. Here, the risk is borne entirely by landowners/burners, in the form of compensation paid to injured parties.[25]

Still, the strict liability would likely lead to a suboptimal social level of burning. Substantial literature indicates that internalizing the risk of injury to landowners/burners provides a strong disincentive for burning, and in all likelihood is one of the major determinants in the decision whether or not to conduct burns.[26] This is the reason for limiting liability to burners.

25. I do note that, while payment may be determined by the court and the law to be that which fairly compensates for injury, to specific individuals the amount may be worth more or less than what they feel they suffered. In particular, in the most extreme case of a fatality, family members may justifiably feel that no amount of money could replace their lost loved one.
26. Jonathan Yoder, David Engle and Sam Fuhlendorf, 'Liability, incentives, and prescribed fire for ecosystem management' (2004) 2 *Frontiers in Ecology and the Environment* 361–366; Rajan Parajuli and others, 'To insure or not to insure? Factors affecting

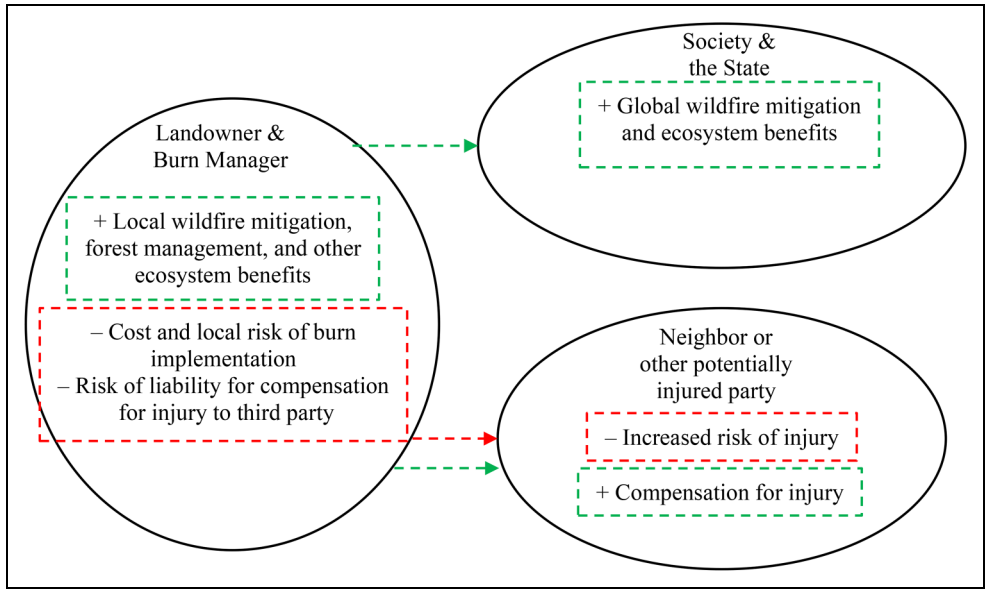

Figure 2. Incentives for forest management burning in a scenario with strict liability for burners as well as technical and financial assistance from the state. Boxes with dashed borders represent benefits (green border, with "+") and costs (red border, with "–").

In many states, forest management burning is not conducted under a no liability or strict liability rule, as suggested in Figures 1 and 2, but rather under either a simple negligence or gross negligence rule.[27] Negligence rules do not change the overarching incentive structure shown in Figures 1 and 2, but rather, make less certain which one applies. It leaves up to a judge and jury to determine whether or not there is sufficient evidence to prove negligence (or gross negligence). If the relevant level of negligence is proven, Figure 2 applies; if not proven, Figure 1 applies. Of course, *ex ante* it is impossible for a burner to know what a judge and jury may or may not decide. This uncertainty can add to the costs of both the burners and others who may be victims of unintended consequences of the burn.[28] Further, fear of liability can be a deterrent to application of prescribed burns.[29]

As shown in Figure 3, the burner and the victim are not the only important parties in this field of policy but the State also plays a role. If the State determines the public on whole benefits from prescribed burning, it could seek to change the balance and distribution of benefits, costs, and risks. A framework based on Coase[30] might work for neighbors of burners. If the State declared that landowners have a right to burn, and no liability, surrounding neighbors might band together to negotiate with a potential burner. However, this market would

acquisition of prescribed burning insurance coverage' (2019) 72 *Rangeland Ecology & Management* 968–975; Yoder (n 1982); Weir and others (n 22); Wonkka, Rogers, and Kreuter (n 22).

27. Under a simple negligence standard, a defendant is held liable if they do not exercise "reasonable care under all the circumstances." There is thus some level of "social fault" even if the action or interest undertaken was legally protected (American Law Institute, *Restatement (Third) of Torts: Liability for Physical and Emotional Harm* (March 2023 update edn, American Law Institute Publishers 2010), Chp. 4 § 3). Gross negligence signifies action taken without even slight attention to care, and in some states or cases relates to reckless, wanton, or willful conduct (ibid § 2; Yoder, Engle, and Fuhlendorf (n 26) 365).
28. Including, but not limited to, the cost of litigation.
29. Weir and others (n 22).
30. Coase (n 15).

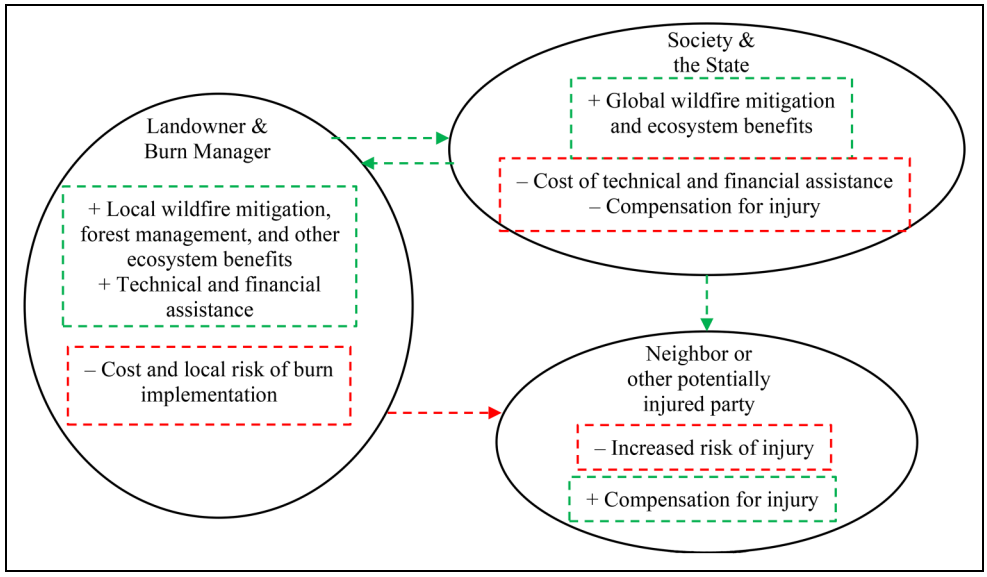

Figure 3. Incentives for forest management burning in a scenario with no liability for burners, as well as compensation for victims of smoke or escaped fire from and technical and financial assistance from the state. Boxes with dashed borders represent benefits (green border, with "+") and costs (red border, with "–").

be limited because the potential recipients of the negative externality include many more people that are difficult to discern *ex ante*, for example, distant landowners, passing motorists, smoke-sensitive residents of faraway cities, for example. In this situation, it is hard to envision a functioning and economically efficient Coasean market. However, subsidies under a framework based on Pigou[31] seem plausible. For example, the State could formulate a liability subsidy for the public good of prescribed fire.

Figure 3 also incorporates state subsidization of the public good provided by burning. This would be intended to help offset the cost of implementing the burn through technical and financial assistance.

Methods: Assessing the legal framework for burns and historical trends

As defined in "Introduction" section, two of my objectives in this paper were to explore the existing legal architecture for managing the risks, costs, and benefits, and to understand the historical evolution of the law related to forest management burns on private lands. In order to achieve these goals, I conducted a qualitative review and synthesis of related statutes, regulations, and prominent court cases in a selection of States. The purpose of this review was to document current and historical law and legal perspectives related to risk of forest management burns.

Haines and Cleaves[32] described four types of laws controlling forest management burns: "(1) air quality law, (2) forest fire control law, (3) general tort law concerning property damage and personal injury

31. Pigou (n 13).
32. Terry K. Haines and David A. Cleaves, 'The legal environment for forestry prescribed burning in the south: Regulatory programs and voluntary guidelines' (1999) 23 *Southern Journal of Applied Forestry* 171.

resulting from escaping fire or drifting smoke (Hauenstein and Siegel, 1980),[33] and (4) environmental laws such as the Endangered Species Act and the Clean Water Act." To broaden this discussion in line with generally recognized areas of law, I reorganize and restate these as (1) common law civil liability, (2) statutory civil liability, (3) statutory criminal liability, and (4) limitations of liability.

To explore each area of law, I reviewed the law in a subset of States. I selected five States to provide regional diversity and overall high level of legal activity in this area: Georgia, Michigan, NM, New York, and Oregon. Where relevant, specific statutes, regulations, and cases from other States are included as examples or to clarify a point. Using Lexis+, I searched for statutes, regulations, and court cases in each of the States using search terms "prescribed burn" and either "smoke management" or "wildfire." Court cases were included only at the appellate level to identify those with more consequential rulings.

The outputs of the searches were reviewed for relevancy to the objectives stated above. I looked for outputs related to private forestry; however, occasionally public lands or agricultural cases proved relevant. I subsequently reviewed cited cases or statutes in each relevant output to identify other sources. Existing legal syntheses and summaries also provided important background information; these are included and cited in the text where relevant. The result of this review was a summary of the legal concepts forming the framework for the legal control of risk associated with forest management burns, presented in "Existing legal framework" section, and a synthesis of historical trends, presented in "Historical trends in the legal framework for burning" section. This summary and synthesis fed into a discussion of issues and policy options in "Discussion and policy options" section, in line with the theoretical framework described in "Theoretical framework: actors, cost-benefits, and liability" section.

Existing legal framework

Common law civil liability

Common law provides the basis for many civil suits. Common law can be complex and many intricacies are beyond the scope of this manuscript. Further, common law is subject to modification by statute, and statutes may form the basis for common law liability; for example, statutes can specifically set the standard of care under which one may be considered non-negligent.[34] Further, failure to abide with statutory requirements, such as notifying the appropriate State agency of a burn in advance, could potentially constitute negligence, *per se*, and subject the burner to common-law civil liability.[35]

Trespass and nuisance

Common law recognizes that individuals can be held liable for trespass,[36] or for nuisance which can be of either a private[37] or public[38] nature. Trespass is more commonly applied to fire than to smoke; however, courts have ruled that both invasion of intentionally set fire or smoke particulates into another's property

33. Eric B. Hauenstein and William C. Siegel, 'Air quality laws in southern states: Effects on prescribed burning' (1981) 5 *Southern Journal of Applied Forestry* 132–145.
34. e.g., NCGS 106–967 to 968.
35. *Butler v. McCleskey* [1993] Court of Appeals of Georgia, 208 GaApp 341.
36. Trespass includes when a person "intentionally and without a consensual or other privilege… (c) permits to remain thereon a thing which the actor or his predecessor in legal interest brought thereon" (American Law Institute, *Restatement of the Law – Torts* (American Law Institute Publishers 1934), §158).
37. Private nuisance is defined as "nontrespassory invasion of another's interest in the private use and enjoyment of land" (American Law Institute, *Restatement of the Law, Second, Torts* (American Law Institute Publishers 1979), §821D).
38. Public nuisance is "an unreasonable interference with a right common to the general public" (ibid., §821B).

can constitute trespass.[39] Both fire and smoke from open burning could potentially constitute either or both trespass and nuisance—trespass if the fire or particulates enter plaintiff's property, or nuisance if it limits enjoyment or use of the property.[40] However, the trespass claim would require a finding of negligence.[41]

Typically, it would be within the jurisdiction of a government agency to address a public nuisance with the alleged perpetrator, rather than a private party bringing suit.[42] However, since many States have recognized the value of prescribed burning,[43] State agencies may be hesitant bring a public nuisance action for smoke arising from prescribed burns, unless there were some particularly egregious action by the landowner, such as negligence or criminal behavior that additionally resulted in a nuisance. Indeed, in many States, Prescribed Burning Acts declare prescribed burning to be in the public interest and statutorily cannot constitute a public or private nuisance, assuming burners follow legal rules.[44]

Creation of hazardous conditions

Burners could be found negligent for not exercising reasonable care while creating conditions that are hazardous. This could be the case when burning escapes or leads to smoke that reduces visibility on a nearby road or highway. Courts have frequently held landowners liable for creation of such hazardous conditions on highways abutting their property.[45] Cases such as *Ryan v. First Nat. Bank & T. Co.*[46] and *Lambert v. Emise*,[47] while not forestry-specific, demonstrate that courts are willing to find property owners negligent for starting fires which result in smoke that subsequently drifts over roadways. If a court were to find that the activity was abnormally dangerous (sometimes referred to as "ultra-hazardous"),[48] it would be subject to strict liability. *Koos v. Roth*[49] presents an example of a case in which an open burn was considered abnormally dangerous. The Oregon Supreme Court stated, "When fire reaches the magnitude of burning essentially the whole surface of a large area open to the winds, the possibility that it will spread beyond its intended bounds cannot be excluded with any practical degree of care."[50]

Statutory civil liability

Statutes are a source of civil liability, which may or may not include liability for damages and injuries, or simply for fines. A first statutory source of civil liability is state-level regulation of forest management procedures. A second source of potential civil liability is derived from regulation of smoke. Smoke from forest

39. *Ream v. Keen* [1992] Supreme Court of Oregon, 314 Or 370; *Elton v. Anheuser-Busch Beverage Group, Inc.* [1996] Court of Appeal, Fourth District, Division 2, California, 50 CalApp4th 1301.
40. *Moon v. North Idaho Farmers Ass'n* [2002] Idaho District Court, First Judicial District, Kootenai County, No CV 2002 3890; *State of Idaho v. Plum Creek Timber Co., Inc.* [2005] United States District Court, D. Idaho, 2005 WL 2415991.
41. *United States v. Idaho County Light and Power Cooperative Association, Inc.* [2020] United States District Court, D. Idaho.
42. *Coffie v. Florida Crystals Corp* [2020] S.D.Fla., 460 FSupp3d 1297.
43. See Section 4.4.3 Prescribed Burning Acts.
44. Ibid.
45. T. C. Williams, 'Emission of smoke or steam from private premises, or existence of other conditions thereon, as ground of liability of owner or occupant for results of an automobile accident in the highway' (1944) 150 *American Law Reports* 371.
46. *Ryan v. First Nat. Bank & T. Co.* [1940] Supreme Court of Wisconsin, 236 Wis 226.
47. *Lambert v. Emise* [1938] Supreme Court of New Jersey, 120 NJL 164.
48. "An activity is abnormally dangerous if: (1) the activity creates a foreseeable and highly significant risk of physical harm even when reasonable care is exercised by all actors; and (2) the activity is not one of common usage" (American Law Institute, *Restatement (Third) of Torts: Liability for Physical and Emotional Harm*, § 20).
49. *Koos v. Roth* [1982] Supreme Court of Oregon, 293 or 670.
50. Nationally, this view currently is the exception more than the rule, and Oregon's legislature subsequently adopted a statute that limits liability to a simple negligence standard when conducted by a certified burn manager (ORS § 526.360).

management burns contains particulates that are regulated under the federal Clean Air Act (CAA).[51] Furthermore, visibility is regulated under CAA. However, in recent decades, the U.S. Environmental Protection Agency (EPA) has granted some flexibility to States in dealing with impacts from smoke due to prescribed burns.

Procedure-based civil liability

Several States, particularly in the western U.S. have Forest Practices Acts that regulate the practice of forest management, including common forest management activities such as timber harvests. These laws are mostly procedural in nature, that is, they require forest landowners to follow certain steps. Noncompliance with these rules typically results in a civil fine. Out of the five States reviewed, only Oregon has a Forest Practices Act,[52] and it does not include rules regarding burning or smoke.

Prescribed Burning Acts may also specify levels of civil liability for suppression costs and damages from escaped fire or smoke. These laws, which are discussed in more detail below, generally limit the level of liability for burners that follow specific rules.[53]

Regulation of smoke

The CAA requires EPA to set National Ambient Air Quality Standards (NAAQSs) for air pollutants that "endanger public health or welfare" and come from diverse sources.[54] it requires each State to adopt and submit a State Implementation Plan (SIP) that shows how it will attain that goal.[55] EPA has regulated particulate matter (PM) since 1971 and currently has NAAQSs for fine (diameter less than 2.5 microns; $PM_{2.5}$) and coarse (between 2.5 and 10 microns; PM_{10}) PM.[56]

Any individual forest management burn seems unlikely to breach the annual PM limits; however, they certainly could surpass the 24-h limit in some areas. EPA has made special provision for prescribed burns, essentially exempting them from air quality regulation if the State and burner follow certain guidelines. Prescribed burns may qualify as "exceptional events" under the Exceptional Events Rule,[57] if the State has adopted a smoke management program, the burn manger employed basic smoke management practices,[58] and the State meets other criteria such as periodically conducting discussions, education, and outreach about air quality and smoke management with burn managers.

Still, the general orientation of the CAA and EPA is that wildfires are "natural" and are usually presumed to qualify as exceptional events, whereas forest management burns are "anthropogenic" and only qualify as exceptional events under relatively narrow circumstances. Scholars have argued for reform because they

51. Clean Air Act (CAA) of 1963, as amended (42 U.S.C. §§ 7401–7671q).
52. ORS §527.610 to 798.
53. Described in more detail in Section 4.4.3 Prescribed Burning Acts.
54. CAA §109 (42 U.S.C. § 7409).
55. CAA §110 (42 U.S.C. § 7410).
56. At time of writing, the NAAQS in force for $PM_{2.5}$ is annual average of 12.0 $\mu g/m^3$ (primary standard for public health) and 15.0 $\mu g/m^3$ (secondary standard for welfare) and 24-hour 98^{th} percentile forms and levels of 35 $\mu g/m^3$. For PM_{10}, 24-hour standard with one-expected exceedance forms and levels of 150 $\mu g/m^3$. EPA has proposed revising the standard beginning July 2023 to lower the primary $PM_{2.5}$ annual standard to within the range of 9.0–10.0 $\mu g/m^3$ (EPA, 'National Ambient Air Quality Standards (NAAQS) for PM' (2023) <https://www.epa.gov/pm-pollution/national-ambient-air-quality-standards-naaqs-pm> accessed 24 February 2023).
57. 40 CFR 50.14 (b).
58. Basic smoke management practices include evaluating smoke dispersion conditions, monitoring, record-keeping, communication and public notification, considering emission reduction techniques such as limiting fuel loads, and coordination with other burners in the area to manage exposure to the public.

believe this disincentivizes forest management burns, which over the long-term will result in greater pollution due to larger wildfires.[59]

EPA does not regulate visibility issues related to dense smoke such as that which might affect roadways or airplanes. However, EPA does regulate haze in an effort to improve visibility in 156 scenic areas such as National Parks and wilderness areas. Like for the PM regulation, States are required to submit a SIP addressing haze. However, unlike with PM, there is no uniform NAAQS; rather, States are required to submit plans to make "reasonable progress" toward reducing haze.[60]

Like with PM, EPA gives leeway to States when considering prescribed burns. If States seek an adjustment to the uniform rate of progress toward limiting regional haze due to prescribed burns, they must estimate and evaluate the impact of prescribed burn on haze, adopt a State smoke management program, and require utilization of basic smoke management practices.[61]

Statutory criminal liability

Most States place statutory limits and restrictions on open burning; violations of these laws can lead to misdemeanor penalties, including fines and jail time.[62] In most States, these laws restrict practices that increase the risk of escaped fire. Many States allow burns only with permits and reserve the right to withhold authorization when conditions are unfavorable.[63] For example, in Georgia in most cases burning without a permit from the county forest ranger is a misdemeanor offense.[64] In addition, in some States violations related to smoke could possibly lead to criminal penalties. For example, in Florida, authorization from the State Forest Service is required to conduct an open burn,[65] and this authorization will not be issued unless smoke management practices are in place such as screening for potential air quality or visibility issues and limitations on size and content of windrows to be burned.[66] Therefore, lack of smoke management would lead to no authorization, and burning without authorization would be a misdemeanor.[67]

Liability limitation and protection

Many States have laws that limit the level of liability for nuisance, harm, or damages resulting from socially beneficial prescribed burns. The basis for determining liability is generally defined to be strict liability,[68]

59. Emily Williams, 'Reimagining exceptional events: regulating wildfires through the clean air act' (2021) 96 *Washington Law Review* 765–810; Engel (n 17).
60. EPA, 'Regional Haze Program' (2023) <https://www.epa.gov/visibility/regional-haze-program> (accessed 25 January 2024).
61. 40 CFR 51.300 *et seq.*
62. Xue Han, Gregory E. Frey and Changyou Sun, 'Regulation and Practice of Forest-Management Fires on Private Lands in the Southeast United States: Legal Open Burns versus Certified Prescribed Burns' (2020) 118 *Journal of Forestry* 387.
63. See Han, Frey, and Sun (n 62) 391, which documented 7 of 9 States in the southeast require permits for open burning at a minimum during certain seasons or in certain parts of the State.
64. O.C.G.A. § 12-6-90.
65. F.S. §590.125 (2) (a).
66. F.A.C. §5I-2.004; 2.006.
67. F.S. §590.125 (2)(d).
68. Under a strict liability standard, burners or landowners are generally liable for any damages or harm due to their action, without regard to negligence or intent, that is, the plaintiff need not prove negligence (American Law Institute, *Restatement (Third) of Torts: Liability for Physical and Emotional Harm, Chp. 4*).

simple negligence,[69] gross negligence,[70] no liability,[71] or uncertain.[72] With liability limitation in place for some socially beneficial activity, the degree of negligence that must be proven is raised one or more levels.

Immunity for public officials

To the extent that State or federal officials are involved in burning or permitting of burns in their official capacity, in certain circumstances sovereign immunity or public duty doctrine may apply, protecting them from individual liability.[73] Federal employees can be sued if negligence is a factor[74]; however, there are exceptions to this waiver of immunity, including discretionary-function exception.[75]

Right-to-Farm acts

All 50 States have enacted some version of what are called "Right-to-Farm" statutes. Generally, these laws protect farming activities in established zones or previously existing farming areas from nuisance lawsuits from newer residents.[76] In order to qualify for protection, the farming activities must meet some standard of reasonableness or general acceptance, depending on the State. In many cases, "farming" for purposes of these acts includes forestry, so if a forest management burn were considered to meet whatever standard of reasonableness the State sets, it potentially could be protected from certain nuisance suits.[77] However, these protections are only applicable when a nonagricultural use "comes to the nuisance," that is, moves into an area of already-established agricultural use.[78] Likewise, a change in the nature of the farming activities after the nonagricultural use was established likely would not be protected.[79]

Prescribed burning acts

Numerous States have passed "Prescribed Burning Acts."[80] In general, these limit the liability of burners and landowners if they meet specific requirements to qualify as a "prescribed burn" or "certified prescribed burn" in that State. These requirements generally include several preburn planning and permitting steps, as well as during-burn implementation steps.[81] These steps, such as creating a smoke management plan and

69. See (n 27).
70. See (n 27).
71. A "no liability" situation was posited as a theoretical by Yoder, Engle, and Fuhlendorf (n 26) 362. Perhaps the closest example of which the author is aware is Texas, which provides for no liability if the burn is supervised by a certified and insured burn manager (Tex. Nat. Res. Code §§ 153.081–082).
72. Changyou Sun, 'State statutory reforms and retention of prescribed fire liability laws on US forest land' (2006) 9 *Forest Policy and Economics* 393; Changyou Sun and B. Tolver, 'Assessing administrative laws for forestry prescribed burning in the southern United States: a management-based regulation approach' (2012) 14 *International Forestry Review* 338; Wonkka, Rogers, and Kreuter (n 22) 2383; Yoder, Engle and Fuhlendorf (n 26) 5.
73. *Georgia Forestry Com'n v. Canady* [2006] Supreme Court of Georgia, 280 Ga 825; *Myers v. McGrady* [2006] Supreme Court of North Carolina, 360 NC 460.
74. 28 U.S.C. §§ 2671–2680.
75. When an official retains a degree of judgment or choice in the course of a mandated action (*Schurg v. United States of America* [2023] United States Court of Appeals for the Ninth Circuit, 63 F.4th 826).
76. Alexandra Lizano and Rusty Rumley, *State Right-to-Farm Provisions* (National Agricultural Law Center 2019).
77. In *Ream v. Keen* (n 39), the State Supreme Court of Oregon was asked to consider if field burning was protected from trespass claims, but the court declined to form an opinion since the question was not raised at trial.
78. *Moon v. North Idaho Farmers Ass'n* (n 40).
79. *Finlay v. Finlay* [1993] Court of Appeals of Kansas, 18 KanApp2d 479.
80. Bill Cary, Jamey Lowdermilk and Jennifer Fawcett, *Prescribed Fire Liability Report for the Southern United States: A Summary of Statutes and Cases* (Southeast Regional Partnership for Planning and Sustainability (SERPPAS) 2022); Han, Frey, and Sun (n 62); Sun and Tolver (n 72).
81. Han, Frey, and Sun (n 62); Sun and Tolver (n 72).

having a trained and/or experienced certified burn manager on site, generally work to limit the risk of an adverse event such as escaped fire or detrimental smoke impact.[82] However, these actions do themselves increase the financial cost of conducting the burn.[83]

Generally, determination of the sufficiency of evidence to prove negligence or gross negligence would be a question for a jury, although in gross negligence cases a judge initially determines if there is sufficient evidence for the jury to consider.[84] Accordingly, Georgia courts have ruled that prescribed burns compliant with the Georgia Prescribed Burning Act in which at least some evidence of diligence or care is demonstrated are protected from liability and can be dismissed by summary judgment.[85]

Historical trends in the legal framework for burning

Tables 1 and 2 show various federal legal events over time affecting the implications for liability and incentives of conducting forest management burns. Overall, there are two discernible trends: overall stricter liability and regulation of forest management burns through the 1980s, and beginning around the 1990s a rules-based relaxation of liability for certain certified prescribed burns.[86, 87]

Regulation under the CAA and a particular court case is instructive in demonstrating these trends. Flexibility for prescribed burning was not always the norm under CAA; indeed as recently as a decade ago EPA gave States leeway on smoke from wildfire as a "natural source," but encouraged vigorous policing of "anthropogenic" forest management burns.[88] The facts as determined in *Safe Air For Everyone v. U.S. E.P.A.*[89] demonstrate the evolution of the EPA and the States on this subject. In 1971, Idaho submitted and EPA approved a SIP for particulates that limited open burning of agricultural fields to just a few situations. In 1993, the new SIP was even more limited and had no provision to allow agricultural field burning. By 2005, the SIP underwent another revision, which allowed burning of agricultural fields if conducted in accordance with a smoke management plan. In that case, EPA argued that burning of agricultural fields was never prohibited and the 2005 SIP was only a clarification rather than a substantive change, but the Court determined that burning had in fact been prohibited in the 1993 SIP and remanded the approval of the SIP to EPA to consider the substantive change. This evolution in regulation demonstrates an overall trend of increasing restrictions and limits on burning from 1970s to 90s, and a subsequent relaxation of these limits for burns conducted in accordance with smoke management practices.

Negligence standards in the court for forest management burns show a similar trend. *Cobb v. Twitchell*[90] in the 1920s determined that a simple negligence standard was appropriate to apply to a legal burn that escaped onto a neighbor's property. Gradually, courts tended to move toward stricter liability through the 1970s and 1980s,[91] presumably due to the growing assumption that it was an abnormally dangerous

82. Yoder (n 19) 300–301.
83. Yoder and others (n 11) 220.
84. *Hodges v. Helm* [1969] Supreme Court of Florida, 222 So 2d 418; *DACS v. Shuler* [2014] District Court of Appeal of Florida, First District, No 1D13–0592.
85. *Wolfe v. Carter* [2012] Court of Appeals of Georgia, 314 GaApp 854; *Newton v. Jacobs* [2021] Court of Appeals of Georgia, 358 GaApp 180.
86. Stephen McCullers, 'A dangerous servant and a fearful master: why Florida's prescribed fire statute should be amended' (2013) 65 *Fla L Rev* 596–598.
87. These trends may not have been uniform across all regions of the country; agricultural burning in some southern States generally remained an accepted practice, influencing the perceptions of forest management burns.
88. Engel (n 17) 651.
89. *Safe Air For Everyone v. U.S. E.P.A.* [2007] United States Court of Appeals, Ninth Circuit., 488 F3d 1088.
90. *Cobb v. Twitchell* [1926] Supreme Court of Florida, Division A, 91 Fla 539.
91. William D. Eshee, Jr., *Legal implications of using prescribed fire* (Florida State University 1997) 130; McCullers (n 86) 603.

Table 1. Timeline and description of common law, federal law, and state law trends impacting smoke management from forestry burns.

Time period	Description of event or law	Reference
Precolonial period	Indigenous Peoples of North America practiced ecosystem burning widely. However, the formal or informal rules, risk mitigation measures, and liability or punishment for improper use or deleterious effects of fire are generally unknown.	Denevan (n 6)
Colonial period and thereafter	English colonies generally adopted English common law, which was supplemented and superseded over time with various statutes. English common law is the basis for concepts such as nuisance, strict liability, and negligence. Former colonies and other territories from other legal traditions, with a few exceptions, adopted English common law upon becoming formally organized as a U.S. territory.	Jerrold S Jensen, 'The Common Law of England in the Territory of Utah' (1992) 60 *Utah Historical Quarterly*
1800s–1980s	Many States pass (and often revise numerous times) open burning or forest fire protection acts that limit how burning can be conducted outdoors, often with criminal penalties	Table 2
1970	Clean Air Act (CAA) Amendments of 1970	42 U.S.C. 7401 *et seq.*
1971	First regulation for particulates promulgated by EPA under CAA, for total suspended particulates 45 microns or smaller	Fed. Reg. 36 (84): 8186
1980s–90s	Many States pass "Right to Farm" statutes limiting nuisance claims for established agricultural practices from new residents in an area.	Table 2
1987	Revised CAA particulate regulation for first time includes PM_{10}.	Fed. Reg. 52 (126): 24634
1990s-present	Many States pass Prescribed Burning Acts specifying the negligence level for liability of burners and landowners that fulfill preparatory and implementation requirements.	Table 2
1997	Revised CAA particulate regulation includes both PM_{10} and $PM_{2.5}$.	Fed. Reg. 62 (138): 38652
1999	EPA issued regulations to improve visibility in 156 National Parks and wilderness areas (Regional Haze Rule). No special consideration for prescribed fire, and to the extent they represent anthropogenic rather than natural sources, are regulated more strictly than wildfires.	Fed. Reg. 64 (126): 35714
2007	CAA Exceptional Events Rule effective. Prescribed burns included as possible exceptional events.	Fed. Reg. 72: 13559
2016	CAA Exceptional Events Rule revised to clarify circumstances under which prescribed burns can be excluded from data assessing nonattainment.	40 CFR § 50.14
2017	Revised requirements for State Regional Haze Plans include specific criteria for States to seek an adjustment to the uniform rate of progress due to prescribed burns.	40 CFR 51.300 *et seq.*

Table 2. State laws and regulations governing smoke management from forestry burns, including year effective and relevant details.

State	GA	MI	NM	NY	OR
Open Burn Statute	GCA §12-6-80 to 93	MCLA 324.51501 to 51514	NMSA §30-32-1 to 4 § 68-2-7 to 16	NY ECL §9-1101 to 1123	ORS §477.001 to 993
Year	1956	1994	1921	1972	1965–1971
Covers smoke?	no	no	no	no	yes
Forest Practices Act	N/A	N/A	N/A	N/A	ORS §527.610 to 798
Year					1991
Prescribed Burning Act	GCA §12-6-145 to 149	MCLA 324.51503b	NMSA §68-5-1 to 8	N/A[a]	ORS § 526.360
Year	1992	1994	2021	N/A[a]	1999
Negligence std	gross	gross[b]	simple	N/A[a]	simple
Smoke Management Regulations	N/A	MAC R 281.425	NMAC 20.11.21.15 to 20	6 NYCRR 194.5	OAR 629-048-0001 to 0500
Year		2007	2003	1993	2008
Right to Farm Statute	GCA §41-1-7	MCLA 286.471 to 474	NMSA §47-9-1 to 7	NY Ag & Mkts §308	ORS §30.930 to 960
Year	1980	1981	1981	1992	1993

[a]NY ECL § 9-1105 (1991) establishes the definition of and conditions under which a prescribed burn may be permitted in New York. However, it does not grant limitation of liability, so it is not considered a "Prescribed Burning Act" for our purposes.
[b]MCLA 324.51503b(3) specifies that gross negligence standard does not apply to fire that escapes the authorized boundary, so would only apply to damages or injury from smoke, or by fire within the authorized boundary.

activity,[92] and also including the possibility of landowners being held vicariously liable for the actions of their contracted burn manager.[93] In the 1990s State legislatures began stepping in,[94] and by 2006, 22 States had adopted either a simple or gross negligence standard for prescribed burns.[95]

Discussion and policy options

There is broad consensus that forest management burns can offer significant benefits to the public at large.[96] Perhaps most importantly, burning under controlled conditions during periods when fires are less likely to create problems can make future wildfires smaller and less severe.[97] If done over large enough areas, this may reduce long-term air pollution and health impacts.[98] However, this does come with risk. The divergent

92. *Koos v. Roth* (n 49).
93. *Midyette v. Madison* [1990] Supreme Court of Florida, 559 So2d 1126.
94. Eshee (n 91) 130.
95. Sun (n 72) 394.
96. Society of American Foresters (n 2); Hunter and Robles (n 3).
97. Hunter and Robles (n 3) 5–6.
98. Xiaoxi Liu and others, 'Airborne measurements of western US wildfire emissions: Comparison with prescribed burning and air quality implications' (2017) 122 *Journal of Geophysical Research: Atmospheres* 6125; Daniel A. Jaffe and others, 'Wildfire and

trends in forest management burning law over the last century are indicative of conflicting benefits and interests.[99]

If landowners, directly or vicariously through their burn managers, bear the burden of risk through exposure to liability, they are likely to reduce the area of forest burned annually. Most people are risk-averse, or perhaps overestimate the likelihood of infrequent but large events. This is true in prescribed fire, where landowner liability concerns seem to outstrip the relative risk, and is understood to be one of the greatest, if not the single greatest, deterrent to use of prescribed burns.[100] It has been shown that States with the greatest degree of liability protection (gross negligence standard) seem to have highest use of prescribed burning.[101]

Uncertainty

Adding to the perception of risk is uncertainty. Knight[102] first formalized the distinction between risk and uncertainty, in which risk has relatively known likelihoods, whereas uncertainties are unknown. The possibility that a burn escapes its boundary is a risk, with probabilities that informed burn managers can estimate and internalize, that change depending upon conditions. The possibilities that a jury might perceive one's actions as negligent, or that a judge may interpret various provisions of law differently than expected, are types of uncertainty that may deter use of forest management burns.

As noted previously,[103] simple or gross negligence rules can create a degree of uncertainty. Depending on the circumstances, liability will either be assigned to the burner or not; that is, either Figure 1 or Figure 2 applies. Negligence rules leave that determination up to a court.

DACS v. Shuler[104] showed that a trial court interpreted the word "extinguished" to mean that a prescribed burn no longer smoldered rather than no spreading flames existed, as defined in statute.[105] Since certified burn managers in Florida are required to be onsite until the burn is "extinguished" and burns can smolder for weeks after spreading flames are put out, this has severe consequences for cost and management of burns. While the trial court ruling was overturned on appeal, it demonstrates both the level of uncertainty and the potential cost of litigation.

Similarly, McCullers[106] argued that ambiguous requirements in the law can provide significant uncertainty to prospective burners. The example provided by McCullers[107] is the requirement that in Florida certified prescribed burners provide "adequate firebreaks … and sufficient personnel and firefighting equipment." Since the law does not define what amount is "adequate" or "sufficient," burners fear that any escaped fire could be used as proof that the firebreaks, personnel, or equipment was inadequate or

prescribed burning impacts on air quality in the United States' (2020) 70 *Journal of the Air & Waste Management Association* 608, 613.

99. As discussed in Section 2, Theoretical Framework: Actors, Cost-Benefits, and Liability.
100. Urs P. Kreuter and others, 'Landowner perceptions of legal liability for using prescribed fire in the Southern Plains, United States' (2019) 72 *Rangeland Ecology & Management* 960; Weir and others (n 22) 534.
101. Gregory E. Frey and Xue Han, 'A Recent History of Controlled Burning for Wildfire Risk Mitigation in the Southern Appalachian States' in James NA (ed), *Fire in the Southern Appalachians: Understanding Impacts, Interventions, and Future Fire Events* (U.S. Department of Agriculture, Forest Service, Southern Research Station 2020) 28; Wonkka, Rogers, and Kreuter (n 22) 2386–2387.
102. Frank H. Knight, *Risk, uncertainty and profit* (Hart, Schaffner and Marx 1921).
103. See Section 2.2 Incentive structure.
104. *DACS v. Shuler* (n 84).
105. F.S. § 590.125(1)(f).
106. McCullers (n 86) 611–613.
107. Ibid.

insufficient, *per se*. Since that is a requirement of certified prescribed burning, they would be found not to be compliant and could be exposed to strict liability.

With few exceptions,[108] the most limited liability rule assigned for certified prescribed burns is the gross negligence standard. Yet, the same statutes[109] that set the negligence standard often require numerous protocols and procedures for the burner to follow.[110] It is difficult to understand how a burner could follow all those steps and still be found not to have paid even slight attention to care (in the case of a gross negligence standard), or even not to have exercised reasonable care (in the case of simple negligence).[111] Thus, States might consider whether moving to a no liability rule when burning under a list of well-defined and unambiguous proper procedures and protocols for a certified prescribed burn might reduce uncertainty for burners. However, such a rule may have other consequences as follows.

Shifting liability from burners

If prescribed burners are shielded from liability, victims of unintended smoke or escaped fire will bear the burden as shown in Figure 1. Neighbors would have no recompense for burns that destroy their timber or buildings; motorists who have accidents due to smoke would bear the cost. This has several possible implications.

First, there could be an overall loss of public support for prescribed burning. Although in sum across society, the benefits likely outweigh the costs, some individuals may suffer significantly. If victims are not compensated somehow, these stories could galvanize public opposition to prescribed burning and lead to legislatures revoking liability protection. Appeals to fairness and justice for the victims on occasion have led governments to create compensation funds for victims of escaped prescribed, on an *ad hoc* basis. This sometimes occurs after prescribed burns become massive fires, as in the Calf Canyon/Hermit's Peak fire described in the introduction.[112] Still, as far as the author is aware, there is no formal policy or compensation fund established by either the federal or any state government to compensate victims of prescribed burns, particularly smaller incidents that might only affect a few individuals but can still be devastating for them and their families. Such a policy landscape can lead to uncertainty and tensions between burners and neighbors, as demonstrated by the burn at Malheur NF, also described in the introduction.

Second, there is a legal question as to whether not compensating the victims might violate the Fifth Amendment to the U.S. Constitution. The Fifth Amendment bans the taking of private property for public use without just compensation. *Armstrong v. United States*[113] held that "The Fifth Amendment … was designed to bar Government from *forcing some people alone to bear public burdens* which, in all fairness and justice, *should be borne by the public as a whole*" (emphasis added). State Prescribed Burning Acts generally declare that prescribed burning is in the public interest, and thus could be considered a public purpose, and its costs a public burden. Certainly that is why State governments chose to limit burners' liability. A burned building, wrecked car, or some other result of prescribed fire, therefore, could be viewed as taking private property for a public purpose.

Without some mechanism to compensate victims, a court might accept the argument that limiting liability of burners violates the Fifth Amendment, striking down Prescribed Burn Acts. The Supreme Court of

108. See (n 71).
109. See Section 4.4.3 Prescribed Burning Acts.
110. Han, Frey, and Sun (n 62); Sun and Tolver (n 72).
111. See (n 27).
112. Romero (n 1).
113. *Armstrong v. United States* [1960] Supreme Court of the United States, 80 SCt 1563.

Idaho considered this argument in *Moon v. North Idaho Farmers Ass'n.*[114] A District Court had determined that the portion of the Idaho Right to Farm Act that granted immunity to certain agricultural burners from suits related to nuisance or trespass from such burning was unconstitutional.[115] That Court decided that allowing one class of landowners to commit nuisance or trespass against another class created an easement, which would qualify as a taking that should be compensated under the Fifth Amendment, and therefore, the law was unconstitutional. Ultimately, the Supreme Court of Idaho overturned the District Court opinion and held that immunity of burners was constitutional and that the victims were not entitled to compensation. However, that ruling may not be replicated elsewhere under different circumstances.

Alternative parties to bear liability

If liability for the burner imposes costs that limit burning (reducing a potential positive externality), and no liability imposes uncompensated harm on other third-party individuals (imposing a negative externality), what alternatives are there? Given the incentive architecture for forest management burns,[116] an option might be for a third party to assume the risk. In many other situations, this could be assumed by a private insurance market. Private insurance is a common way to manage risks and liability in various other sectors. However, for various reasons, at the time of writing, private insurance for burning is not widely available.[117] This type of insurance for prescribed burns is only recently emerging and a survey reported in 2019 showed that only 39% of prescribed burn managers with contact information on file with a Cooperative Extension Service (presumably among the most engaged and active burners) had insurance.[118] Weir and others[119] document a case in Texas in which existence of insurance coverage seemed to spur a large number of lawsuits; the insurer later withdrew coverage.

If a private insurance market is not well-developed, there may be ways for the State to facilitate development or fill the gap, as indicated in Figure 3. Examples include:[120] (1) some form of State-level fund or public insurance mechanism could be used to compensate victims, (2) the State could subsidize private insurance in some way, either permanently or for an initial period of time, or (3) some form of tax deduction or other tax incentive either for purchasing insurance or for paying compensation. The system might precisely describe requirements that would be placed on the burners to qualify for this plan. It is important to note that a State-funded compensation or insurance system, while increasing the incentive to burn, could also lead to "moral hazard"; that is, it also lowers the incentive for burners to avoid potentially risky behaviors.[121] Such moral hazards are common in insurance markets, and frequently are addressed with mechanisms such as eligibility requirements, deductibles, and copayments.

Conclusions

Adverse impact from forest management burns poses a risk for society. It can become a nuisance or trespass, impede enjoyment of scenic views, impact health, damage or destroy property, or cause direct harm to

114. *Moon v. North Idaho Farmers Ass'n* [2004] Supreme Court of Idaho, 140 Idaho 536.
115. *Moon v. North Idaho Farmers Ass'n* (n 40).
116. See Section 2.2 Incentive structure.
117. Weir and others (n 22); Parajuli and others (n 26).
118. Parajuli and others (n 26) 970.
119. Weir and others (n 22) 563.
120. It is possible to imagine many other potential mechanisms, these are just a few examples.
121. See David Rowell and Luke B. Connelly, 'A history of the term "moral hazard"' (2012) 79 *Journal of Risk and Insurance* 1051–1075 for a description and history of the term "moral hazard" and underlying concepts.

individuals, even death. Of course, these negatives are all shared with wildfires, and it is widely recognized that prescribed burns can reduce the overall long-run risks from wildfires. Still, forest management burn risk persists. A major question is, how can policy be used to reduce and balance this risk? Liability standards and regulations for burns over time through most of the twentieth century increasingly placed the burden of that risk on the shoulders of the landowners conducting the burns. However, in the later decades of the century, an increased recognition of the benefits of forestry burns led many States to reverse this trend. In order to reduce disincentives for landowners and burners, some States have implemented gross negligence standard or elimination of liability for a subset of qualified (certified) prescribed burns that met requirements designed to reduce risks. In addition, some literature has discussed the value of Prescribed Burning Acts and regulations being very clear and specific as to the requirements, so that uncertainty about meaning and potential liability does not impede implementation.

While the Prescribed Burning Acts, through requirement of good practices, does mitigate the risk from burns, there will always be some risk and someone will bear it. If the State does nothing further to step in, either burners or victims of smoke or fire will bear this risk, and in the case of a simple or gross negligence standard the allocation of liability to either burners or victims will be uncertain until after the fact. Since the public at large are assumed to benefit from proper prescribed burning, States may consider how best to provide legal clarity, how to balance associated risks, and where to place the liability burden, including the possibility of the State assuming some of this burden.

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