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A tale of two fire systems: indigenous fire stewardship in British Columbia and California

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Abstract

Background An increasing wildfire problem in western North America has created a policy space for Indigenous fire stewardship (IFS) to mitigate wildfire. We compare how British Columbia and California have supported IFS—two jurisdictions with distinct ecosystems but similar histories of colonialism and its socio-ecological consequences. We examine how IFS is incorporated into each jurisdiction's institutional framework, and the barriers to, and opportunities for implementation.

Results Each jurisdiction's approach to recognizing IFS is shaped by different constitutional frameworks and legal relationships with Indigenous Peoples. California recently developed policies and planning documents to support IFS and enable co-stewardship and contracting agreements similar to the policies of some federal agencies. However, barriers related to land tenure constrain IFS practitioners and inhibit meaningful implementation across broader landscapes. Compared to California, British Columbia has not shown as much openness to supporting independent IFS practitioners, but instead has begun a project to integrate aspects of IFS into the existing provincial wildfire service. While British Columbia has expressed interest in working toward a shared decision-making approach with First Nations, the present framework restricts IFS to Indigenous land tenures (which comprises only 0.4% of the province).

Conclusions Despite legal and policy changes to support IFS since 2017, deep-seated constraints prevent systematic implementation at a meaningful scale in both jurisdictions. Laws cannot by themselves catalyze social change; they must be complemented by a suite of initiatives to transform the social context. Some of these changes to enable IFS include government support for Land Back and land access for IFS practitioners; the removal of agency silos; building awareness of, and support for IFS within agencies and among the public; and providing resources for Indigenous Peoples to steward landscapes throughout the year, to achieve multiple goals.

Keywords Indigenous fire stewardship (IFS), Indigenous peoples, Law, Land tenure, Treaties

Resumen

Antecedentes El problema incremental relacionado con los incendios de vegetación en el oeste de Norte América ha creado un espacio en el desarrollo de políticas de Administración Indígena de Tierras para mitigar los incendios de vegetación (*Indigenous Fire Stewardship*, IFS). Comparamos cómo la Columbia Británica y California han apoyado las IFS, dos jurisdicciones con distintos ecosistemas pero con historias similares en cuanto al colonialismo y sus consecuencias socio-ecológicas. Examinamos cómo las IFS han sido incorporadas al marco institucional de cada jurisdicción, y las barreras u oportunidades para su implementación.

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Resultados El enfoque de cada jurisdicción para reconocer las IFS fue concebida y modelada por diferentes marcos constitucionales y relaciones legales con pueblos indígenas. California desarrolló recientemente políticas y documentos de planificación para apoyar las IFS y ser capaces de co-administrar y desarrollar acuerdos contractuales similares a las políticas de algunas agencias federales. Sin embargo, las barreras relacionadas con la tenencia de las tierras condicionan a los practicantes de IFS e inhiben una implementación más provechosa a través de paisajes más amplios. Comparado con California, la Columbia Británica no ha mostrado tanta apertura para apoyar a los practicantes de las IFS para que actúen de manera independiente, aunque han comenzado, en cambio, con un proyecto para integrar aspectos del IFS a los servicios de fuego provinciales. Mientras que la Columbia Británica ha expresado su interés en trabajar hacia una aproximación para la toma de decisiones compartidas con las comunidades indígenas (*First Nations*), el presente marco de trabajo restringe las IFS sólo a territorios de propiedad indígena (que comprende sólo el 0,4 % de la provincia).

Conclusiones A pesar de los cambios legales y de políticas para apoyar a las IFS desde 2017, profundos condicionantes previos previenen la implementación sistemática en una escala significativa en ambas jurisdicciones. Las leyes por sí solas no catalizan el cambio social; deben ser complementadas con un conjunto de iniciativas para transformar el contexto social. Algunos de los cambios que permitan desarrollar las IFS incluyen: el apoyo del gobierno para retornar las tierras y el acceso para los practicantes de IFS; la remoción de agentes que actúan como compartimientos estancos reteniendo información; la creación de conciencia sobre, y el apoyo para las IFS, dentro de las agencias y entre el público; y proveer recursos para comunidades indígenas para administrar paisajes durante todo el año, y de esa manera alcanzar múltiples objetivos.

Background

As the wildfire crisis worsens in British Columbia (B.C.) and California, their institutional frameworks have become more receptive to the fire practices of Indigenous Peoples, or what is termed Indigenous fire stewardship (IFS) (e.g., California Wildfire and Forest Resilience Task Force 2022, Lake 2021, Nikolakis and Roberts 2020). IFS includes cultural burning as well as a range of activities to support the application of good fire on landscapes to meet the diverse goals of Indigenous Peoples. This willingness to accommodate IFS, after more than a century of prohibiting the practice, is driven by several factors, including Indigenous Peoples' activism, a general recognition that fire suppression is not effective in mitigating wildfire risk (Parks et al. 2025), and the growth in Indigenous Peoples' rights to govern their lands and collectives in their own ways (Nikolakis et al. 2024).[1]

B.C. and California have both implemented IFS into their wildfire governance frameworks, but there are gaps and opportunities in the two approaches, with reference to their distinct legal, political, administrative, ecological, and structural contexts. Furthermore, there are identifiable areas for learning to support IFS and to meaningfully address the wildfire crisis in both jurisdictions. Given these understandings, we first present the context and history of each jurisdiction and the processes of colonization, with particular attention paid to Indigenous People's land rights and fire uses; we then present the diverse ecological contexts of each jurisdiction and discuss studies that have reconstructed the ecological history of IFS. Second, we present each jurisdiction's wildfire governance framework since colonization, how it has evolved over time, and the laws and policies to recognize IFS. Third, we discuss opportunities for supporting the learning and growth of IFS in light of three key barriers.

Contexts

Indigenous Peoples and their land rights

British Columbia

There are 203 First Nations in B.C. (of 630 across Canada), who are the Indigenous Peoples to the region. These peoples have intimately existed here for millennia and their unique societies, laws, and sovereignty are derived from a deep relationship to place. By comparison, B.C. as a colonial province has a relatively short and less-rooted history. The Hudson's Bay Company established a settlement on Vancouver Island in 1843. In 1846, the Oregon Treaty, signed by Britain and the USA, established the boundaries between the two nations at the 49th parallel latitude north. The Colony of B.C. was established in 1858. In 1863, its boundaries were extended north and in 1866 incorporated the Colony of Vancouver Island. B.C. joined Canada in 1871.

[1] In B.C this is reflected in the implementation in law of the United Nations Declaration on the Rights of Indigenous Peoples, 2007.

From 1850 to 1854, the Crown made 14 land purchases from First Nations on Vancouver Island (the Douglas Treaties).[2] After 1871, the Crown adopted a *terra nullius* perspective in B.C., that Aboriginal title did not exist or was extinguished. No other treaties were signed in B.C. until 1899, when Treaty 8 in the province's northeast was signed. During that period, most First Nations across the province were often compelled or forcefully relocated to small reserve lands; today, there are 1583 reserves assigned to 203 First Nations. Most First Nations territories have been claimed by the Crown and settlers, and there has been resistance to giving land back (Diamond and Sanderson 2025).[3] The first Crown provincial law that deemed IFS as illegal was the 1874 Bush Fire Act (Copes-Gerbitz et al. 2022).

In the 1973 Supreme Court of Canada decision of *Calder v. British Columbia*, a split court reasoned that Aboriginal title had survived B.C.'s confederation into Canada. The federal government then commenced the modern land claims process to resolve any outstanding land claims like those of the Nisga'a claimants in *Calder*. The B.C. Treaty Commission was established in 1992, and the first treaty negotiated in the province was the Nisga'a Final Agreement in 2000. Since then, only three treaties have been finalized and implemented in B.C.. Most land claims remain in limbo. Because of this, many First Nations have pursued other strategies to get their land back. For instance, in 2014, the Tŝilhqot'in Nation obtained Aboriginal title to approximately 1700 km^2 of their traditional territories in central B.C.—the first title claim declared by the Supreme Court of Canada.[4] Aboriginal title is an exclusive right to customary lands, protected under Sect. 35 (1) of the Constitution Act, 1982. Aboriginal title holders can use their land as they wish, and they can develop laws and regulations for forests and wildfire.

However, more than 50 years on after *Calder*, most First Nations in B.C. do not have their land back. Total recognized First Nations lands represent around 15,742 km^2 of the provinces total area of 944,735 km^2. The lands that First Nations typically have secure access to are reserve lands—small pockets of land held in trust for First Nations by the Crown. Applying IFS to areas off-reserve is contentious (Nikolakis et al. 2024). However, many First Nations are negotiating their inherent right to self-government with the Crown, which may create opportunities for applying IFS more broadly than reserves. B.C. was one of the first jurisdictions to implement the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) into law by establishing the Declaration on the Rights of Indigenous Peoples Act, 2019. Sections 6 and 7 provide for shared decision-making agreements between the Province and First Nations which may create broader opportunities for IFS (see potential agreements under Sect. 23 of the Wildfire Regulations in Table 1).

California

For millennia, Tribal Nations across California exercised their sovereignty and stewardship of their lands, including IFS. In 1769, Spain strengthened its settlement of what is today California, and established Missions along the coast for Tribes to be Christianized (often forcibly). Spain recognized Indigenous land rights (occupancy rights) and sought to protect these under the 1681 Recopilación de Leyes de los Reinos de las Indias (Wood 2008). The tribal villages and towns neighboring Missions were recognized as rancherias or pueblos. The first fire control regulations on IFS were put in place by Alta California Governor Jose Joaquin de Arrillaga, in a proclamation dated 31 May 1793 (Timbrook et al. 1982). In 1821, California came under the jurisdiction of Mexico, but the protection of land rights and any land grants or title made by the Spanish were maintained. In 1834, Mexico secularized the Missions, which led to many Indigenous Peoples being forced from their lands, and the conversion of rancherias or pueblos to ranchos. The best lands were often taken up by other Mexican citizens. The remaining Indigenous lands on the ranchos then became rancherias.[5]

In 1846, the USA occupied California, and in 1850, California entered the union as a free state. The Act for the Government and Protection of Indians, passed on 22 April 1850, claimed to protect the lands of Indians; however, it also provided a legal framework for settlers to claim these lands, and allowed for the use of indentured labor of Indians (Wood 2008). The 1850 law, and later statutes to protect Indian land rights, was not implemented or enforced by the USA (Wood 2008). Another key element of this Act was that it criminalized IFS.

[2] The Royal Proclamation of 1763 assigned power to the Crown to obtain lands from Indigenous Nations through written treaties. As the Crown moved westward across the North American continent, fewer treaties were signed. The Douglas Treaties are an exception in British Columbia. Those treaties recognized reserved village sites and First Nations rights to hunt and fish; however, the total footprint of those treaties is relatively small, approximately 927 km^2 (358 square miles) of land (Government of Canada 2013).

[3] The Indian Act, 1876, governs nearly all First Nations living on reserve across Canada, through a Band Council or an elected Chief and Council system. In 1927, the Indian Act was amended to prohibit First Nations from raising funds for lawyers to pursue land claims for lands off reserve (this was repealed in 1951).

[4] Recently, two other First Nations have had title to parts of their territory declared.

[5] Reflecting Spanish, Mexican, and USA law, today in California, there may be various terms applied to Indian Country, including rancheria, mission, pueblo, rancho, village, farm, colony, or reservation (Wood 2008).

Table 1 Institutional framework for fire governance and Indigenous Fire Stewardship (IFS)

Institutional framework for wildfire and IFS	British Columbia	California
Key laws and regulations	The British Columbia Wildfire Act, 2004, provides: • restrictions on non-prescribed fire in forest and grasslands (Sects. 5 (1)—(2)) • that the Minister can create policies and priorities for fire control (Sect. 8) • that the government may carry out fire control on "any land" (Sect. 9) • for restrictions on "open fires" (Sect. 10) • the government's right to use fire to reduce fire risk, enhance public safety, or meet specific forest values or objectives (Sect. 18) • that the Crown may assist Indigenous Peoples in carrying out burning (Sect. 18.01 (1–2)) British Columbia Wildfire Regulation, 2005: • establishes four classes of "open fires," ranging from category 1 campfires to category 4 resource management open fire, which includes fire to meet ecological or forestry goals • category 4 open fires require a burn plan to be submitted and approved, and they must be given a burn registration number (Sect. 23 (1) c-d)	On SRAs, the Public Resources Code sets out CAL FIRE's statutory duties: • fire prevention and suppression (Sects. 4101–4123) • vegetation management programs, including prescribed burns (Sect. 4775) • regulating controlled burns, including permits issued by CAL FIRE (Sects. 4431–4437) The California Code of Regulations sets out provisions for CAL FIRE's fire protection, timber harvesting, and resource management responsibilities On federal lands, the Tribal Forest Protection Act, can empower Native American tribes in wildfire mitigation, and the California State Tribal Gathering Policy allows for Traditional Management Techniques. However, the state of California has been most progressive in advancing IFS
Institutional structure	The B.C. Wildfire Service, formed in 1912, is part of the Ministry of Forests. In collaboration with the Ministry of Emergency Management and Climate Readiness, it has responsibility for delivering wildfire management and emergency response to protect lives and values at risk, and to encourage sustainable, healthy, and resilient ecosystems The B.C. Wildfire Service is divided into six regional fire centers, which are further divided into local fire zones. The Provincial Wildfire Coordination Centre and Headquarters directs and coordinates these centers and units In the responsible Minister's Mandate Letter from the B.C. Premier (Eby 2024: 5), the goal for the year was to "strengthen the B.C. Wildfire Services focus on wildfire prevention and management year-round, including cultural and prescribed fire," and to meet the Declaration on the Rights of Indigenous Peoples Act	CAL FIRE is part of the California Natural Resources Agency. It is responsible for fire protection and the control or prevention of wildfires on state responsibility areas. CAL FIRE is divided into a northern and a southern region, and has 21 operational units for which it provides suppression activity CAL FIRE has an operational division and a policy division; 80% of its budget is spent on fire protection and suppression (Anonymous, CAL FIRE official, personal communication, 2024c) CAL FIRE has appointed a Deputy Director of Tribal Affairs to enhance engagement with Tribal Nations and implement the Tribal Affairs program. "Recognized" Tribal Nations may have their own fire programs (as dependent sovereign nations) on their reservations. Burning on federal trust lands does require Bureau of Indian Affairs oversight, triggers National Environmental Policy Act approval, and needs a burn plan and a National Wildfire Coordinating Group qualified burner to implement the plan

Table 1 (continued)

Institutional framework for wildfire and IFS	British Columbia	California
Recognition of IFS	The Province is co-developing a draft cultural fire strategy with First Nations. The Province defines cultural burning as "the intentional use of fire at a broad scale on the land that is led by First Nations or is based in First Nations distinct cultural values, perspectives, or practices" (British Columbia Government 2024a:1) The Province notes that while it does not undertake cultural burning, it has a "responsibility to address some of the barriers to cultural burning that exist… in line with its commitments in the Declaration on the Rights of Indigenous Peoples Act… [and] …intends to work in partnership with Indigenous Peoples to co-develop a policy and program framework for cultural and prescribed fire that aligns with the UN Declaration and provides the foundation for a sustainable, long-term, and co-managed approach" (British Columbia Government 2024a) A B.C government (2023) discussion paper outlined feedback from engagement with Indigenous governments and cultural fire practitioners. The key issues identified were the need to align wildfire governance with the United Nations Declaration on the Rights of Indigenous Peoples, rebuild First Nations capacity for cultural burning, address liability concerns, integrate fire and land use planning, evaluate the carbon implications of cultural burning, align air quality and smoke guidelines, and "normalize" good fire through public outreach The B.C Declaration on the Rights of Indigenous Peoples Action Plan, 2022–2027, set out 89 actions for government to actively address. One relates to cultural fire: "2.11 Integrate traditional practices and cultural uses of fire into wildfire prevention and land management practices and support the reintroduction of strategized burning. (Ministry of Forests, Emergency Management BC)" (British Columbia Government 2022: 14). However, there is no information on the implementation of this action in the annual reporting for the Action Plan The B.C government's (2024b) Cultural Fire and Prescribed Burning Annual Summary Report stated that in 2023, 23 projects were implemented and 2 214 hectares were treated (in 2022, 35 projects were implemented and 1 647 hectares were treated (16.47 km^2)). In 2023, five of the 23 projects were implemented in partnership with First Nations, and more than 23 burn plans were developed or co-developed with First Nations (up from 15 in 2022). Sixty-one burns were planned for 2024	Senate Bill 310 amended Chapter 7 of Part 2 of Division 4 of the Public Resources Code to read as follows: Article 4.5. Tribal Sovereignty with Respect to Cultural Burning 4505. (a) (1) The Legislature acknowledges that federally recognized California Native American tribes have inherent sovereignty and authority to regulate their members and cultural practices, including, but not limited to, cultural fire practitioners and cultural burning Section 3333.8 (f) of the Civil Code provides that "Cultural burn" or "cultural burning" means the intentional application of fire to land by a California Native American Tribe, a tribal organization, or a cultural fire practitioner to achieve cultural goals or objectives, including for sustenance, ceremonial activities, biodiversity, or other benefits."
Recognition of cultural fire practitioners	There is no explicit legal recognition of IFS and cultural fire practitioners. Though there is recognition that a person authorized by an Indigenous governing body has the power to implement cultural burning (where shared decision-making agreements are in place, see row below)	Building from the reforms of SB332 (around mitigating liability for cultural burning) and Assembly Bill (AB) 642 (which set out who was a cultural fire practitioner) SB 310 amended Sect. 3333.8 of the Civil Code (paragraph g) and Sect. 4002.6 of the Public Resources Code to define "Cultural fire practitioner" as "a person recognized by a California Native American tribe or tribal organization with substantial experience in burning to meet cultural goals or objectives, including for sustenance, ceremonial activities, biodiversity, or other benefits." Practitioners must be affiliated with a Tribal Nation and must have an understanding of their fire values

Table 1 (continued)

Institutional framework for wildfire and IFS	British Columbia	California
Government-to-government agreements, and burn plans for cultural fire	Section 60 of the Wildfire Act provides the responsible Minister, or an official authorized by the Minster, the power to enter into agreements with others for fire control In line with Sects. 6–7 of the Declaration on the Rights of Indigenous Peoples Act, 2019, Sect. 23.1 (1) of the Wildfire Regulations provides for agreements with Indigenous governing bodies. Where agreements have been developed, any persons with authority to act on behalf of an Indigenous governing body may not have to comply with a Sect. 23 (1) (c) of the Wildfire Regulations (the need for a written burn plan) Per the Wildfire Regulations, an Indigenous governing body is defined under the Declaration on the Rights of Indigenous Peoples Act, 2019, as an entity that is authorized to act on behalf of Indigenous Peoples that hold rights recognized and affirmed by Sect. 35 of the Constitution Act, 1982. This could be a traditional decision-making body Section 23.1 (2) of the Wildfire Regulations provides that where an agreement with an Indigenous governing body exists, all references to a burn plan in Sect. 23 must be read as references to the agreement	Section 3333.8 of the Civil Code was amended with subsection (c) "Cultural burns conducted by a cultural fire practitioner are exempt" from a written burn plan approved by an authorized burn boss Article 4505. (b) (1) of the Public Resources Code provides that "The Secretary of the Natural Resources Agency…may enter into written agreements with federally recognized California Native American tribes in support of tribal sovereignty with respect to cultural burning in their ancestral territories. In deference to tribal sovereignty, the secretary may agree in a written agreement regarding cultural burning that compliance with either of the following is not required: (A) The state permitting or regulatory requirements… (B) The burn plan requirements…" This Article also provides that local air districts may enter into agreements with recognized tribes (paragraphs (b) 3 (A)-(C) Paragraph (e) provides that a cultural burn conducted with an agreement developed under this section meets the permit requirements pursuant to Sect. 3333.8 of the Civil Code These provisions are to remain in effect until 1 January 2030, and as of that date is repealed
Liability	Under legislation and common law, those who conduct burning are responsible for any losses resulting from the burn. No liability fund is available for IFS practitioners.[a]	SB 332 amended Sect. 3333.8 of the Civil Code to mitigate liability for cultural burning. Law SB 926, which came into effect in September 2022, established the pilot US Dollar $20 million Prescribed Fire Claims Fund, to be administered by CAL FIRE until 1 January 2028. The fund covers any losses from prescribed or cultural burns, up to US Dollar $2 million for each project, led by a qualified burn boss or cultural fire practitioner who can enroll in the fund To support any fire investigations, a protocol with ecological and cultural indicators has been developed to assess whether practitioners are burning reasonably (Anonymous, cultural fire practitioner, personal communication, (2024b) At the time of writing, no claims had been made to the fund (Anonymous, cultural fire practitioner, personal communication, 2024b) Some losses are not covered by the claims fund, including "smoke taint" that impacts wine grapes. This could be a barrier moving forward
Tenure	The B.C. Wildfire Services exercises powers to control and mitigate wildfires on "Crown lands"[b] and to engage in fire control on private lands where necessary (which includes Indigenous lands) Indigenous governments can engage in fire control and prevention activities on their lands (which includes reserve, treaty settlement lands, and title lands)	California represents a "checkerboard" of tenures, including federal, state, private, and tribal lands, which have different responsibilities regarding fire. Federally recognized Tribal Nations have sovereignty to implement burns on their lands However, it can be difficult for them to burn on their land because those lands are under federal responsibility and require that Bureau of Indian Affairs approvals and federal fire qualifications be met. It is easiest to burn on private lands that are owned by the tribe or a tribal individual, or where a landowner has given permission to burn (Anonymous, cultural fire practitioner, personal communication, (2024b)

Table 1 (continued)

Institutional framework for wildfire and IFS	British Columbia	California
Funding	Funding is available for First Nations governments to co-develop burn plans with the B.C. Wildfire Service and to implement those plans, under the Cultural and Prescribed Fire Program, established in 2021	In 2023, CAL FIRE granted approximately US Dollar $20 million to eight Tribal Nations to plan for, or implement, prescribed burning. There are other funds available through the Tribal Nature Based Solutions grant, and the Department of Conservation's Regional Fire and Forest Capacity grants program

[a] See, for example, the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development Policy 9.9 (20 October 2021): Compensation for Fire Control Damage. https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/about-bc-wildfire-service/bcws-policies/policy_99_compensation_for_fire_control_damage.pdf

[b] "Crown lands" is in quotation marks given that the ownership of these lands is contested and may be claimed by, and come under the ownership of Aboriginal title-holders

Military reservations were established in 1853, which were akin to farms or Missions. They were not meant to be permanent, but three remain today (Round Valley, Tule River, and Yurok) (Wood 2008).

Between 1851 and 1852, the US federal government negotiated 18 treaties with more than 100 Tribal Nations in California (however, all but two of them were in the central or northern part of the state). The treaties would have provided 34, 398 km^2 (8.5 million acres) of land to the Tribal Nations, with another 269,116 km^2 (66.5 million acres) ceded to the USA (Wood 2008). In the period following the signing of the treaties, many people relocated from their homelands to the designated treaty areas, which were often near forts. In 1852, the US Senate rejected the treaties due to political pressures from California; they came to be known as the "18 Unratified Treaties" (Kelsey 1973). The lands that were meant to be provided to the Tribal Nations were allocated to the public domain, which displaced many tribes from their traditional lands. Many of those lands were allocated to settlers, particularly after the Civil War, following genocide by volunteer Militia groups backed by wealthy American Settlers, and later compensated by the State and Federal Government (Madley 2016). Following this, there were a number of Presidential Executive Orders in the 1870s onward that established reservations, largely across southern California. The Indian population of California was reduced by as much as 90% from 1848 onward as a gold rush brought miners from around the world (Flushman and Barbieri 1985).

In 1905, the 18 Unratified Treaties came to public attention, and as a result of advocacy, public appropriations were made to purchase lands for Tribal Nations in central and northern California (Wood 2008). The Indian Land Claims Commission, established by Congress in 1946 and operating through to 1977, heard grievances about land lost, and provided compensation to affected Tribal Nations (Kelsey 1973). If the 18 Unratified Treaties had been honored, Tribal Nations in California would have 20 times the land base they had in 2008 (Wood 2008). In 2019, the Bureau of Indian Affairs estimated that Tribal lands in California comprised 660,837 acres (2674.31 km^2) (Native Land Information System 2019). More recently, California has made efforts to facilitate the return of lands to Tribal Nations, such as the 2800 acres (11.33 km^2) granted back to the Shasta Indian Nation in 2024 (among several others). Tribal Lands represent 2725 km^2 of the 423,967 km^2 of the total state (or 0.6%). Regardless, without treaties or not, the land rights and rights of stewardship have not been relinquished (Hankins et al., in press). Land Back creates opportunities for expanding IFS.

Today, there are 109 federally recognized Tribes in California (of 574 across the USA), and many more lack federal recognition for various reasons including the California Rancheria Termination Act of 1958. Federal recognition creates a government-to-government relationship between the USA and the Tribal Nation. A recognized Tribe has access to special programs and services. However, the Tribe has limited sovereign immunity and powers of self-government, including policing and fire services (among others) (Hankins et al. in press). Unrecognized tribes lack access to federal programs and services and do not have protected self-governance powers (Goldberg and Champagne 1996). Recognized Tribal Nations, including Tribal organizations established under Public Law 93–638, can enter into contracts (or 638 Agreements for Self-Determination) with federal agencies such as the US Forest Service to engage in activities such as fire mitigation or protection—typically on lands adjacent to reservations or ancestral territories (see the Tribal Forest Protection Act 2004). Many Tribal Nations are developing agreements with federal agencies to implement IFS (Lake 2021). Similarly, the passage of Senate Bill (SB) 310 in California in 2024 enables federally recognized tribes to enter into contract agreements for fire stewardship with state agencies.

Ecological context

British Columbia

Across western North America, a diversity of biological, geological, and climatic conditions give rise to unique ecological regions (see Fig. 1). The largest ecological region in B.C. is the Northwestern Forested Mountains, which is predominantly coniferous forests of spruce (*Picea* sp.), pine (*Pinus* sp.), and subalpine fir (*Abies lasiocarpa*) (Meidinger and Pojar 1991). The Northern Forests and Taiga are dominated by white and black spruce (*Picea glauca, P. mariana*) (Meidinger and Pojar 1991). The Marine West Coast Forest receives abundant precipitation and has the lowest wildfire risk; it supports western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), and western redcedar (*Thuja plicata*) (Meidinger and Pojar 1991). The interior Desert region hosts bunchgrass and sparse forests of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) (Meidinger and Pojar 1991). Lightning strike densities range from 10 strikes annually per 100 km^2 in coastal B.C. to 50 strikes annually per 100 km^2 in northeastern B.C. (Environment and Climate Change Canada 2024). IFS modified components of the fire regimes of all these ecosystems by diversifying the frequency, seasonality, and location of ignitions compared to natural lightning (Lake 2021).

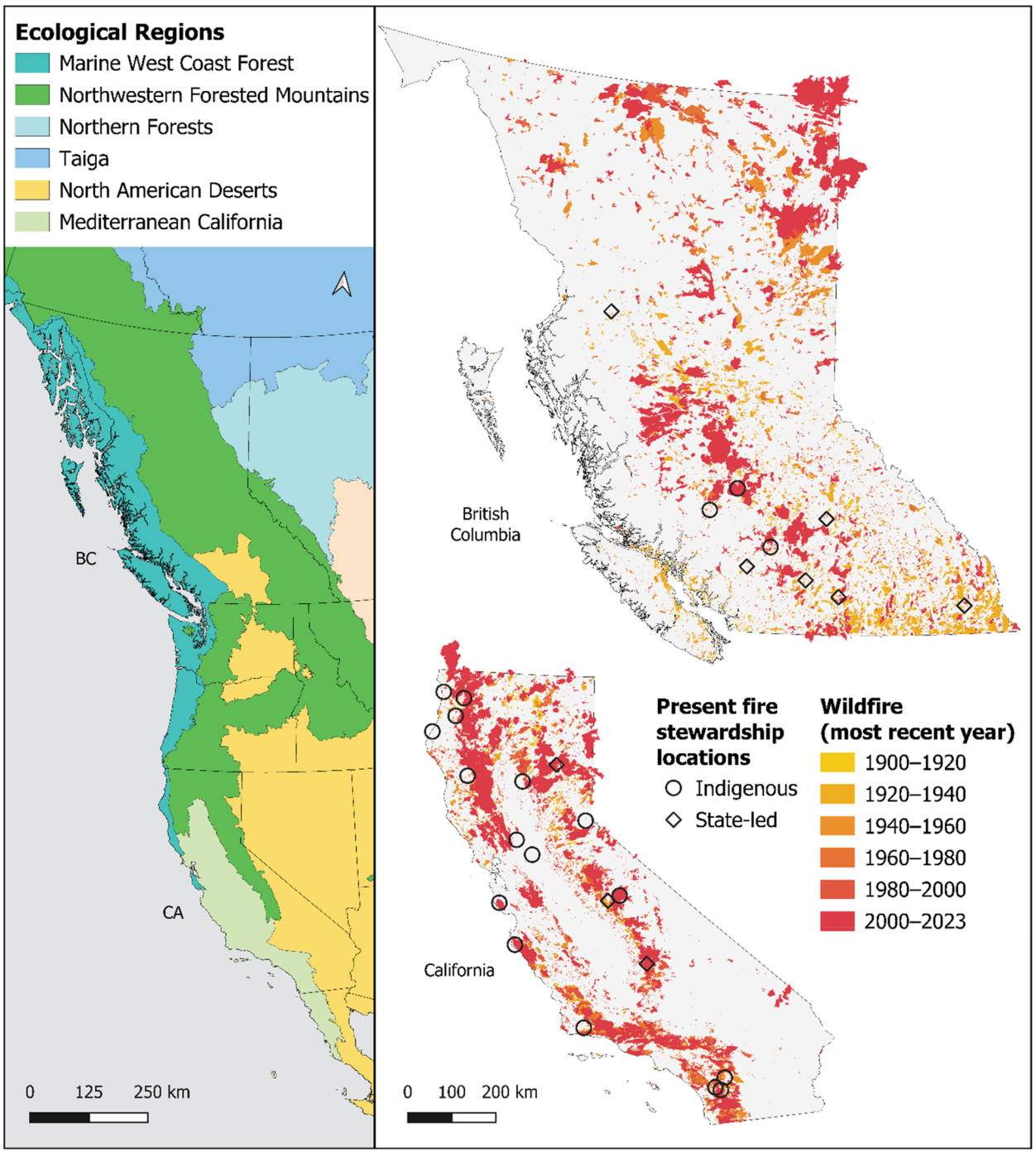

Fig. 1 Area of interest, spanning B.C. (Canada) and California (USA). Ecological Regions of North America (left) (Commission for Environmental Cooperation 2010), and wildfire perimeters in B.C. (top right, 1917–2023) (B.C. Wildfire Service 2024) and California (bottom right, 1900–2023) (California Department of Forestry and Fire Protection 2024), with some locations of known present IFS activities from published sources (we note there are others)

While unique regions have different fire ecologies, common trends emerge following fire suppression. In the absence of fire, dense coniferous forests cover the landscape; fast-growing, late-seral species include Douglas-fir and lodgepole pine *(Pinus contorta)*, which establish naturally and are planted post logging to create homogenous second-growth forests. Overall, fuel loading and continuity increase across

multiple ecosystems and among various habitats. Fire suppression increases wildfire risk in areas where conifers encroach previously open areas (Taylor et al. 1998), and in forested areas where fire deficit increases stand flammability (Parisien et al. 2020).

Fire regimes in many parts of B.C. have shifted from more frequent low- to moderate-severity fires to sporadic stand-replacing wildfire events (Wong et al. 2004; Daniels and Gray 2006; Brookes et al. 2021). Historical fire return intervals vary by ecological zone in B.C., from five years to more than 1000 years (Wong et al. 2004). The Coastal Western Hemlock zone experiences infrequent stand-replacing fires (313–1 379 years) (Wong et al. 2004), though low- to moderate-intensity fires play an important role in shaping plant communities (Hoffman et al. 2017). Fire-return intervals range from five to 50 years in interior Douglas-fir forests, and from 45 to 91 years in the Sub-Boreal Pine—Spruce zone (Wong et al. 2004). The B.C. government uses prescribed fire to reduce hazardous fuels and maintain silviculture and wildlife habitat; though the use of this practice has declined in recent years, likely driven by political and timber constraints (<150 km^2 per year, on average, in 2000–2020 compared to >1000 km^2 in 1986) (Hoffman et al. 2022). Wildfire in B.C. burned an average of 990 km^2/year (SD: 1559) during the second half of the twentieth century (1950–1999), but has since increased to 3540 km^2 annually (2000–2023, SD: 6493), with a maximum of 28,524 km^2 in 2023 (Fig. 2) (B.C. Wildfire Service 2024).

In B.C., wildfire activity has been increasing in the twenty-first century (Fig. 2) due to fuel accumulation and a drier climate (Parisien et al. 2023). Silviculture practices can influence fire risk in different directions. For example, the removal of biomass can reduce wildfire risk in the short term (Nitschke and Innes 2008); while replanted stands can carry increased risk due to higher tree density and species flammability (Parisien et al. 2023). At the landscape scale, the structure of second-growth stands in coastal forests contributes to increased ignition risk and wildfire spread (Pew and Larsen 2001; Daniels and Gray 2006). Insect-driven tree mortality in stands affected by mountain pine beetle (*Dendroctonus ponderosae*) also contributes to higher fire risk (Perrakis et al. 2014). In southern B.C., burn probability is expected to increase due to the combined risks from changing weather and more frequent ignitions (Wang et al. 2016).

Across generations and for millennia, IFS has shaped the province's landscapes, from coastal rainforests

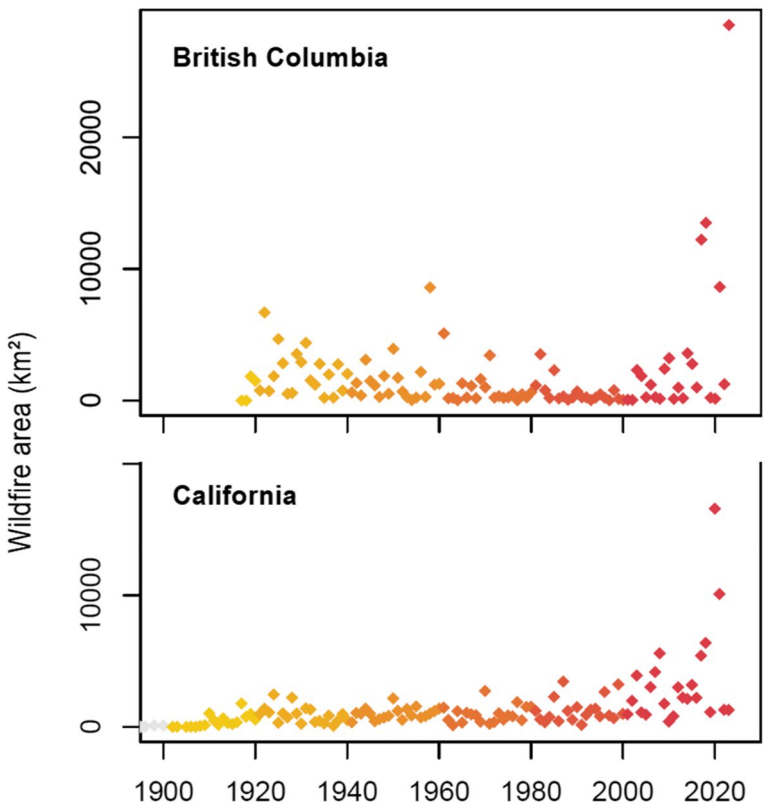

Fig. 2 Area burned by wildfire (km.^{2}), by year, in B.C. (1917–2023) (B.C. Wildfire Service (2024) and California (1900–2023) (California Department of Forestry and Fire Protection 2024)

(Hoffman et al. 2016), to mountain meadows (Turner et al. 2011) and to dry interior forests (Copes-Gerbitz et al. 2023). IFS has been and is used to enhance production of food, such as the energy-rich bulbs of *Erythronium* sp., *Lilium* sp., *Camassia* sp., and *Claytonia lancelota*. (Turner 1999). Indigenous Peoples have burned berry shrubs to increase fruit yield, including huckleberry (*Vaccinium* sp.), raspberry (*Rubus idaeus*), Saskatoon *(Amelanchier* sp.), currant (*Ribes* sp.), and soapberry (*Shepherdia canadensis*) (Turner 1999). In coastal B.C, fire and other management practices are known to enhance the productivity of food systems in Garry oak (*Quercus garryana*) savannahs (McCune et al. 2013). Hazelnut (*Corylus cornuta*) is similarly burned to enhance production (Turner 1999); the tending of this plant expanded its distribution in B.C (Armstrong et al. 2024).

California

The diversity of climate and geological conditions in California gives rise to four ecological regions, three of which are the southern extents of regions shared with B.C. (Fig. 1). The Marine West Coast Forest extends down the northern California coastline and supports coastal scrub and forests dominated by coast redwood (*Sequoia semperviens*), Douglas-fir, Sitka spruce, and oak (*Quercus* sp.) (Sugihara and Barbour 2006). The Northwestern Forested Mountains cover the Cascades, Sierra Nevada, and Klamath Mountains, where vegetation spans an elevational gradient from foothills of chaparral and oak to montane mixed-conifer forests (Sugihara and Barbour 2006). The Desert region is arid and sparsely vegetated; fire is limited by a lack of contiguous fuel (Sugihara and Barbour 2006); however, the invasion of non-native grasses can lead to increased fire frequency (Brooks and Chambers 2011). The Mediterranean California region covers the Central Valley, presently dominated by urban and agricultural landscapes interspersed with grasslands, emergent wetlands, and riparian woodlands that are considered rare ecosystems (Hankins 2024), and the South Coast, which hosts grassland, scrub, chaparral, and mixed woodland and forest (Sugihara and Barbour 2006). Lightning strike densities average 17 strikes annually per 100 km^2, with a range from 3 strikes annually per 100 km^2 in the coastal regions to 27 strikes annually per 100 km^2 in the Southeast Deserts (van Wagtendonk and Cayan 2008). Like in B.C., IFS modified the components of the fire regimes of all these ecosystems by diversifying the frequency, seasonality, and location of ignitions compared to natural lightning (Lake 2021).

Fire return intervals in California ecosystems vary greatly, and fire occurred more frequently prior to settler management (Stephens et al. 2007). For example, the redwood forest has a lightning-induced mean fire interval of 135 years; in comparison, it burned every 8–12 years under IFS (Brown et al. 1999; Stephens and Fry 2005), 20–50 years under settler management, and 130 years under recent management (Greenlee and Langenheim 1990). Prairies and oak woodland had burned as frequently as annually or bi-annually under IFS depending on the conditions, but after the exclusion of Indigenous practices, the burn cycle has ranged from 20 to 30, and 225 years, respectively (Greenlee and Langenheim 1990). Prior to the use of Euro-American management regimes in California, an estimated 18,000 km^2 burned annually (Stephens et al. 2007); the average in the twenty-first century (2000–2023) is 3361 km^2 annually (SD: 3608) (California Department of Forestry and Fire Protection 2024). In the Northwestern Forested Mountains, the amount of forest biomass has doubled following fire suppression and the exclusion of IFS (Knight et al. 2022).

By area, more than half (54%) of California's vegetation is fire-dependant (Sugihara and Barbour 2006). Fire suppression has resulted in a fire deficit that impacts landscapes (Parks et al. 2015, 2025). The accumulation of fuel loads following fire suppression is the main driver of wildfire in central and northern California conifer forests (though some recent significant wildfires have been wind-driven), whereas wildfires in coastal central and southern California shrublands are wind-dominated (Keeley and Syphard 2019); however, IFS was also conducted in these ecosystems (Anderson and Keeley 2018). Wildfire activity in California is higher in dry years following wet years (Taylor and Beaty 2005), in years with earlier spring snowmelt and hotter temperatures (Westerling et al. 2006), and in areas with invasive grasses that provide a contiguous fuel bed (Parks et al. 2015). In recent years, climate change has prolonged wildfire conditions through to late autumn (Goss et al. 2020).

Many species of cultural importance to Indigenous Peoples in California require fire to enhance their productivity and usability. Fire-stewarded food staples include fruits, acorns, and "Indian potatoes"—belowground plant parts such as corms, bulbs, and tubers (Anderson 2006). Tended berries include elderberry (*Sambucus* sp.), choke cherry (*Prunus virginiana*), strawberry (*Fragaria vesca*), blackberry (*Rubus* sp.), grape (*Vitis californica*), huckleberries (*Vaccinium* sp.), and currant (*Ribes* sp.) (Anderson 2006). Oak (*Quercus* sp.) savannahs were maintained by conducting regular burns of the understory to improve the quality of acorn crops and reduce insect infestations (Anderson 2006). Species used in basketry require fire or pruning to initiate the growth of epicormic shoots—young stems that are flexible, straight, unbranched, and long—which are preferred for making baskets (Anderson 2006). In northern

and coastal California, hazelnut is an important food resource (Fine et al. 2013) and is tended with fire to create basketry stems (Marks-Block et al. 2021).

Reconstructing fire histories

Dispossession and genocide resulted in significant decreases in IFS, which resulted in increased fuel and tree densities. Various methods have been used to reconstruct the ecological history of IFS in B.C. and California: archeological surveys (Cuthrell et al. 2016), vegetation surveys (Hoffman et al. 2017), tree ring analyses (Hoffman et al. 2019; Brookes et al. 2021; Knight et al. 2022), charcoal and pollen deposits (Derr 2014; Hoffman et al. 2016; Knight et al. 2022), and sediment cores (Klimaszewski-Patterson and Mensing 2020). However, studies that rely solely on these quantitative approaches risk underestimating IFS because they do not adequately capture patch burning (Roos et al. 2019). The choice of scale in the collection of pyro-archeological data can also introduce bias; locally intensive IFS histories can be overlooked in studies that uniformly survey vast landscapes (Roos 2020).

When paired with Indigenous knowledge and objectives, collaborative eco-archeological research can produce valuable insights on, and for, IFS (Apodaca et al. 2021). In a case study of the Quiroste Valley in coastal California, a multidisciplinary research team worked closely with the Amah Mutsun Tribal Band to describe historical IFS through multiple independent lines of inquiry (Cuthrell et al. 2016). Based on archeological, sediment, plant, genetic, and soil silica research, Quiroste Valley shows evidence of sustained IFS, which maintained grasslands for centuries prior to Spanish colonization (Lightfoot and Lopez 2013). Grasslands in coastal California could not be sustained through non-anthropogenic fire activity (Keeley 2002), and their encroachment by dense scrub and Douglas-fir forests co-occurs with the exclusion of IFS (Cuthrell et al. 2016). Further, areas in which IFS was conducted had higher numbers of fire-related plant foods in archaeobotanical samples (Cuthrell et al. 2016); and sizes of remaining food plant populations have shrunk compared with previously stewarded populations (Fine et al. 2013), particularly the California Hazelnut, a culturally important species for food, materials, and basketry ranging from central California to B.C. (Armstrong et al. 2024).

Charcoal surveys in coastal B.C. point to an anthropogenic fire regime that is more than 12,000 years old (Hoffman et al. 2016). Coastal sediment samples, which can also span millennia, show records of regular burning to 5000 years ago (Derr 2014). In central B.C., fire scars show a shift in fire activity and forest stand development in the mid-nineteenth century, coinciding with the exclusion of IFS from the landscape (Brookes et al. 2021). After more than a century of fire suppression, historical sites of IFS retain a greater abundance of fire-stewarded plants (Hoffman et al. 2017; Hankins 2013).

In places where IFS knowledge persists, interviews with community members about their land use (Hankins 2013), together with ethnographic, archival, and tree ring data, have been used to reconstruct IFS history and inform future land management (Copes-Gerbitz et al. 2021; Lake 2013). Oral accounts spanning more than a dozen First Nations and diverse ecosystems in B.C. highlighted the widespread use of IFS (Turner 1999). Similarly, Indigenous knowledge and ethnographic accounts describe burning in all but the most sparsely vegetated ecosystems in California (Stewart 2002; Anderson 2006).

Wildfire governance and IFS

British Columbia

Copes-Gerbitz et al. (2022) identified five distinct provincial-fire governance eras from the 1870s onward—each re-enforcing colonial control and fire culture. The first era was heralded by the Bush Fire Act, 1874, which regulated open fires on landscapes in B.C.. Under this statute, anyone who ignited fires on Crown or other land, and then left without extinguishing the fire, was subject to a fine up to Canadian dollar (CAD) $100, or up to 3 months imprisonment (MacDonald 1929). Districts across the province could develop fire protection measures under the Act by petitioning the Lieutenant Governor in Council, with petitions signed by at least two-thirds of the settlers from the area. By 1911, two provincial supervisors, 10 divisional fire wardens, and 110 district fire wardens were hired across the province to provide fire protection and reduce fire hazards from logging and other activities. As MacDonald (1929: 31) related, the "districts were large, their number comparatively small and their transportation facilities primitive, patrol must have been far from intensive and control measures on fires must have, in most cases, been undertaken only after fires had been burning for some time." At the same time, there were increased public expectations for the "intensive protection of the forests from fire" (MacDonald 1929: 32). That led to the passing of the Forest Act of 1912 and the creation of a Forest Branch to manage forests and a fund for forest protection. The number of staff for forest protection increased significantly to several hundred employees.

The second era, post-1912, emphasized the control of fire on Crown land to sustain timber supply, which was led by the B.C. Wildfire Service within the Ministry of Forests. Control was expensive; therefore, a forest protection fund was developed through a levy of one cent per acre on all timber leases and licenses. In 1912, the fund

totaled CAD $105,259 and was matched by the government. In 1913, the levy was increased to 1.5 cents per acre, and the amount was matched through an allocation from consolidated revenue. In the summer of 1914, the provincial government was called upon for an additional CAD $143,000 for fire protection. Policy evolved, so that in times of extreme hazard, the fund could obtain an overdraft from Treasury, set initially at a limit of CAD $200,000; this limit was removed in 1925. As a result of the devastating wildfire seasons that followed, annual levies were increased—but each year, there was never enough in the fund to cover the costs of protection (MacDonald 1929). This has been a consistent problem as suppression costs have ballooned.[6]

The third era was the "emulating fire" period (1976–1995), in which the need to re-introduce natural fire on the landscape was recognized (Copes-Gerbitz et al. 2022). However, fire suppression and control remained central; the Ministry of Forests Act, 1979, established fire control targets on the area and volume of timber burned each year.

The fourth era was "siloing fire" (1995–2017). The B.C. Wildfire Service became a stand-alone organization within the Ministry of Forests in 1995, and was no longer "embedded at the district level" (Copes-Gerbitz et al. 2022: 48). Thus, fire and forestry functions were separated.

The catastrophic 2003 wildfire season led to the writing of the 2004 Filmon report, which included 74 recommendations, many of which focused on proactive measures to deal with fuel build-up and an expanding wildland–urban interface. Importantly, the report called for greater involvement of different stakeholders in wildfire governance. Nikolakis and Roberts (2022) noted that the Filmon report was a missed opportunity for change because only 17 of the 74 recommendations were implemented. The Wildfire Act, 2004, and the Wildfire Regulation, 2005, were established to clarify accountability and liability for the forest sector in engaging in proactive wildfire mitigation measures (Copes-Gerbitz et al. 2022).

The fifth era, and current phase of wildfire governance, is "coexisting with fire," starting in the record-breaking 2017 wildfire season. The Abbott and Chapman report, released in 2018, evaluated the provincial response to the 2017 fires. Like the Filmon report, it called for an increased use of proactive fuel management strategies to mitigate wildfire risk. However, the Abbott and Chapman report emphasized the importance of shared decision-making and collaborations with Indigenous governments as a priority moving forward (Nikolakis and Roberts 2022). In 2024, amendments to the Wildfire Act and Wildfire Regulation aimed to establish a framework for shared decision-making on wildfire governance with Indigenous governing bodies, in line with Sect. 6 and 7 of the Declaration on the Rights of Indigenous Peoples Act (Table 1).

California

Section 10 of the Act for the Government and Protection of Indians 1850, made it an offense for people to "set the prairie on fire, or refuse to use proper exertions to extinguish the fire when the prairies are burning, such person or person shall be subject to fine or punishment, as a Court may adjudge proper." This provision was especially onerous for an Indigenous person, because if they were fined by the courts, under Sect. 14 of the Act, "any white person may, by consent of the Justice, give bond for said Indian, conditioned for the payment of said fine and costs, and in such case the Indian shall be compelled to work for the person so bailing…." This led to forms of indentured servitude.

In 1885, California created a Board of Forestry to deal with open fires and wildfires (Pyne 2016). Many unclaimed or settled lands of California were designated as Forest Reserves that then became National Forests. In 1905, the US Forest Service took jurisdiction over national forests, and California enacted the Forest Protection Act. This statute appointed a state forester, who could then appoint volunteer fire wardens to enforce fire laws and gather people to fight fires. Counties could organize fire districts and fire patrols, and paid for them.

Gifford Pinchot was the first chief of the US Forest Service. Under his direction, a national forest fire policy was initiated, and the agency began systematic fire suppression, including the development of an infrastructure of equipment, fire stations, lookouts, and trails (Stephens and Sugihara 2006). Pinchot declared that one of the objectives of the national forests was to make sure that "timber was not burnt up." The Weeks Act of 1911 enabled grants and cooperation between the federal government and qualifying states for fire protection. Passage of the federal Clarke-McNary Act in 1924 tied federal appropriations to when state's adopted fire suppression; this law effectively created a national fire suppression policy.

In 1935, federal forest fire policy was updated to incorporate the "10 AM" policy that was created to increase suppression efficiency. This policy directed that all fires should be controlled in the first burning period or by 10 AM the following morning. To accomplish this objective, a large labor force and improved access to wildlands

[6] The Government of Canada provides financial assistance to provincial and territorial governments where costs exceed those they can bear on their own. Assistance is provided through the Disaster Financial Assistance Arrangements, administered by Public Safety Canada.

were necessary. The newly created Civilian Conservation Corps provided thousands of workers to assist in this effort; they were effective in the mid-1900s through establishing a network of Guard Stations in rural mountain regions to quickly and actively suppress and extinguish wildfires (Anderson et al. 1941; Pyne 1982).

The first US national education campaign designed to influence public behavior regarding forest fires began when the Forest Service created the Cooperative Forest Fire Prevention Program in 1942 (USDA, 1993), which was concerned with reducing fires during wartime. This program encouraged citizens nationwide to make a personal effort to prevent forest fires. The campaign was modified 3 years later to produce the national "Smokey Bear" campaign that is still in existence today (Stephens and Sugihara 2006). While it is important to be careful with fire in all cases, the Smokey Bear campaign resulted in the US public thinking that all fire was bad rather than a key ecosystem process in many ecosystems.

In 1968, the first managed wildfire program was created by the US National Park Service (USDI 1968, Kilgore 1974; van Wagtendonk 2007). Lightning-ignited fires were administratively allowed to burn and were monitored to achieve resource benefits. The era of wildland fire use in the National Park Service had begun; the long era of total suppression had ended (Kilgore 1974). This program has produced significant benefits to forested areas (Stephens et al. 2021). Following the US National Park Service approach, fire policy in the US Forest Service changed from fire control to fire management in 1974. Henry DeBruin, Director of Fire and Aviation Management, stated "we are determined to save the best of the past as we change a basic concept from fire is bad to fire is good and bad" (DeBruin 1974: 12). This was a major shift for the US Forest Service, but fire suppression still dominated for decades (Stephens and Ruth 2005). The US Forest Service's change in fire policy in 1974 was an opportunity missed by most of the country in terms of increasing the beneficial use of fire. However, the southeast US continued its large prescribed fire program (Stephens et al. 2019). In the USA, the southeast continues to be the prescribed fire capital for forests, and the Great Plains region is the top area for grassland prescribed fires.

The use of prescribed fire in the California State Park system was initiated in 1972 at Montaña de Oro State Park on the central coast and then in Calaveras Big Trees State Park in the Sierra Nevada (Biswell 1989). The program was initially the target of considerable political and academic criticism, but persistent efforts to evaluate the biological impacts of fire and fire exclusion have supported the need for prescribed fire to maintain ecosystems (Stephens and Sugihara 2006). Today, the California State Park system is working to revitalize its prescribed fire program, which has decreased in scope since the early 1990s.

In 1987, the Department of Forestry added Fire Protection to its name. In 1999, "Ranger" was changed to "Chief"—collar brass identified rank, and the khaki uniforms were changed to the navy blue of the urban fire service (Pyne 2016). The Department became CAL FIRE in 2006, which Pyne (2016: 38) termed as an "urban fire service in the woods," and narrowed its land management approach to emergency management. CAL FIRE is responsible for fire response on more than 31 million acres of land (121,406 km^2). In 2024, it had more than 12,000 permanent and seasonal employees, and an annual budget of US Dollar $4 billion, which had doubled in the last decade.

CAL FIRE has used its Vegetation Management Program (derived from a Chaparral plan in the 1960s) to encourage partnerships among private landowners to reduce fire hazards. Since CAL FIRE is not established as a land-owning agency, its focus is on suppression and wildland vegetation on lands designated as a state responsibility area (SRA). Within the SRA, it is difficult to initiate fuels management programs across diverse land owners. In an effort to facilitate more beneficial fire use, CAL FIRE prepared a Programmatic Environmental Impact Report that is intended to serve as the overarching California Environmental Quality Act-compliant process for all vegetation treatment projects on SRAs (around 125 345 km^2). The overall goal is to create more partnerships with landowners and to streamline environmental review to implement fuel reduction treatments in appropriate vegetation types—but results to date have been mixed. California in partnership with federal agencies within the state established a goal of treating 1 million acres (4047 km^2) per year by 2025, which recognizes the opportunity for some of this work to be completed by Prescribed Burn Associations and potentially, Tribal Nations.

In line with this goal, in 2021, SB 332, from Senator Dodd, amended Sect. 3333.8 of the Civil Code to mitigate liability for any costs for people implementing prescribed burns for wildfire reduction or cultural burning (among several other purposes). In 2023, SB 310, from Senator Dodd, proposed a suite of changes to define and advance cultural burning and cultural fire practitioners. It was stated that this reform would overcome the "permitting requirements and prohibitions related to prescribed burns." The resulting law amended the Civil Code and Public Resources Code. Article 4505. (a) (2) of the amended Public Resources Code provides that "The Legislature finds and declares that in order to meet fuel management and wildfire resilience goals the state has to address the historical wrongs of criminalizing cultural

use of fire, the state must work collaboratively with federally recognized California Native American Tribes that engage in cultural burning within their ancestral territories." The key changes (reflected in Table 1) focused on facilitating agreements between recognized Native American tribes and California's Natural Resources Agency, and potentially under these agreements, exempting authorized cultural burns and cultural fire practitioners from legally requiring burn plans and contingency plans in the on-line LE 7/8 Broadcast burn permitting system, which are prepared by burn bosses.

Discussion

Since 2017, both B.C and California have taken incremental steps toward including Indigenous Peoples and IFS into their wildfire governance frameworks. California has laws to support government-to-government agreements with Tribal Nations, and laws that recognize cultural fire practitioners, removing the need for burn plans and burn bosses, and that limits their liability and provides liability funds of up to US Dollar $2 million per cultural burn (no claims on this fund have been made to date). B.C has made changes to the Wildfire Act and regulations to facilitate shared decision-making agreements between the Crown and Indigenous governing bodies, in line with the UNDRIP. Questions remain about how persons are authorized to act on behalf of an Indigenous governing body—is it a process rooted in Indigenous law, which may be oral-based? At the time of writing, provincial officials confirmed that no agreements have been finalized to date (Anonymous, British Columbia Government official, personal communication, (2024a).

At various levels of government, recommendations, goals, and strategic plans detail shifts in each jurisdiction's relationship with IFS. However, these are targeted primarily at integrating IFS into the state's existing wildfire management system. The (California Wildfire and Forest Resilience Task Force 2022: 17) unveiled a strategic plan to create "policies, programs, capacity, and knowledge to effectively deploy sufficient prescribed fire, cultural burning, and fire managed for resource benefit" by 2025. While the plan mentions respecting Tribal sovereignty, the main focus is to "integrate California Native American tribes, tribal organizations, and cultural fire practitioners into other forms of beneficial fire across California" (California Wildfire and Forest Resilience Task Force 2022: 27). In B.C., an action plan to "integrate traditional practices and cultural uses of fire into wildfire prevention and land management practices and support the reintroduction of strategized burning" (British Columbia Government 2022: 5) is applied through the B.C. Wildfire Service's Cultural and Prescribed Fire program, which invites First Nations to co-develop and participate in agency-style prescribed burns led by the Province (British Columbia Government 2024a). In the spring of 2024, the US Congress heard recommendations from the Wildland Fire Mitigation and Management Commission (2023), 22 of which supported the theme of "enabling beneficial fire" and reducing barriers for cultural burning by Tribes. These recommendations begin to move past the integration paradigm by instead positioning Tribes as self-governing co-managers (rec. 141), and calling for legal changes that would ensure Tribes are on "equal footing to States […] in the management and restoration of fire" such as revising the Weeks Act to put Tribal Nations on equal footing to the states in managing fire (rec. 49; Wildland Fire Mitigation and Management Commission (2023).

Despite these changes and intentions, three persistent barriers continue to limit the abilities of Indigenous Peoples to apply fire on landscapes. First, and perhaps the most challenging, is the Land Back question, where IFS is most often applied to Indigenous land tenures (typically reserve lands in B.C. and private Tribal lands in California) (see also Hankins et al. in press, and Nikolakis and Myers Ross 2022). However, these lands represent only a small fraction of the overall landscape: 0.4% in BC and 0.6% in California, meaning IFS is highly circumscribed in practice. A key part of this is whether Indigenous Peoples have a legal right to apply IFS to their territories, which Hankins et al. (in press) argues is an unceded right. There are also geographical factors: there is a tendency to be more risk averse in using prescribed or cultural fire in more urban and populated areas, such as southern California, and some public advocacy groups are seeking to maintain fire suppression and prevention on chaparral landscapes in the state's south (see for example California Chaparral Institute, (2020). In B.C., the focus is on using cultural fire in less populated interior areas, where the main risks are on timber and rangeland values (Nikolakis et al. 2024). In some cases, cultural fire has been applied closer to regional population centers, such as Williams Lake, B.C., through partnerships between the B.C. Wildfire Service and local First Nations.

The second barrier to implementing cultural fire on landscapes stems from coordination issues among different layers of government and agencies, which can prevent the application of fire across broader landscapes particularly where containment remains an overriding concern. The web of tenure and jurisdiction also makes change difficult. In California, the "checkerboard" of tenure and jurisdiction not only represents different interests, but also reflects different levels of risk acceptance, as well as understandings of IFS. For example, in 2023, a Kumeyaay fire practitioner was arrested for trespass for burning ancestral lands in southern California; his probation

includes restrictions on burning (Burgueno and Dusek 2024). The criminalization of IFS varies across regions and land types. Some cultural fire practitioners have built positive relationships with local agency staff and are able to lead burns without conflict. For example, the North Fork Mono Tribe, led by Tribal Chair Ron Goode, has revitalized a tribal burning practice on US Forest Service lands, as did the Karuk in the Six Rivers National Forest in 2023, without the need for burn plans or a burn boss (Anonymous, cultural fire practitioner, personal communication, (2024b). While the director of CAL FIRE has committed to improving relationships and respecting the "jurisdictional authority" of "sovereign Nations," the 21 regional units lack cohesion in adherence to, and application of, top-down changes (Armstrong 2024). Similarly, Yunesit'in fire practitioners in B.C. have encountered restrictions when seeking to burn on "Crown lands". In B.C., the question of who owns the land is contested and in flux. Opportunities are emerging to apply fire on contested "Crown" lands; however, most IFS, like that of the Yunesit'in fire program, occurs on Indigenous land tenures. The province's cultural burning approach is to bring IFS within the ambit of the B.C. Wildfire Service (Nikolakis et al. 2024).

The National Wildfire Coordinating Group and the California Wildfire and Forest Resilience Task Force both seek to support coordination among agencies and encourage evidence-based decision-making. To improve the co-management of fire, the California Wildfire and Forest Resilience Task Force (2022: 29) plans to support "land management agencies [in adopting] strategies that provide tribal partners with significant discretion, authority, and resources to implement cultural burning and other Native management techniques." In order for co-management to succeed, agencies require the authority to enter into meaningful agreements with Tribal Nations, and the capacity to support and recognize Tribes as self-governing and sovereign entities. Cultural fire practitioners have also called for improved and mandatory education of agency staff on IFS, including deepening the understanding of the colonial context of fire suppression and respecting sovereignty (Burgueno and Dusek 2024). This is also echoed in recommendation 96 in the report of the Wildland Fire Mitigation and Management Commission (2023).

The third barrier to applying cultural fire on landscapes is capacity issues, not only in terms of having enough skilled and culturally competent people to implement IFS, but also in defining the scope of this work within an Indigenous knowledge and stewardship framework. For instance, a staffing gap of fire practitioners in CAL FIRE and the US Forest Service limits their ability to implement prescribed burning. Tribal members could possibly fill this gap, but these positions should not be siloed as fire prevention jobs. The positions must be year-round stewardship positions, grounded in Indigenous knowledge and ancestral practices, and this spans the work of different agencies and portfolios (e.g., water, lands, forests, fire, fish, wildlife). The same issue exists for First Nations in B.C.: most fire-related jobs are seasonal and are focused on fire suppression. Interviews with Indigenous fire practitioners stress that IFS is more than simply fire prevention; it also includes revitalizing Indigenous stewardship of the land, in ways consistent with Indigenous laws (Nikolakis et al. 2020). Cultural fire practitioners who seek to work independently of government agencies face financial barriers to establishing and maintaining stewardship programs; calls for increased support are a priority in both Canada and the US (Hoffman et al. 2019; Nikolakis and Roberts 2020; Nikolakis and Myers Ross 2022, Wildland Fire Mitigation and Management Commission (2023).

There have been various public commissions and inquiries on the wildfire crises in B.C. and California (Miller et al. 2022; Nikolakis and Roberts 2022). While these can provide important learning opportunities, agencies have continued to focus primarily on suppression and emergency response, and few resources have been provided for mitigation or IFS (Nikolakis et al. 2024). A broader public awareness and education campaign is crucial for fostering appreciation around the essential ecological and wildfire mitigation role of IFS on landscapes—this may create the political will to accelerate meaningful change.

There may be opportunities to expand IFS in both jurisdictions through Land Back initiatives, and through Indigenous Protected and Conserved Areas and Tribal Parks (Hankins et al. in press). Some First Nations in B.C. are revitalizing their laws and practices around IFS laws, and there has been state pressure on cultural fire practitioners to provide written fire laws that guide their IFS activity.[7] However, some Nations seek to maintain their oral laws regarding fire (see also Hankins 2024, Hankins et al. in press). For example, Esk'etemc First Nation in central B.C., has a council of matriarchs that selects cultural fire practitioners—a practice that is grounded in their own unwritten laws (Nikolakis et al. 2024). In California, some Tribal Nations orally share their IFS laws, and they have no desire to codify these laws and make them static in tribal codes and laws (Anonymous, cultural fire practitioner, personal communication, (2024b).

[7] It is asserted that IFS is a right that attracts constitutional protection under Sect. 35 (1) of the Constitution Act, 1982. These laws may offer proof that IFS is grounded in the laws and traditions of the First Nation.

The legal changes made in California and, to some extent, B.C. are important for supporting the reactivation of IFS. However, for laws to be effective in enabling social change, the social system must also be transformed (Allott 1981). A comprehensive government approach, involving multiple agencies, is necessary to facilitate land access and Land Back for Indigenous Peoples, break down agency silos, and build a shared public vision for the role of IFS on landscapes. There must be the resources and space for Indigenous Peoples to steward their lands year-round—not just for wildfire mitigation, but for this stewardship to create diversity and resiliency in landscapes and human communities.

Conclusions

B.C. and California have taken important steps to recognize and incorporate IFS into their institutional frameworks. California has gone the furthest by enacting laws to recognize cultural fire and cultural fire practitioners, removing regulatory barriers for putting fire to the land, and mitigating the liability of cultural fire practitioners. B.C. is developing a cultural fire strategy and has amended wildfire laws, in line with the UNDRIP, for developing shared decision-making agreements with Indigenous governing bodies regarding IFS—though none have been concluded yet. These differences in approaches are rooted in the fact that California recognizes the self-governance of Tribal Nations, whereas B.C. is negotiating shared decision-making within its legal framework. However, in both jurisdictions, a lack of secure tenure and access to land prevents IFS from being implemented at broader scales and in ways that increase the desired attributes of fire regimes.

To be effective, legal changes, like those made to catalyze IFS, must be accompanied by supportive transformations in the social context. The development of IFS will be constrained without providing more Indigenous land tenure, or at least secure access to land, simplifying the complex web of jurisdiction and interests, and providing full-time Indigenous stewards with the resources to achieve diverse landscape and cultural goals. There is evidence of a cultural change taking root, a willingness to not only listen to, but to seek guidance from Indigenous knowledge and practices in navigating ecological crises. This may represent a new phase of wildfire governance, but to take root, it must be supported by a comprehensive suite of measures for implementing IFS.

Further research could explore the different ways that IFS is being implemented in practice. This includes building an understanding of the agreements being negotiated for land access to implement IFS; examining the positive relationships being built by Indigenous and Tribal Nations with government and land-owners to implement IFS, and the ways that different cultures, knowledge systems, and values are being bridged; and documenting the kinds of full-time stewardship roles being developed by Tribal and Indigenous governments, in which IFS can be embedded.

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Authors' contributions
WN conceptualized and wrote the manuscript. GS conceptualized and wrote the section on Ecological Context (including data acquisition, analysis, and creation of Figs. 1 and 2), Reconstructing Fire Histories, and contributed to the Discussion. RMR, SLS, and DLH assisted in conceptualization and writing. SLS wrote parts on California in the Ecological Context and the Wildfire governance and Indigenous Fire Stewardship sections. DLH and RMR engage in IFS in practice. RMR and WN re involved with organizations that support and implement IFS through the Gathering Voices Society and the Yunesit'in Government. No direct funding was provided for this research.

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The authors declare no competing interests.

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