

Traditional use of field burning in Ireland: history, culture and contemporary practice in the uplands

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Abstract. Fire use is increasingly recognised as a central component of integrated land management in fire-prone places. Historically, fire use has been commonplace in many places in Ireland, where field burning is an established practice with a long pedigree among upland farmers seeking to improve forage among other benefits. This practice has been subject to controversy as wildfires – a hazard often associated with upland burning practice – continue to gain public attention and concern. This research seeks to understand the practice of field burning from the viewpoint of practitioners themselves through focus groups with upland burners conducted in a variety of locations across Ireland. Discussions focused on the history of field burning, reasons for its use, and how knowledge of the techniques involved in burning has been passed down through generations. The narrative that emerges is that of a critical livelihood-supporting practice steeped in social and ecological value but threatened by stringent regulation and shifting public opinion. We suggest that one way to preserve this practice may be to establish more formal linkages between fire use practitioners and Ireland's fire services, public land managers and regulators to promote appropriate use of traditional fire within modern legal and best practice frameworks.

Keywords: agricultural land management, cross-boundary collaboration, field burning, fire policy, fire use, focus groups, intergenerational learning, traditional knowledge.

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Introduction

Human use of fire as a vegetation management tool is rooted in a complex yet extensive history of efforts to achieve specific land management goals or maintain desired social-ecological conditions (Kimmerer and Lake 2001; Ryan *et al.* 2013). Cultural practices that use fire often seek to sustain a landscape that is both healthy and can produce benefits for those who live there (Huffman 2013; Lewis *et al.* 2018). However, active use of fire on the landscape has become increasingly controversial as social contexts, landscape fragmentation and evolving climate conditions shift or become more complex (Barbero *et al.* 2015; Czaja *et al.* 2016; Paveglione *et al.* 2019). Many organisations, groups, communities and individuals who use fire as a tool are now caught between what could be described as a false dichotomy of calls to preserve cultural practices and demands to better regulate perceived risks to society. Traditional field burning on Irish landscapes represents one such instance where practices passed down through generations of landholders are contrasted against current public perceptions of fire use and its risks. In this study, we trace Irish field burning practices back to their social roots, before exploring how this knowledge has been shared and implemented over time with a particular focus on the challenges those undertaking this practice face today.

Field burning in locations where livestock grazing has been a predominant land use typically involves the removal of undesirable vegetation to improve forage quality for livestock in subsequent years. However, in recent years, wildfire has become an increasingly visible phenomenon in many northern European countries (Prat-Guitart *et al.* 2019). Many members of the public in these landscapes do not always make a clear distinction between agricultural burning and wildfire and worry that the former can quickly turn into the latter, thus rendering burning increasingly controversial. Recent uncontrolled vegetation fires in Ireland have begun to generate public discussions around risks and impacts associated with burning. The 2017 Cloosh Valley Fire in County Galway burned one-third of Ireland's most extensive forest, making it the largest fire on state forestry lands in recorded history (Coillte 2017). More recently, a gorse fire destroyed two homes in County Donegal in April 2019 (Thomas 2019). These incidents are indicative of a broader trend towards more frequent wildfires in Ireland and the United Kingdom (UK) driven by a rise in human-caused ignitions and climate change (McMorrow 2011; DAFM 2019; Forestry Commission 2019). Ongoing conversations around field burning raise concerns about air quality and respiratory health, wildlife protection and habitat destruction, human and structural safety,

and water quality or carbon storage issues among others (Wulfhorst and Nielsen-Pincus 2003; Ward *et al.* 2007; Ramchunder *et al.* 2009). However, while there is a growing abundance of research surrounding the biophysical processes and outcomes of wildland fires, social science efforts to understand fire use and management in the UK and Northern Ireland remain largely absent (Edgeley and Paveglio 2016). Documenting the cultural importance of field burning is of particular relevance as landowners, managers and researchers continue to unravel the connectivity of fire and its management across social-ecological systems and in shared landscapes.

Although there is a growing literature that explores the benefits and challenges of fire as a landscape management tool, the social processes through which often longstanding but informal burning techniques are learned and adopted remain largely undocumented. This study explores local histories and traditions among farmers who practice field burning in the Republic of Ireland, with particular attention to how knowledge about burning has been preserved and persevered over time. We present findings from focus groups with farmers from six counties who actively practice field burning in order to better understand how this land management approach originated and the ways in which it is currently implemented. Our intent is to provide a preliminary effort to document the history, enduring knowledge and perspectives of those who actually conduct these practices under increasingly challenging social-political conditions. Understanding how farmers implement generational practices and the reasons they hold for this approach offers opportunities for improving government–field burner relationships, preserving and promoting the continuity of local livelihoods and historic practices, and for the creation of avenues for environmental policy design that give greater credence to the social contexts of field burning practices.

Literature review

Burning as a historical management tool

Field burning and fire use practices are used around the world as a means to achieve agricultural management goals such as sustainable grazing practices, landscape health, and weed or invasive species management (Coggins 2002; Fowler and Konopik 2007; O'Rourke and Kramm 2009; Johansson *et al.* 2012; Ley and Weber 2014). Various forms of deliberate burning have been documented across Europe for centuries, beginning as a tool for creating space for hunting and supporting livestock before later evolving into a farming tool for clearing stubble and rotational burning to maintain arable lands in many areas (Pyne 1997). Field burning for pastoral purposes has a deep history in Europe; burning traditions and their landscape impacts have been documented in Italy (Falcucci *et al.* 2007) and Portugal (Fernandes and Botelho 2004; Fernandes *et al.* 2013) among other countries (Tinner *et al.* 2005). However, these practices are perhaps most extensively documented in the Basque regions of Spain and France (Gómez-Ibáñez 1973; Garcia-Gonzalez *et al.* 1990; Métaillé 2006; Murray 2010; Coughlan 2013).

The general historical patterns characterising the evolution and later the rise of state regulation of pastoral field burning practices in Europe – and, in particular, the Pyrenees – are well captured in

the work of Métaillé (2006) and Coughlan (2013). Métaillé describes how fire use from the Neolithic times to the Bronze Age made agriculture possible and resulted in the creation of pastures. Burning intensified from the Middle Ages forward and aided in the enhancement of soils to render them more suitable for agriculture. The use of fire then evolved as a means of pasture management under circumstances where rural labour was plentiful. This centuries-old pattern began to change in the 1950s as formerly frequent burning became sporadic and more opportunistic as rural depopulation accelerated. Accompanying these changes was the rise of the role of the central state in regulating land use activities and the imposition of principles based on western science created by that same state. Similar shifts were occurring elsewhere in Europe, including France where 'recent portrayals of pastoral fire in the Western Pyrenees have characterised it as an overly haphazard, self-interested, or degraded practice in need of organised reform in order to meet changing social and environmental conditions' (Coughlan 2013, p. 86).

Irish field burning practices on hillsides and uplands have been documented as early as the 18th century (Townsend 1810; McWhiney and McDonald 1985), and continue to be used predominantly by the agricultural community (Pyne 1997). Burning occurs on both private lands and commonage – jointly owned lands, usually agriculturally marginal areas such as moorland and coastal dunes, on which the joint owners (usually referred to as 'shareholders') hold grazing rights. Other shared rights may include peat cutting on moorland, and dune grass harvesting and seaweed collection in coastal areas (McKenna *et al.* 2007). Field burning practices in Ireland are commonly used to improve sheep grazing, and to a lesser extent grouse habitat, in contrast to England and Scotland where upland burning (*muirburn*) is more explicitly associated with grouse and deer, particularly in estate management contexts where hunting for these species is common (O'Rourke and Kramm 2009). Such burning efforts historically occurred in spring and fall (autumn) to accommodate sowing of seasonal crops; now, burning during these shoulder seasons is also encouraged because conditions for uncontrolled fire spread are lowest.

Historic records document the intersection of fire and agriculture in Ireland through two dominant types of burning. Bell and Watson (2007) note that a practice known as 'burning and paring' featured heavily in 18th and 19th century Irish agricultural texts as a means to reclaim land and make it suitable for tillage. A County Kerry historian (Donovan 1931, p. 192) described this process:

The gruffaun was a large sharp steel-headed bent hoe which lifted the heatherly scraw from the hillside... In dry summers these scraws with heather or furze roots and all, were burned... The hillside, once covered with heather and furze was changed in a few years into green fields and meadows. In this way, the green hills of Kerry and Donegal, and in fact all the green hills of Erin became, by the sweat of the peasant's brow the hillside and mountain farms of the present day.

The second form of burning (and the focus of the present study) aims to enhance and maintain forage on lands whose primary use is grazing by sheep and cattle. Most land burning practices now relate to extensive pasture management for sheep,

and limited upland beef enterprises. Burning of upland pastures, often dominated by *Molinia caerulea* (purple moor grass, fionán grass) and *Calluna* and ericaceous heathers, is primarily undertaken to improve grazing conditions through the removal of accumulated coarse, dead and woody material from the target vegetation. On heather-dominated sites, fire is used to reverse the growth phase of heather to encourage the development of new succulent shoots, as well as reducing overall vegetation height (Nugent and Casey 2014). Burning efforts are typically passively controlled using local topography, weather and existing burn mosaics to limit the spread of fire, which requires a certain familiarity with the recent history of both that land and the way natural processes interact with it.

There is no central wildfire management agency in Ireland; instead, municipal fire services are stationed at the county and community levels (Murphy and Greenhalgh 2013). Fire stations, fighters and their appliances or equipment are prepared for both structural and vegetation fires as a result. It is rare for rural departments to have full-time firefighters, instead operating on a 'retained' or on-call style system. Neighbouring fire departments may share agreements or memorandums of understanding to foster cross-jurisdictional support. These local fire departments respond to agricultural burns that become uncontrolled; however, it typically falls to county government to both enforce burning regulations and issue fines for illegal or mismanaged burning. In some counties, that fine may include the cost of fire services response under the *Fire Services Act of 1981* and the *Local Government (Financial Provisions) (No. 2) Act of 1983* unless the landowner or burner can demonstrate that 'exceptional hardships exist' (ISB 1981, 1983).

Despite its widespread use, agricultural burning, particularly to improve livestock forage, has long been controversial in Ireland. In 1743, Irish Parliament introduced the 'Act to Prevent the Pernicious Practice of Burning Land' after declaring that pastoral fires were negatively impacting livestock and agricultural practices, and that the desired landscape outcomes fire was used for could be achieved through other means (Cherry 1893; Pyne 1997). In his agricultural tour of Ireland in 1776, Arthur Young reported on a disagreement between an English landlord and Irish tenant farmers over agricultural burning in which the tenant was ultimately allowed to continue the practice (Hutton 1892, p. 398):

Sir William being prejudiced against the custom of burning land, insisted that they should not do it, which impeded them for some time; but upon being convinced that they could not go on well without it, he relaxed, and since that they have improved rapidly.

Further, indirect evidence of this practice in Ireland is provided by McWhiney and McDonald, historians of the American South who argue that the custom of range burning in that region 'seems to have been another adaptation in America of a Celtic tradition' (McWhiney and McDonald 1985, pp. 175–176). English landlords in 18th-century Ireland and English visitors in antebellum America objected to what they called the Irish 'custom of burning land'.

Agricultural field burning in Ireland has once again been subjected to controversy and regulation in recent years, most notably around the *Wildlife Act of 1976* (amended in 2000 and

again in 2016). Some of that controversy relates specifically to the timing of burns relative to potential impacts of ground-nesting bird species during breeding season (Harper *et al.* 2018). The original 1976 *Wildlife Act* states: 'It shall be an offence for a person to cut, grub, burn or otherwise destroy, during the period beginning on the 15th day of April and ending on the 31st day of August in any year, any vegetation growing on any land not then cultivated or in course of cultivation for agriculture or forestry' (Section 40). In 2000, this was amended to shorten the open burning season, stating: 'It shall be an offence for a person to cut, grub, burn or otherwise destroy, during the period beginning on the 1st day of March and ending on the 31st day of August in any year, any vegetation growing on any land not then cultivated.' Further amendments in 2018 through the *Heritage Act* permitted managed burning in March on a trial basis. However, this provision was never enabled during the prescribed lifetime of the legislation.

Temporal restrictions on burning can conflict with traditional patterns of burning and limit farmers' ability to account for annual weather variations when planning and executing burns (Browne 2018). Land found to have been burned outside the legal season may be deemed ineligible for agricultural support schemes (Murphy 2016). Prior studies of farming in Ireland indicate that existing regulations and policies may complicate the ability of farmers to manage land effectively to achieve long-term landscape health goals (Midmore *et al.* 2001). As conversations about regulating fire use continue to emerge, it is critical to document the impetus behind the use of this practice by Irish farmers.

Burning as a management challenge

A growing body of research seeks to understand how cultures and livelihoods are tied to landscape conditions and maintenance, and how this local knowledge might inform improved management and policy (Whitehead *et al.* 2003; Christianson 2015). Efforts to incorporate historical knowledge of burning traditions into fire and vegetation management are increasingly intertwined within these conversations (Prober *et al.* 2011; Lake *et al.* 2017). Fewer efforts explore how cultural land management practices originate and are passed on intergenerationally. This information can help identify why land management approaches are adopted and how they are shared. Such insights may be valuable for policy design and implementation that takes local social historic contexts into account (Corsi 2009; Chiswell 2018). Acknowledging and incorporating local histories and practices into land management is increasingly seen as critical by agencies and governments, who are now responding to calls for more cohesive land management approaches that promote collaboration across boundaries (Sturtevant *et al.* 2005; Cyphers and Schultz 2019). This collaborative component is particularly pertinent to Ireland's commonage, which requires balanced land use by multiple users.

Use of fire as a management tool has created public controversy for decades as conditions for fire spread and loss of life and property continue to worsen (Shindler 2007; Ní Aodha 2017). Concern from members of the public and organisations with conflicting management preferences also has grown in response to field burning. Irish field burning has recently begun to generate pronounced public opposition – a conversation that shares parallels with other populations discussing agricultural

use of fire around the world (Raish *et al.* 2007; Molina-Terrén *et al.* 2016). Many arguments against fire use in Ireland, while perhaps valid, paint field burning practices as one-dimensional and give little consideration to the extended history, culture and intended purpose of this practice on local landscapes (Davies *et al.* 2016; Harper *et al.* 2018). This is not helped by the scarcity of efforts to document the origins of field burning, justifications for these practices, or how this knowledge has been shared across generations.

Understanding social relationships with field burning holds international value in its transferability; for example, debates around bluegrass field burning in northern Idaho, USA, focus on air quality and public health impacts – a concern shared by residents in many countries where burning occurs (Wulforst and Nielsen-Pincus 2003; Ley and Weber 2014). In Australia, burning practices in both grassland and forested settings are contested, where among its other purposes, burning is used in grasslands by Aboriginal peoples to enhance hunting opportunities (Bird *et al.* 2016; Steffensen 2020). Given that public opinion can have a significant influence on decision-making about fire and fire use, collecting and including qualitative research is increasingly needed to capture the social dimensions of landscape management and policy development.

In sum, modern Irish field burners were preceded by generations of farmers who faced similar social and legal controversies. Those difficulties are mirrored in many other countries where environmental concerns and risk perceptions restrict social licence to conduct historic land management practices. Engaging farmers in conversations about the histories of their practices, the emergence of tradition and knowledge transfer offers an opportunity to identify shared land management preferences and develop policy that respects local culture while also preserving ecosystem health. This study aims to address the gaps identified above through the following research questions:

1. How and why do farmers practice agricultural field burning?
2. How are field burning skills acquired and passed on?
3. How do farmers who burn or support burning react to recent public controversy concerning these practices?

Methods

Researchers conducted eight focus groups with 60 farmers and farm landowners responsible for upland areas across Ireland where field burning practices are prevalent. These areas included Counties Wicklow, Kerry, Cork, Louth, Donegal and Carlow. Individuals were selected for focus group participation via preliminary key informant interviews conducted with leaders of farming organisations in each of the six counties. Initial key informants were identified as those who had considerable personal experience in field burning and who were knowledgeable about the practices of others on their locales. Agricultural group leaders in the targeted areas were contacted and asked to provide names of farmers knowledgeable and/or experienced in field burning in their areas. Focus groups ranged in size from 6 to 12 participants as a result of chain referral sampling that began with these key informants (Biernacki and Waldorf 1981). Data collection for this effort was conducted between 2011 and 2016.

The first author facilitated focus groups using a broad protocol designed to establish a basic understanding of field burning practices in Irish landscapes. Initial questions and discussion were designed to gather information on the role of burning as a farming tool, including: (1) a description of farms and farming practices in each locale; (2) perceptions of wildfire risk in the area; and (3) a description of how, when and why and for how long field burning has been conducted in each locale. Participants were also asked a combination of additional and probing questions that explored the transmission of knowledge and skills related to burning, how burns are typically organised, and participants' perceptions of both the effects of and barriers to the use of burning in their local areas. Focus group discussions lasted 1.5 h on average.

Each focus group was recorded with the participants' permission and transcribed verbatim for analysis. Data for two focus groups were lost owing to technological difficulties. The first author took detailed notes after these two focus groups, and cross-referenced notes with emergent themes identified during the coding process to confirm that lost data were consistent with findings from other focus groups. The first author coded each transcript using a process of thematic analysis. Thematic analysis involves identifying commonalities across data through an inductive approach that uses increasingly restrictive rounds of coding to identify consistent themes. The second author then independently reviewed transcripts to ensure that codes were consistent in a process known as inter-coder reliability (Saldaña 2015). Finally, representative quotes were selected for each theme.

Results

Local contexts: land tenure and ownership

Farming is carried out in the context of a mixed land tenure system consisting of both privately held land and commonages in all six counties covered by this research. These arrangements were created by the Irish Land Commission during the land reform era following the breakup of (mostly British-held) estates in the late 19th and early 20th century. This historic allocation of commonage remains a determining factor in access to and use of commonage today. The effects of the land reform era emerged in discussions about the size of commonages, where a typical explanation was as follows:

Well, there [are] different mountains like... there is one commonage there, there would be 3000 acres... anybody who paid rates on it [the commonage] years ago, they would have a share. Like the mountain that I am on now, there is 24 on it. (Louth farmer)

Despite high shares in commonage among farmers, participants emphasised that the number of families that have a *right* to graze on a particular commonage is generally larger than the number who currently do so. Participants attributed this divergence to the general trend of rural depopulation in Ireland and restrictions on stocking levels of sheep allowed or subsidised by the Irish government in response to European Union regulations. Decline in use of commonage and the challenges of regulating land use in a dynamic social environment meant that use of commonage operated under an 'honour system':

You're depending on good will, good neighbours. There's never any more trouble. Long ago there used to be trouble,

when places, when every place was stocked. But nowadays there is only a few fellas grazing this commonage. So no one takes any notice of the next fella.

In sum, Irish field burning practices in our study areas occur in landscapes used mostly for upland sheep farming on a mix of privately owned land and commonage by a declining number of families that have typically been in specific areas for generations. Commonages tend to be prevalent in more upland landscapes with thinner soils that are often used for grazing, meaning that they are burned more frequently than more lowland sites with better soils. The result is a historically based practice by farmers with a knowledge built up over generations of the particular lands on which they live and work and, as we will see below, an acute understanding of how the vegetative conditions have changed on these lands as agricultural practices have evolved over decades and generations.

Historical burning practices built on local knowledge

There was a general consensus that field burning traditions in each county originated centuries ago. Participants illustrated this through a range of responses, ranging from 'A long time... hundreds of years' (Carlow farmer) and 'How long is a piece of string?' (Louth farmer) to specific eras: 'Well, I suppose since famine times [the 1840s].' Regardless of exactly when seasonally repeated burning began, all participants agreed that the primary reason for this practice remained the same now as it was then: for improvement of forage. A Cork farmer explained:

There were places where the white grass was growing, t'would be there now in the spring and the green grass... it would have to grow so long before you would get up through it. So, if you burned the place there in February or March, come [later in the year], you'd have lovely green shoots for sheep and lambs... [T]he ewes need burning to produce milk for a lamb.

Most burning targeted the removal of brackens and whins. Participants identified the elimination of non-palatable vegetation competing for growing space with the succulent nutritious grasses as an important part of burning to produce better forage. The same farmer continued:

There [is] both the need to rotate the burning of the heather – the heather requires a specific skill ... t'would be at least 8 to 10 years before you come to burn that again... Whereas finnon, you should burn it every year nearly.

Participants noted that the only real alternative to fire for controlling less desirable vegetation is the use of herbicides, which is both costly and comes with its own environmental risks. Participants also described how the timing and size of particular burns depended on recent grazing history and the needs of the flock in a given location:

You don't want a whole section to be burnt at once because if your sheep settle there, it doesn't make common sense. It's common sense not to burn the whole lot of a section; do it bit by bit.

Another emergent theme across all locations was the relationship sheep farmers described between the reduction in sheep stocking levels in the decade or so before this research and what they see as an increased need for burning to maintain and restore vegetative conditions that have historically existed in their areas. They felt that reduced grazing has led to an increase in the amount and maturity level of woody and other non-palatable vegetation, which in turn has crowded out desirable grasses. In addition to improving the grazing conditions for sheep, participants described numerous other benefits to field burning. These included burning as a means of combatting tick infestations, which they said had plagued their sheep in the years since stocking levels and burning had been reduced. Participants described field burning as an enhancement of habitat for grouse:

On our hills we have a lot of grouse and we have a ... pile of heather. You must burn, say if you take just one acre, you must burn a third of that acre every year if you want to keep it right... say maybe every 10 years. But you will have no grouse if you don't burn the heather.

How burning is organised

Modern burning practices in Ireland are grounded in historical approaches. When asked about how burning had historically been organised, the following exchange occurred:

Cork farmer: There'd have more people around the locality [than is now the case]. There'd be meitheals... A meitheal is a group of farmers that would get together to [share work].¹

Facilitator: Was traditional burning always done in the meitheal?

Cork farmer: There'd be no hard and fast rule, one man could go out... The kids would go with them, the kids would want to see and the kids are learning exactly how the old people done it.

When we queried the participants about how local field burning is organised in the present day, responses were remarkably consistent across the groups. The following is a typical response to questions about how the conditions for burning are determined and how the task is organised, given by a Kerry farmer:

Typically, one or two men. When the wind is from the right point they'd know where to start. And they'd pick an area where the fuel load wouldn't be as high and maybe have their strip control there, they'd assess the situation. Like I could be at home today and burning could be the last thing on my mind and tomorrow depending on what way the weather was for that 24 hours [I would burn].

In many cases, participants burned fairly narrow strips of pasture in a given year with adjacent strips being slated for burning in subsequent years. A Cork farmer explained how they burn strips in crews:

What we carry is a small handheld lamp and you, you, Finn's sister [indicating a crew of at least three people]... she'd be

¹See Arensberg and Kimball (2001) for a description of the historical role of meitheals in Irish farming communities.

pulling the fire ahead of us, and we'd be following her, quenching it. You know, this is the danger side on this side and we'd be letting it burn back towards a stream or somewhere we knew there was little cover.

In short, the practices they described were to use various forms of ignition to burn annually rotating sections of sheep pastures using natural landforms and barriers to prevent unwanted spread and in some cases hand-carried water to keep fire contained within strips burned strategically as fire breaks where such barriers do not exist.

Acquiring and passing on burning knowledge and techniques

Knowledge about, and the ability to conduct, field burning has been developed and transmitted across generations in all study locations. Participants consistently agreed that there was very little of what could be described as conscious teaching or learning involved in acquiring burning skills; rather, they understood how to burn through the absorption of knowledge over the course of day-to-day activities with members of older generations. As one Carlow participant explained, 'We seen it been done since when we were in the pram.' During each focus group, there was considerable discussion about the informal process of learning to burn as a young person growing up in the area:

Let me say, as the ewe lamb following the ewe... every one of us went out with our father, uncle and, and maybe you went cutting turf or you know, it was incidental to maybe another days' work...

The participants also described how a shared knowledge of the landscape, including place names, allowed them to work cooperatively on burning and other pasture management tasks in the commons areas. One Cork farmer explained the value of this place-based knowledge, and how those names might soon be lost:

Before GPS, they'd named every valley and stone in the mountain. So, if Paddy Murphy was up the hill and he saw my black ewe at the slat, he was able to come back and tell me and I knew exactly where to find her, you know... my children... who are reared and gone, they would have had no reason to know those things. They might know... 10% of them [place names].

One of the crucial lessons that young people learned from their elders about field burning techniques is the sensitivity of timing as it relates to moisture levels in the vegetation. Identifying an appropriate window for optimal burning was a central theme in discussions among participants; as one Carlow farmer explained, 'A dry day is no good, you need a dry week or two...'

Current issues around burning as seen by practitioners

Field burning in Ireland has become controversial in recent years, owing in part to public perceptions that escaped fires present a risk to upland communities. Some participants suggested that burning was a low-risk endeavour, predominantly

because of the nature of the vegetation being burned, as one Carlow farmer explained:

The only time it would be a risk, we'll say, if it happened in the month of April, the vegetation was dry and you was near forestry. You would be definitely afraid then. Forestry is the biggest danger.

However, as participants in County Kerry noted, fire risk as a more complex issue tied to sheep stocking levels and timing restrictions on burning practices. When the facilitator asked if uncontrolled fire was a risk locally, it generated the following discussion:

Kerry farmer: Yes, but it all ties in with the undergrazing as well, you have far more dense scrub to burn... it builds up and when it does catch fire then it's impossible to control.

Facilitator: Would fire have been a problem for your grandfathers?

Kerry farmer: No, they managed it... they control-burned, they burned into sections. You cannot burn before the first of March in reality because in practice the weather wouldn't [allow it].

This increase in risk was echoed by participants in Wicklow, who felt that uncontrolled fire risk in their area had drastically increased in recent years owing to reduced opportunities for field burning. Concerns across both locations were tied to increasingly restrictive policies that determined when farmers could legally burn. One participant attributed the reduced burning of heather to a lack of resources provided for Coillte (the state-owned forestry enterprise), saying that they used to burn strips around forestry plantations but had not done so in recent years owing to seasonal burning restrictions that tie the hands of farmers wanting to burn. These restrictions meant that farmers in our focus groups could not burn to the extent that older generations had, and many participants saw changes to their commonage and private lands that they felt were not sustainable for livestock.

Policy shifts away from local traditions meant that farmers sometimes felt that they had to choose between following legal requirements and maintaining traditional practices they and previous generations felt were best for the land. Carlow participants described this unintended consequence of the seasonal restriction on burning:

If you're within the law you can stay with it. If you're outside the law you just don't hang around till you're caught and then there's no control fire.

Participants discussed how field burners could deal with growing opposition to burning from people who are not farmers, a concern associated with an increasing number of residents calling the local fire brigade when smoke from field burns was sighted:

Carlow farmer: Well sure, they [the general public] don't realise, they don't realise what's being done...

Facilitator: So, there is tension between the farmers and the fire brigade about this? Do you ever meet with the fire brigade and try to work things out?

Kerry farmer: We did, yes.

Facilitator: Does it work?

Kerry farmer: (laughter) Yes, it does work to a certain extent if we could get more done. [A Kerry farmer] met with the fire brigade and they were going to take a few of us away on a course to show us how they think it should be done... there would be a couple of very good experts who could show the fire brigade how to burn in this room. (laughter)

Discussion

Burning as an historical practice in a contemporary environment

The authors believe this research to be the first systematic attempt to document how the underlying knowledge and specific techniques of field burning practices have been maintained and transmitted through generations of Irish upland farmers dating back to the 18th century. Focus group discussions revealed that much like [Métailié \(2006\)](#), [Coughlan \(2013\)](#) and others described in the Pyrenees, field burning is an intergenerational communal practice that participants view as an integral part of their farming heritage. The shared work of burning in the commons appears to be a classic example of the traditional rural Irish communal norms of reciprocity of labour (referred to as coiring) in which a meitheal (band) of workers would assemble to accomplish tasks than could not be done as effectively by individuals or members of nuclear families ([Arensberg and Kimball 2001](#)). The narratives we recorded regarding knowledge transmission and the locally perceived relationship of these practices to the broader context of upland sheep farming were remarkably consistent across study areas, with only minor variation in techniques and specific vegetative conditions between locations. This appears to be clear evidence that burning techniques are part of the shared heritage passed down through generations of Irish upland farmers. It should therefore not be surprising that such farmers react defensively to what they perceive as threats to such traditions. With grazing-focused burning practices already under growing scrutiny from urban populations and non-farming rural neighbours, participants were united by growing concerns for the preservation of their landscape management traditions. This was framed by a shared belief that burning was needed now more than ever owing to reduced stocking levels of sheep and the resulting proliferation of woody vegetation in many pastures that was prevented in past decades by higher levels of grazing.

Intergenerational knowledge exchange about how and when to burn appeared to be learned subconsciously through participation from a young age. Critically, this practice has relied on informal knowledge exchange over time for generations, making the *process* of sharing through discussions and hands-on involvement equally important to preserve as the knowledge itself. This process bears many similarities with existing studies of knowledge exchange for land management across generations ([Chiswell 2018](#)); it is deeply place-based and relies on the attentiveness of the burner to small changes in the land and its weather. Efforts to formally document this knowledge in a way that is culturally appropriate is increasingly important as environmental conditions and policy change, and younger

generations become less likely to share an interest in upholding traditional agricultural practices.

Misalignment between farmers' burning traditions, evolving policy restrictions, and public opposition identified in these focus groups extends a growing history of conflict around field burning in Ireland ([McWhiney and McDonald 1985](#); [Pyne 1997](#)). Framing this conflict in sociological terms, these interactions exemplify tensions between what German sociologist Ferdinand Tönnies ([Tönnies 1887](#)) and Max Weber referred to as *Gemeinschaft* (community) and *Gesellschaft* (society). In its classic formulation, *Gemeinschaft* refers to the affectual values and localised lifeways originally found in preindustrial communities, while *Gesellschaft* refers to the more formalised structures and rules imposed by a modernising industrialised society. Whereas Tönnies believed that as nation-states became more powerful and centralised, industrialisation progressed and *Gesellschaft* emerged, that *Gemeinschaft* would disappear, Weber and many sociologists since his time argued that the two sociological forms would coexist in tension with each other. This conflict can be framed as a case of the latter argument.

Study participants saw new and restrictive policies, declining land management resources, and what they viewed as public misconceptions about burning (*Gesellschaft*) as significant threats to the continuation of intergenerational burning practices (*Gemeinschaft*). Some saw these changing conditions as potentially more conducive to uncontrolled or escaped fires, rather than as a preventative. Participants repeatedly argued that risks associated with burning despite having increased in some areas owing to the expansion of forestry and changed vegetative conditions in mountain pastures themselves are nonetheless overblown in the media and in the minds of the non-farming public. Farmers' narratives emphasised the skills and traditions developed within their community and a reliance on their intergenerational experience with the land that is not seen the same way by their critics in the public or even within the fire services. They also saw themselves as often taking public blame for uncontrolled fires set by youths, arsonists and others not associated with farming. As public awareness of fire risk and conditions for fire spread has increased, there has emerged a clear need for more productive discourse about both the benefits and potential negative consequences associated with upland field burning.

Tensions between community and society in our data mirror similar challenges for burning internationally. We suggest that Tönnies and others' arguments provide a helpful framework for understanding and navigating this conflict in Ireland and beyond; similar conflict elsewhere has been managed through recognition that respects and incorporates both *Gemeinschaft* and *Gesellschaft* into formal fire use and management. Ireland has yet to completely reconcile these two perspectives, but focus group discussions indicate that efforts to resolve this tension must not only foster respect for intergenerational knowledge of field burners (*Gemeinschaft*), but also acknowledge the need for some incorporation of professional fire management practices and formal oversight for fire management developed by policy makers (*Gesellschaft*), such as increased supervision of land being burned, increased coordination with local fire brigades and use of personal protective equipment (PPE) by field burners ([Métailié 2006](#)).

Recent controversy surrounding the use of fire as a tool on Irish landscapes is also indicative of a deeper conflict driven by changes in local social contexts across time. Farmers' freedom to burn the land as previous generations had is fading amidst divergent conversations about what is 'good' for the landscape and its residents in Ireland and Europe more broadly. These debates tend to frame the issue around biodiversity, species protection and aesthetics *v.* more utilitarian land uses, and in particular, grazing for meat production. All the groups were in agreement that as land management practices, grazing and burning were inexorably linked. It was explained that as sheep stocking levels have been reduced and burning restricted, succulent vegetation has been outcompeted by woody vegetation in many places creating a vicious cycle making future pasture burning both more important from their perspective and more difficult to carry out safely. Focus group participants drew on their intergenerational knowledge to describe this and what they saw as other negative long-term implications associated with a decline in burning including diminishment of suitable habitat for some wildlife species – particularly grouse. Furthermore, these conversations often centre indirectly around what should be considered a productive use of the land without explicit examination of how culture and livelihood are tied to current landscape conditions. As livelihoods increasingly shift away from the land into tertiary employment, the value of traditional practices is lost in translation on national platforms during conversations about environmental health and public safety.

We suggest that conversations around the benefits and consequences of field burning in Ireland require greater inclusion of not only historic ecological data but also qualitative cultural knowledge associated with this practice. In many contexts where fire is lauded as a beneficial tool, the risk of uncontrolled wildland fire has long been present; this hazard is still somewhat limited on Irish landscapes in comparison owing to climatic conditions and vegetation types. However, as fire risk continues to increase owing to changes in vegetative land cover, demographic shifts and climate change, it has become arguably more important for Ireland to explore potential environmental futures by examining and adapting lessons learned in other cultures that incorporate burning.

Protecting a tradition: preservation through collaboration?

Our focus group data suggest that the use of fire as a land management tool has reached a critical point; farmers, fire professionals, governments and other central groups in this debate must come together to find a path forward if burning is to survive as a socially and politically acceptable practice (Métailié 2006). Study participants interpreted recent uncontrolled fires arising from other ignition sources as evidence of the role that historic upland burning – while principally aimed at maintaining and improving conditions for grazing – has played in reducing risk of uncontrolled fires. This is not to say that field burning has not been one source of ignition of some uncontrolled fires given changed conditions in the Irish landscape, but rather that this risk is likely exaggerated on some occasions. The recent experiences and outcomes of large-scale, high-intensity wildfires on land where no farming takes place would appear to support the position that well-managed field burning can reduce

rather than increase wildfire risk (San-Miguel-Ayanz *et al.* 2020). Building stronger relationships between landowners who use fire and fire management agencies at both the local and national level may lie at the heart of preserving this historic practice and according a wider modern purpose to it. Bringing together the domain of local burning knowledge and skillsets – that derived from generations of community experience (Gemeinschaft) – with that of the modern fire management knowledge and experience in agencies (Gesellschaft) – could yield a useful synthesis of approaches to a safer and more effective expression of burning practice moving forward.

Researchers and practitioners increasingly aim for collaboration as an approach for détente across land management conflicts. Such studies often examine approaches across land management boundaries to identify shared values that can encourage cohesive actions. Fire offers a tangible and useful catalyst for shared discussions and actions that can yield wider fruit. Ireland's commonage framework offers a unique angle on such conversations; recent experience with locally led and results-based approaches to agricultural, ecological and rural development challenges have been proved extremely promising (DAFM 2019). Focus group participants operating on commonage indicated a high level of trust in others utilising this shared resource that was afforded to this group through centuries of practice.

In the face of climate change, increasingly problematic fire regimes and changing upland demographics, openness to contemporary fire management thinking on the part of current critics of field burning is arguably in order, as is greater sensitivity by local practitioners to the perceptions and fears concerning fire among much of the public. Traditional fire use has a valuable role to play in responses to this if the right conditions and relationships can be established that permit collaboration within cohesive fire management planning environments (Montiel and Kraus 2010; Rego *et al.* 2010). More specifically, developing working partnerships between farmers who practice burning and land management and firefighting entities may offer the clearest path forward. Local-level fire management groups, such as those operating in counties Cork and Kerry since 2011 provide a suitable forum for discussion and platform for improved cooperation, training and knowledge transfer in both directions. Initial moves in this direction in Ireland have so far proved positive (San-Miguel-Ayanz *et al.* 2018). This cross-fertilisation of knowledge and practices between those possessing traditional knowledge of fire use that has been handed down within the farming community and those from the fire services and public land management agencies charged with protecting rural communities and landscapes from fire can foster opportunities for efficient and effective melding of old and new. A collaborative format where both fire professionals and farmers are given equal standing is likely to minimise the likelihood of conflict, while also offering opportunities for the infusion of traditional burning with modern firefighting training and response (Fernandes *et al.* 2013).

Efforts elsewhere to build relationships between burners and fire professionals have taken many forms. Efforts like prescribed burning training exchanges (TRES) in the USA – events where professionals from diverse backgrounds come together to burn and share knowledge – have thrived as policy seeks to incorporate

collaboration and partnerships into land-management strategies. In Australia, there has been notable progress in incorporating Indigenous knowledge and practices about fire use into contemporary land management through cross-cultural collaboration and education (Steffensen 2020). In the UK, there increasingly is a demand for partnership in wildfire risk reduction that has remained largely grassroots (McMorrow 2011; Edgeley and Paveglio 2016). The emergence and scale of the current fire challenge in Ireland is a clear indicator that there are wider problems afoot (Nugent and Casey 2014). Adapting existing frameworks for relationship-building around fire management practice offers a concrete step to more inclusive conversations and cohesion around wider land use issues in Ireland.

Conclusion

Intergenerational knowledge exchange around burning has allowed a centuries-old land management technique to persist on Ireland's uplands and commonages. Emerging conflict around upland burning in Ireland is yet another microcosm of many past and present debates centred on fire use internationally. However, while many countries have embarked on a deliberate shift to incorporate scientific and locally based evidence around fire use into land management, public debates in Ireland and the UK have instead shifted against burning for land management benefits (Davies *et al.* 2016). Our focus group data indicate a growing awareness that upland farmers can be active productive participants in conversations about land management so that they have a platform for sharing their knowledge as policy and perceptions affecting burning evolve. A decline in the window of opportunity available annually for burning driven by national-level policy change and reinforced by largely urban-based public attitudes will make it increasingly difficult for traditional upland farming to survive as a viable land use choice, along with the myriad of other traditions, economic activities and cultural practices it supports. Farmers, supporting bodies and agencies appear to have an opportunity to forge a path forward together if these traditions, communities and landscapes are to adapt and survive.

Conflicts of interest

The authors declare no conflicts of interest.

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References

- Arensberg CM, Kimball ST (2001) 'Family and Community in Ireland (3rd edn).' (Clasp Press: Ennis, County Clare, Ireland).
- Barbero R, Abatzoglou JT, Larkin NK, Kolden CA, Stocks B (2015) Climate change presents increased potential for very large fires in the contiguous United States. *International Journal of Wildland Fire* **24**, 892–899. doi:10.1071/WF15083
- Bell J, Watson M (2007) 'A History of Irish farming 1750–1950.' (Four Courts Press: Dublin).
- Biernacki P, Waldorf D (1981) Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research* **10**, 141–163. doi:10.1177/004912418101000205
- Bird RB, Bird DW, Coddling BF (2016) People, El Niño–Southern Oscillation and fire in Australia: Fire regimes and climate controls in hummock grasslands. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* **371**, 20150343. doi:10.1098/RSTB.2015.0343
- Browne B (2018). Farmers warned they could lose vital payments over illegal fires. *The Corkman*. Available at <https://www.independent.ie/regionals/corkman/news/farmers-warned-they-could-lose-vital-payments-over-illegal-fires-36705989.html> [verified 31 May 2020]
- Cherry RR (1893) 'The Irish Land Law and Land Purchase Acts, 1860–1891 (2nd edn).' (John Falconer: Dublin).
- Chiswell HM (2018) From generation to generation: changing dimensions of intergenerational farm transfer. *Sociologia Ruralis* **58**, 104–125. doi:10.1111/SORU.12138
- Christianson A (2015) Social science research on Indigenous wildfire management in the 21st century and future research needs. *International Journal of Wildland Fire* **24**, 190–200. doi:10.1071/WF13048
- Coggins CR (2002) Ferns and fire: village subsistence, landscape change, and nature conservation in China's southeast uplands. *Journal of Cultural Geography* **19**, 12–159. doi:10.1080/08873630209478291
- Coillte (2017) Update – Forest Fire at Cloosh Valley. Available at <https://www.coillte.ie/media/2017/05/Update-Forest-Fire-at-Cloosh-Valley.pdf> [Verified 10 May 2020]
- Corsi A (2009) Family farm succession and specific knowledge in Italy. *Rivista di Economia Agraria* **64**, 13–30.
- Coughlan MR (2013) Errakina: pastoral fire use and landscape memory in the Basque region of the French Western Pyrenees. *Journal of Ethnobiology* **33**, 86–104. doi:10.2993/0278-0771-33.1.86
- Cyphers LA, Schultz CA (2019) Policy design to support cross-boundary land management: the example of the Joint Chiefs Landscape Restoration Partnership. *Land Use Policy* **80**, 362–369. doi:10.1016/J.LANDUSEPOL.2018.09.021
- Czaja MR, Bright AD, Cottrell SP (2016) Integrative complexity, beliefs, and attitudes: Application to prescribed fire. *Forest Policy and Economics* **62**, 54–61. doi:10.1016/J.FORPOL.2015.07.003
- DAFM (2019). Forest Statistics – Ireland 2019. Department of Agriculture, Food and the Marine, Ireland. Report. Available at <https://www.teagasc.ie/media/website/crops/forestry/advice/Forest-Statistics-Ireland-2019.pdf> [Verified 21 April 2021]
- Davies GM, Kettridge N, Stoof CR, Gray A, Ascoli D, Fernandes PM, Marrs R, Allen KA, Doerr SH, Clay GD, McMorrow J, Vandvik V (2016) The role of fire in UK peatland and moorland management: the need for informed, unbiased debate. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* **371**, 20150342. doi:10.1098/RSTB.2015.0342
- Donovan TM (1931) 'A Popular History of East Kerry.' (Talbot Press: Dublin).
- Edgeley CM, Paveglio TB (2016) Influences on stakeholder support for a wildfire early warning system in a UK protected area. *Environmental Hazards* **15**, 327–342. doi:10.1080/17477891.2016.1209155
- Faluccci A, Maiorano L, Boitani L (2007) Changes in land-use/land-cover patterns in Italy and their implications for biodiversity conservation. *Landscape Ecology* **22**, 617–631. doi:10.1007/S10980-006-9056-4
- Fernandes P, Botelho H (2004) Analysis of the prescribed burning practice in the pine forest of northwestern Portugal. *Journal of Environmental Management* **70**, 15–26. doi:10.1016/J.JENVMAN.2003.10.001
- Fernandes PM, Davies GM, Ascoli D, Fernández C, Moreira F, Rigolot E, Stoof CR, Vega JA, Molina D (2013) Prescribed burning in southern

- Europe: developing fire management in a dynamic landscape. *Frontiers in Ecology and the Environment* **11**, e4–e14. doi:10.1890/120298
- Forestry Commission (2019) Environment. In 'Forestry Statistics 2019'. Ch. 5, pp. UK Forestry Commission. Available at <https://www.forestry-research.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2019/environment/woodland-fires/> [Verified 10 May 20]
- Fowler C, Konopik E (2007) The history of fire in the southern United States. *Human Ecology Review* **14**, 165–176.
- García-González R, Hidalgo R, Montserrat C (1990) Patterns of livestock use in time and space in the summer ranges of the western Pyrenees: a case study in the Aragon Valley. *Mountain Research and Development* **10**, 241–255. doi:10.2307/3673604
- Gómez-Ibáñez DA (1973) 'The Western Pyrenees: Differential Evolution of the French and Spanish Borderland.' (Clarendon Press, Oxford).
- Harper AR, Doerr SH, Santin C, Froyd CA, Sinnadurai P (2018) Prescribed fire and its impacts on ecosystem services in the UK. *The Science of the Total Environment* **624**, 691–703. doi:10.1016/j.scitotenv.2017.12.161
- Huffman MR (2013) The many elements of traditional fire knowledge: synthesis, classification, and aids to cross-cultural problem solving in fire-dependent systems around the world. *Ecology and Society* **18**, 3. doi:10.5751/ES-05843-180403
- Hutton AW (1892) 'Arthur Young's tour in Ireland (1776–1779).' Vols I and II. (Tutis Digital Publishing Private Limited: London)
- ISB (1981) Fire Services Act, 1981. Irish Statute Book. Available at <http://www.irishstatutebook.ie/eli/1981/act/30/enacted/en/html> [Verified 3 January 2021]
- ISB (1983) Local Government (Financial Provisions) (No. 2) Act, 1983. Irish Statute Book. Available at <http://www.irishstatutebook.ie/eli/1983/act/21/enacted/en/html> [Verified 3 January 2021]
- Johansson MU, Fetene M, Malmer A, Granström A (2012) Tending for cattle: traditional fire management in Ethiopian montane heathlands. *Ecology and Society* **17**, 19. doi:10.5751/ES-04881-170319
- Kimmerer RW, Lake FK (2001) The role of Indigenous burning in land management. *Journal of Forestry* **99**, 36–41.
- Lake FK, Wright V, Morgan P, McFadden M, McWethy D, Stevens-Rumann C (2017) Returning fire to the land: celebrating traditional knowledge and fire. *Journal of Forestry* **115**, 343–353. doi:10.5849/JOF.2016-043R2
- Lewis M, Christianson A, Spinks M (2018) Return to flame: reasons for burning in Lytton First Nation, British Columbia. *Journal of Forestry* **116**, 143–150. doi:10.1093/JOF/FORE/FVX007
- Ley AJ, Weber E (2014) Policy change and venue choices: Field burning in Idaho and Washington. *Society & Natural Resources* **27**, 645–655. doi:10.1080/08941920.2014.901461
- McKenna J, O'Hagan AM, Power J, Macleod M, Cooper A (2007) Coastal dune conservation on an Irish commonage: community-based management or tragedy of the commons? *The Geographical Journal* **173**, 157–169. doi:10.1111/J.1475-4959.2007.00225.X
- McMorrow J (2011) Wildfire in the United Kingdom: Status and key issues. In 'Proceedings of the Second Conference on the Human Dimensions of Wildland Fire'. (Eds S McCaffrey, C LeBlanc) USDA Forest Service, Northern Research Station General Technical Report NRS-P-84, Vol. 84, p. 44. (Newtown Square, PA, USA)
- McWhiney G, McDonald F (1985) Celtic origins of southern herding practices. *The Journal of Southern History* **51**, 165–182. doi:10.2307/2208823
- Métaillé J (2006) Mountain landscape, pastoral management and traditional practices in the Northern Pyrenées (France). In 'The conservation of Cultural Landscapes'. (Ed. M Agnoletti) pp. 108–124. (CAB International: Wallingford, UK)
- Midmore P, Sherwood AM, Roughley G (2001) Policy reform and the sustainability of farming in the uplands of the United Kingdom: conflicts between environment and social support. *Journal of Environmental Policy and Planning* **3**, 43–63. doi:10.1080/15239080108559293
- Molina-Terrén DM, Cardil A, Kobziar LN (2016) Practitioner perceptions of wildland fire management across south Europe and Latin America. *Forests* **7**, 184. doi:10.3390/F7090184
- Montiel C, Kraus D (Eds) (2010) Best Practices of Fire Use – Prescribed Burning and Suppression Fire Programmes in Selected Case-Study Regions in Europe. Research Report 24. European Forest Institute.
- Murphy P, Greenhalgh K (2013) A framework for fire safety in Ireland. *Fire* **105**, 45–47.
- Murphy T (2016). Hot topic – illegal burning on land could send you to prison. *Farming Independent*. Available at <https://www.independent.ie/business/farming/hot-topic-illegal-burning-on-land-could-send-you-to-prison-34699467.html> [Verified 31 May 2020]
- Murray S (2010) The presence of the past: a historical ecology of Basque Commons and the French state. *Zeitschrift für Wirtschaftsgeographie* **43**, 131–147.
- Ní Aodha G (2017) Farmers defend 'extreme and irresponsible' gorse bush burning as best practice. *The Journal*, Ireland. Available at <https://www.thejournal.ie/gorse-fire-burning-debate-3352600-Apr2017/> [Verified 31 May 2020]
- Nugent C, Casey J (2014). Prescribed fire as a land management tool in the Irish uplands. In 'Proceedings of 2014 Teagasc Hill Sheep Conference, Bantry, County Cork' (Ed M Diskin), pp 26–31. (Animal & Grassland Research and Innovation Centre: Galway, Ireland). Available at <https://www.teagasc.ie/media/website/publications/2014/Teagasc-Hill-Sheep-Conference-proceedings.pdf> [Verified April 2021]
- O'Rourke E, Kramm N (2009) Changes in the management of the Irish Uplands: A case-study from the Iveragh Peninsula. *European Country-side* **1**, 53–66. doi:10.2478/V10091-009-0005-5
- Paveglio TB, Carroll MS, Stasiewicz AM, Edgeley CM (2019) Social fragmentation and wildfire management: Exploring the scale of adaptive action. *Management* **71**, 12–23.
- Prat-Guitart N, Nugent C, Mullen E, Mitchell FJG, Hawthorne D, Belcher CM, Yearsley JM (2019) Peat Fires of Ireland. In 'Coal and Peat Fires: A Global Perspective'. (Eds Stracher, G.B., Prakash, A., Sokol, E.V) Vol. 5, pp. 451–482. (Elsevier: Amsterdam, The Netherlands)
- Prober SM, O'Connor MH, Walsh FJ (2011) Australian Aboriginal peoples' seasonal knowledge: a potential basis for shared understanding in environmental management. *Ecology and Society* **16**, 12. doi:10.5751/ES-04023-160212
- Pyne SJ (1997) 'Vestal Fire: An Environmental History, Told Through Fire, of Europe and Europe's Encounter with the World.' (University of Washington Press: Seattle).
- Raish C, Gonzalez-Caban A, Martin W, Martin I, Bender H (2007) Cultural variation in public perceptions concerning fire use and management. In 'People, fire and forests: a synthesis of wildfire social science'. (Eds T. C. Daniel, M. S. Carroll, C. Mosley, and C. Raish) pp. 70–88. (Oregon State University Press: Corvallis, OR).
- Ramchunder SJ, Brown LE, Holden J (2009) Environmental effects of drainage, drain-blocking and prescribed vegetation burning in UK upland peatlands. *Progress in Physical Geography* **33**, 49–79. doi:10.1177/0309133309105245
- Rego F, Rigolot E, Fernandes P, Montiel C, Sande Silva J (2010) Towards Integrated Fire Management. Policy Brief 4. European Forest Institute.
- Ryan KC, Knapp EE, Varner JM (2013) Prescribed fire in North American forests and woodlands: history, current practice, and challenges. *Frontiers in Ecology and the Environment* **11**, e15–e24. doi:10.1890/120329
- Saldaña J (2015) 'The Coding Manual for Qualitative Researchers.' (Sage: Thousand Oaks, CA).
- San-Miguel-Ayán J, Costa H, de Rigo D, Libertá G, Vivancos TA, Durrant T, Nuijten D, Löffler P, Moore P (2018) Basic criteria to assess wildfire risk at the pan-European level. In 'JRC Technical Reports'. EUR 29500 EN (Publications Office of the European Union: Luxembourg, Luxembourg)

- San-Miguel-Ayanz J, Durrant T, Boca R, Maiani P, Liberta' G, Artes Vivancos T, Jacome Felix Oom D, Branco A, De Rigo D, Ferrari D, Pfeiffer H, Grecchi R, Nuijten D, Leray T (2020) 'Forest Fires in Europe, Middle East and North Africa 2019.' EUR 30402 EN. (Publications Office of the European Union: Luxembourg).
- Shindler B (2007) Public acceptance of wildlife fire conditions as fuel reduction practices: challenges for federal forest managers. In 'People, fire and forests: a synthesis of wildfire social science'. (Eds T. C. Daniel, M. S. Carroll, C. Mosley, and C. Raish) pp. 37–54 (Oregon State University Press: Corvallis, OR).
- Steffensen V (2020) 'Fire country: How Indigenous fire management could help save Australia.' (Hardy Grant Publishing: Melbourne).
- Sturtevant V, Moote MA, Jakes P, Cheng AS (2005) Social science to improve fuels management: a synthesis of research on collaboration. USDA Forest Service, North Central Research Station General Technical Report NC-257. (St. Paul, MN).
- Thomas C (2019) Gardaí investigating after gorse fire destroys house in Co Donegal. *The Journal*, 20 April 2019. Available at <https://www.thejournal.ie/donegal-fire-gorse-4600845-Apr2019/> [Verified 10 May 2020]
- Tinner W, Conedera M, Ammann B, Lotter AF (2005) Fire ecology north and south of the Alps since the last ice age. *The Holocene* **15**, 1214–1226. doi:10.1191/0959683605HL892RP
- Tönnies F (1887) 'Community and Society.' [trans. Charles P. Loomis 1957]. (Michigan State University Press: East Lansing, MI).
- Townsend H (1810) Statistical Survey of the County of Cork: With Observations on the Means of Improvement. Dublin Society (No. 19999). (Graisberry and Campbell).
- Ward SE, Bardgett RD, McNamara NP, Adamson JK, Ostle NJ (2007) Long-term consequences of grazing and burning on northern peatland carbon dynamics. *Ecosystems* **10**, 1069–1083. doi:10.1007/S10021-007-9080-5
- Whitehead PJ, Bowman DM, Preece N, Fraser F, Cooke P (2003) Customary use of fire by Indigenous peoples in northern Australia: its contemporary role in savanna management. *International Journal of Wildland Fire* **12**, 415–425. doi:10.1071/WF03027
- Wulfhorst JD, Nielsen-Pincus M (2003) Negotiating public health: A theoretical perspective on agricultural burning and community conflict in northern Idaho. *Applied Environmental Science and Public Health* **1**, 33–43.