

## **An Eternal Flame: The Elemental Governance of Wildfire's Pasts, Presents and Futures**

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**ABSTRACT:** Views of fire in the contemporary physical sciences arguably accord with Heraclitus' proposal that 'all things are an exchange for fire, and fire for all things, as goods for gold and gold for goods.' Fire is a media, as John Durham Peters has stated, a species of transformative biochemical reactions between the flammable gases found in air, such as oxygen, and those found in fuels, such as plants. Inspired by an ignition source, these materials react and transform themselves and their surrounds into light and heat energy, carbon dioxide, water vapour, char and much else besides. Fire is conjunctural, durational and transformative. Fire is a dialectician, at once consuming living and dead organic matter and providing both the space and ingredients for new and renewed organic life. In this article, we consider the diverse ways in which fire is today framed as a social problem, an ecological process, an ancient tool, a natural disaster, a source of economic wealth and much more. In this way, we seek to explore the value and limits of 'elemental thinking' in relation to the planetary predicaments described by 'the Anthropocene'.

**KEYWORDS:** Wildfire, governance, Anthropocene, elemental, geography, anthropology

### **INTRODUCTION**

In one of the surviving fragments of his teachings, the pre-Socratic Greek philosopher Heraclitus suggests that 'all things are an exchange for fire, and fire for all things, as goods for gold and gold for goods.' There is some debate about the meaning of this partial thought, but one reading is that, for this paradoxical theorist, fire was both the origin and standard of an inconstant world. Fire creates other elements, such as air, and the ceaseless change visible

in its flames reveals the universal truth that even the most visibly stable entities—such as mountains, or the moon—are actually always in flux. A charitable contemporary reading of this philosophy might say that Western scientific thought disagrees with Heraclitus on this point in detail but not in spirit. From the quantum to the cosmic scale, things are ever in motion, and combustion plays a crucial role in these infinitely unfolding choreographies. At the same time, *contra* Heraclitus, fire is not itself convertible into or comparable with water or air because it is a process rather than a substance. It is a media, as John Durham Peters has argued, in that it is a channel or passageway through which materials are irreversibly transformed. A ‘great dialectician’, fire is the ‘subtractive technique’ through which materials and their surrounds are transformed into light and heat energy, carbon dioxide, water vapour, char and much else besides.<sup>1</sup>

From this latter perspective, the Heraclitian vision of fire as an exchange rings true. A fire is a conjunctural, durational and transformative biochemical reaction. Materials meet and interact, and the intensity and length of these interactions determines what then emerges. Fire is thereby elemental, not because it is a substance or material essence that can be transformed, but because it is itself a transformative process fundamental to material life on this planet. Fossil records suggest that since the end of the Devonian Period, some 350 million years ago, the Earth has had sufficient oxygen and carboniferous vegetation for its landscapes to freely combust.<sup>2</sup> Pulses and patterns of wildfire crept across the planet for tens of millions of years before the first mammals emerged. Subsequently, as historian Stephen Pyne states, *Homo sapiens* and their predecessors evolved as ‘fire creatures’ both shaped by the affordances of their flammable surrounds and, at the same time, shaping those surrounds through selective burning. Nigel Clark notes that recent global climatic changes, now being glossed as the Anthropocene, have been forced precisely because certain humans ‘appropriated and advanced’ the planet’s own technique for processing and redistributing excess, namely combustion.

This leads us to the intuition that fire is an important site for exploring the value and limits of thinking elementally. Over the past decade, humanities scholars, social scientists and others have centred elemental entities—water, soil, coal, fossils, and so on—in a variety of efforts to understand present ecological entanglements. Following Engelman and McCormack, the elemental is alluring because ‘it both captures something tangible about the world and also remains excessive of human agency or intervention.’<sup>3</sup> It is foundational, situates us, embeds us, and is beyond us. ‘You are never out of your element,’ as Cohen and Duckert suggest.<sup>4</sup> In this sense, elemental thinking borrows from infrastructural thinking,

revealing the foundational background of our habits and habitat, but is capable of different kinds of analytical and narrative work. For example, as the anthropologist Gabrielle Hecht has argued, close attention to uranium takes us to the atomic level of its isotopes, the geographical specificity of a given ore, the local, regional and transnational economies of its extraction, and the international policing of its circulation. The elemental can provide such ‘interscalar vehicles’ for analysis, useful for ‘keeping the planet and all of its humans in the same conceptual frame’.<sup>5</sup>

Following Hecht, this paper focuses on wildland or landscape fires to investigate elemental conjunctures or exchanges across scales and contexts. Every year, approximately 340 million hectares, or 4%, of the Earth’s surface burns. Due to climatic changes forced by industrialised combustion over the past two centuries, slightly more of the Earth is burning every year, in fires whose frequency, intensity, and impact is steadily climbing. Constraining the combustion of living and dead organic matter in power stations or forests alike has become vital to maintaining the planetary boundaries suitable for human life.<sup>6</sup> But, without entertaining fantasies of ecological control, contemplating such constraint requires us to first understand how fire and its elemental accomplices are governed. Drawing on our respective research in three fire-prone countries—Australia, Canada and the Philippines—we seek to explore some of the diverse ways in which the presence and effects of landscape fires have been and are being discursively framed and socially distributed. Far from being simply an emergency or disaster, as it is often represented, the rich field of meanings surrounding wildfire’s elemental exchanges and their inequities provide insights as to how another politics of fire is possible.

### **1: Fire as deep time dialectician**

Scholars within twentieth century fire science have developed their own dialectical concepts to explain the occurrence of combustion in the world, centring on three nested triangles. The first, the fire triangle, has oxygen, fuel and heat at its vertices. These are the elemental conditions of possibility for burning. Without all three there is no fire, and their relative abundance or absence has profound effects on a fire’s expression or outputs. The fire environment triangle, the second, links fuel, weather and topography. These determine the behaviour of a particular fire in a landscape. Without fuel there is nothing to consume, without wind a fire will not travel, topography affects behaviour as fires move much faster uphill than downhill; up to a limit, a fire’s rate of spread doubles for every ten degrees of slope it traverses. The fire regime triangle, the third, includes vegetation, climate and

landform. Some types of vegetation are more flammable than others, some climates have longer arid and windy periods than others, and some landforms have greater slopes than others. These three factors reveal the frequencies and intensities of burning expected in different locations over decades or centuries.

The three triangles implicitly describe the list of materials required for sketching out a history of fire in deep time. As Author has stated elsewhere, efforts to write this history have largely revolved around attempts to discern relationships between a set group of ecological agents, events and materials lodged in geological strata.<sup>7</sup> Just as gas bubbles concealed in ice cores indicate climatic composition, the presence and abundance of pollen from plants variously tolerant or intolerant of fire can tell us something of the prevailing order of combustion in particular places. From such signals we learn, for example, that many tree species developed their thick bark during the Cretaceous Period 100 million years ago, eager to insulate themselves from this ‘high-fire world’, and that sclerophyll or hard-leaved plants that promote fire came to dominate the Australian continent over 40,000 years ago. Charcoal, spores, bones, eggshells and many other materials can, in the hands of palaeoecologists and archaeologists, be made similarly eloquent about this planet’s past arrangements of oxygen, fuel and heat.

When and how anthropogenic agency becomes legible in these archaic remains is a matter of ongoing discussion. The first clear evidence of fire in human hearths has been found in sites located within northern Kenya and South Africa, dating to approximately 1.8–1.6 million years ago. When humans started ‘off-site fire use’ or burning the land is unknown. Recent comprehensive literature reviews suggest that anthropogenic fires are ‘nearly invisible’ in Earth’s strata prior to the Holocene, 12,000 years ago, and that they were unlikely a ‘widespread and broadly ecologically relevant factor on any continent’ until somewhere between 8,000 and 4,000 years ago.<sup>8</sup> Combining archaeological evidence with more recent ethnographic evidence demonstrates that in almost all fire-prone locations people lit up their surrounds in ‘planned, organised and complex’ ways from this time on, though, as Bowman et al. summarise, ‘debate rages’ about their ecological impacts, with views ranging from beneficial to catastrophic to negligible.<sup>9</sup> Overall, we can say that fire has been and continues to be put outside the hearth towards legion ends—Scherjon et al. estimate twelve different purposes including ‘fun’ and ‘warfare’—and in each we can detect some form of elemental exchange. A well-placed fire can convert thick shrubs to a bed of ash and char, making a forest passable, or turn senescent grass into fertiliser for fresh regrowth, nourishing mammals for hunting and farming.

Due to its fire-tolerant flora, pre-colonial anthropogenic fire regimes, and post-colonisation issues with major landscape fires, the Australian continent has been singularly important for understanding our relations with combustible ecologies. Since European travellers began intruding upon and invading the landmass in the seventeenth century, they took note of Aboriginal peoples' fire practices, but it was only in the late 1950s, after centuries of state-sponsored dispossession, that the institutions of white settler science began to seriously inquire into their motivations and effects. Famously theorised by Jones as 'firestick farming', Aboriginal peoples' sometimes frequent and broad-scale burning of the landscape has subsequently been cast as, to quote two prominent historians, the 'skilled, detailed and provident management of country' and 'a Faustian bargain that further fed Australia's ravenous pyrophilia'.<sup>10</sup> In short, thousands of years of anthropogenic burning has at once enhanced the continent's habitability and its flammability. Putting aside the character and distribution of these practices, which many other authors have explored, our present interest here is in foregrounding how they have been figured in relation to current Anthropocenic problems of elemental arrangement and exchange.

As the following section will discuss, unplanned landscape fires or wildfires are the object of significant governance infrastructures globally, due to their massive potential economic, ecological and social impacts. In Australia, major fire events in the continent's forested south have typically been married with official inquiries, which, intent upon finding preventative solutions, have routinely observed that such fires are increasing in these places. The drivers of these increases are complex. As in other fire-prone nations, since the mid-twentieth century, people in Australia have moved towards ever greater intimacy with the 'interface' of flammable grasslands and forests, multiplying the sources of ignition and the scale of their potential impacts. Additionally, this same period has exhibited a 'clear signal' of climatic change towards more hazardous fire weather.<sup>11</sup> Nonetheless, as Buizer and Kurz have argued, the aforementioned inquiries have maintained 'a degree of optimism' about the possibility of perfectible technical strategies that might 'generate win-win outcomes', the most consistent being prescribed burning.<sup>12</sup>

Prescribed burning involves burning forests and grasslands during wetter and cooler periods of the year in order to reduce fuels during the drier and hotter periods—'fires of choice' to mitigate 'fires of chance'. Periodically since the early twentieth century, policymakers have called for greater prescribed burning in the name of protecting (human) lives and homes, buoyed by researchers within federal agencies who contended it was the 'only way' to prevent large wildfires in southern Australia.<sup>13</sup> Over the past two decades,

prominent voices in the wildfire management sector have continued to insist that '[we] know the answers to megafires' in the hotter months (November–April), which is to intentionally burn 10–25% of forests every year as opposed to the 1–4% typically burnt.<sup>14</sup> These claims are made on two core bases, the first being experiments conducted in southwest Western Australia, and the second being hypotheses that there were few or no 'killer fires' prior to colonisation because precolonial Aboriginal peoples ignited 'most' of the continent at least every five years.<sup>15</sup> What is curious about such 'radical' solutions is not just that contemporary Aboriginal peoples' rights and interests are absent from their discussion, but that they also serve a broader status quo. The hope is to preserve recent human migrations into places occupied by pyrophilic plants by exchanging their presence for 'our' security.

Fire does not make such straightforward deals. Increasing landscape combustion by an order of magnitude or more also means vastly increasing the smoke and, thereby, the fine particulate matter (particularly PM<sub>2.5</sub> or particles less than 2.5 micrometres in diameter) suspended in the air we breathe. Considering established correlations between wildfire and fatal inflammatory effects, more fires of chance may save houses in the exurbs of Sydney and Melbourne but will definitely lead to more people dying prematurely, choking on the ostensible answer.<sup>16</sup> This is not to question the acuity of Aboriginal fire practices, which are poorly represented by many non-Indigenous boosters, but rather to draw attention to what is displaced or elided in this imagined transaction. To expand on this point, let us look to northern Australia's tropical savanna, an area of approximately 1.9 million square kilometres. In any given year, more than 600ml of rain falls here in the annual monsoonal wet season, promoting the widespread rapid growth of annual grasses that cure and become increasingly flammable during the dry season between April and November, leading to grassfires over more than a third of its area. Due to the regularity and low intensity of these fires, compared to southern Australia, their emissions were included under the 2007 Kyoto Protocol as 'reportable' parts of the nation's annual greenhouse gas inventory. In this way, savanna fires were integrated into emergent carbon trading markets, to the point that now one can offset air travel with carbon credits from savanna burning.<sup>17</sup>

How are fire's exchanges fungible in this way? In short, since methane and nitrous oxide are released by savanna fires form 'carbon debts', demonstrable reductions in these emissions can be translated into 'carbon credits'. Australia ratified the first accredited method for counting such credits in 2010. This involved first using past images from the spectroradiometers aboard NASA's Terra and Aqua satellites to generate aggregate 'baseline' data on the presence of fires in a given area, correlating this with vegetation mapping to

calculate that area's 'baseline' emissions. By then managing land differently, chiefly by burning it earlier in the dry season and suppressing fires when they do occur in the late dry season, land managers are able 'harvest' emissions abatements and have them translated into the Anthropocene's common 'metric of the human'—namely 'carbon'—ready for the market.<sup>18</sup> More than 70 projects have been established using this methodology to date.<sup>19</sup> Purchasers include not only multi-nation petrochemical companies such as Woodside and Caltex, and airlines such as Qantas, but also the Australian government, which has bought contracts for roughly \$200 million of carbon credits from savanna burning since 2013 in order to pay off carbon debt incurred by its citizens and industry.

Fascinating as these translations are, though, they can obscure the exchanges of temporalities occurring through savanna fires. By repurposing the deep time pulse of Aboriginal peoples' combustive interventions in their surrounds, economic value is created—part of which supports Aboriginal peoples' continued inhabitation of ancestral areas—and futures are paid down. The calculative device built around savanna fires, at least ostensibly, buys fractions of future time in a survivable climate. For hundreds of millions of years, combustion has been central to the elemental ordering of the planet, establishing and re-establishing rhythms in biotic exchanges from state to state and place to place. For tens or hundreds of thousands of years, humans have interceded in these rhythms, to the point where combustive activity has become the target of political action and global surveillance. Fire's dialectical character makes it a useful phenomenon for exploring how environments are now variously counted, translated, redistributed, and substituted across temporal and spatial scales.

## **2: Fire as bureaucratic achievement**

Thinking elementally reminds us that wildfires, like other forms of environmental 'disasters', are highly social and material processes. Depending on where they go, how and what they burn, wildfires mobilise elements into and from landscapes and bodies in ways that are often difficult to predict. The chemical makeup of wildfire emissions, for example, is dependent on a number of factors including the material properties of a given fuel source. Volatile organic compounds and trace minerals are commonly emitted from wildfires.<sup>20</sup> In Canada, most wildfires occur in the conifer-dominated Boreal Forest. This area encompasses nearly two billion hectares of land, spanning from the Atlantic to Pacific Oceans to its upper range in the Arctic tundra, in a region that coincides with much of the country's mining and industrial

activities. In areas of industrial development, wildfires can activate contaminants previously deposited in the environment including radionuclides, heavy metals and other toxicants, mobilising them into waterways and bloodstreams alike.<sup>21</sup> Even in areas not dominated by people or located beyond the urban–wildfire interface, anthropogenic activities, aided by techno-scientific developments and industrial productionism, can mix uneasily with fire regimes, creating novel problems for scientists and environmental managers alike.<sup>22</sup>

Anthropogenic climate change has led to a number of uncertainties or ‘known unknown’ problems that environmental managers try to anticipate and mediate.<sup>23</sup> These range from changes at the molecular level—incomplete fuel combustion, caused by changes to fire intensity, may lead to increased dioxin production—to those that directly influence fire management strategy. Wildfire scientists in Canada, for example, are increasingly concerned about fires located in peat bogs, which are now drier than before and more capable of combustion. These sites are sources of gaseous mercury that, through fires’ elemental translations, may be deposited in areas where they become methylated and rendered toxic to humans and wildlife.<sup>24</sup> Practically speaking, wildfire managers have also noted an increase in what they refer to as ‘blow-downs’, where strong winds feed powerful fires that knock trees down and make it difficult for fire crews to access fires and dig escape routes. Beyond producing a ‘risk society’, where managers face new difficulties in identifying and managing risks, the character of these problems is indeterminate, in the sense described by Brian Wynne, in that their ‘inherent’ risk is in part contingent on, and produced through the social world of regulatory regimes, scientific practices, and government priorities.<sup>25</sup>

In Canada, as in many fire-prone countries, wildfires are sites of bureaucratic governance, in which states and their delegate agencies play a major role in what is often referred to as ‘fire and fuels management’. Fire and fuels management, like other forms of hazards management, involves a sophisticated process of identifying, accounting for, and anticipating social, institutional and environmental risks.<sup>26</sup> In this drama, risks are posited ‘out there’ in the world, providing a space and justification for intervention. Thinking with fire, we are pointed to how risks associated with flammable processes are characterized and shared among bureaucratic institutions.

For example, Departments of Environment are focussed more explicitly on processes of combustion, which includes fire suppression and mitigation work. Smoke, by contrast, is managed as a public health issue, where air quality is monitored by public health officials who warn publics of known physiological health risks and ‘acceptable’ levels of smoke contamination. These categories of fire and air, disciplined over time by experts working in



bureaucratic institutions, may merge together when risks are deemed an emergency situation. Elected officials responsible for the wellbeing of communities, are tasked with weighing risks according to the experts (e.g. the proximity of a fire to a community, the health effects of smoke concentrations), including risks made known to them by community-members when deciding whether to evacuate. All the way down, then, we see that the ways in which fires are categorized, monitored, measured, and evaluated as risks to certain people and values is not pre-given, but as Author and others have shown, the outcome of ‘intuition, experience, local knowledge, and political nous’.<sup>27</sup> Wildfire risks are an achievement, always tinkered with, constantly changing.

Crucially, how risks are understood and addressed necessarily involves the material geographies—the presence of water bodies, rocky subsurfaces, minerals deposits, tree types—and the political economies of a given location. As in Australia, fuels management in Canada is organized provincially, meaning each province has its own policies and strategies for managing wildfire risks.<sup>28</sup> British Columbia, for example, has policies of full fire suppression, while Saskatchewan and the Northwest Territories monitor fires until they threaten an institutionally identified ‘value-at-risk’. In these latter provinces, what constitutes a ‘value’—much like the idea of risk itself—is not an inherent quality or character of an object or thing being protected, but something enacted through the practices, policies, and ultimately interests of governments.<sup>29</sup> In different provinces, banal and generalised values such as ‘human life’ and ‘threatened species’ have been variously ordered and reordered over time. After the 2015 Fort McMurray fires in Alberta, which temporarily halted the multi-billion dollar Athabasca tar sands industry, oil and gas infrastructure was moved from fifth priority to fourth priority, above ‘natural resources’.

The province of Saskatchewan can roughly be split into agricultural land in the south and 34 million hectares of Boreal forest in the north. Much of the northern forest is dominated by pyrophilic trees, including black spruce, jack pine, and the highly flammable balsam fir. Today, due to nearly a century of forestry-industry-inspired, provincially led fire suppression, many areas throughout the forest are overdue for a burn, becoming ‘tinder boxes’ prone to insect infestation and disease. New efforts to reintegrate fire into the environment are, at least in part, efforts to repair the ecological well-being of forests.<sup>30</sup> Fire is now promoted to maintain ‘ecosystem health’ and ‘habitat diversity’, to reduce disease for the benefit of the foresters and, to protect communities from potentially massive wildfires.<sup>31</sup> That said, many of northern Saskatchewan’s 90,000 residents, of which the vast majority are Dené, Woodland Cree and Métis peoples, have expressed concern over current policies of

fire re-integration. Indigenous and local governments have argued that current policies do not take into account radical ecological differences caused by fire suppression and ongoing climate change. Fires burn differently now, lead to increased community smoke exposure, and have resulted in things of value to Indigenous peoples being destroyed, such as trap lines, cabins, animals, animal habitats, and sources of traditional medicines.<sup>32</sup> Here, we see that fire shifts from a destructive to a rejuvenating to a colonizing force depending on whose values are protected or made ‘at-risk’.<sup>33</sup>

Due to combustion’s positive and negative possibilities, then, how fires are governed is always a process of environmental ‘infrastructuring’—one that can favour different types of more-than-human relations.<sup>34</sup> A focus on the practices involved in this multispecies, multi-elemental kin-making may point us to the institutional and organizational structures through which fires and their ostensible ‘risks’ become objects of management. According to organizational theorist Henry Rothstein and others, regulatory agencies increasingly face what they have distinguished as ‘social’ and ‘institutional’ risks.<sup>35</sup> While social or societal risks might include things such as direct harm caused by smoke and fires, institutional risks result from heightened oversight and increased (often financial) accountability requirements regarding how risks are governed. These risks include potential harm to fire agency and government reputations or even threats of funding cuts. The confluence of these types of risks often results in the ‘spiralling tendency’ of what they term ‘risk colonization’, whereby institutions become overly focused on managing their responses to societal risks as risks to themselves.<sup>36</sup>

As public institutions accountable to the oversight and scrutiny of legislative branches of government, risk colonization may influence fire management in Canada in a number of ways. First, how risks are addressed must be legible to bureaucratic forms of rationalization. This means that particular risk management efforts might not be possible if they are not already proven or their results not immediately tangible or calculable. In Saskatchewan, lack of legislative support for ‘fuels mitigation’ projects—what often amounts to cutting trees in areas immediately surrounding its many forest-enclosed northern communities—is one example of this. Despite being a more favourable and cheaper option than fire suppression, and despite its widespread approval by fire practitioners, First Nations, and Northern municipalities alike, the province’s Wildfire Branch has struggled to secure funding from the provincial treasury for its fuels mitigation projects. While reducing fuel sources might seem intuitive when thinking elementally, pilot projects are currently underway to prove the effectiveness and ‘worthiness’ of fuels mitigation strategies.

Second, risk colonization may impact fuels management, with practitioners, on behalf of governments, allocating risks across spaces, publics and stakeholders.<sup>37</sup> This can take place through a range of practices, from the way values are entered into fire prediction models to ‘hazards reductions’ programs geared towards property owners, to the different stakeholders brought into fuels management decisions. In many Boreal locations in northern Canada, foresters play a key role in managing the goods and bads of wildfires, and one increasingly popular method of fuels management is the emulation of natural disturbance (END).<sup>38</sup> This involves clear-cutting forest to mimic the patterns and, ideally, functions of wildfires while also giving industry a lucrative role in maintaining ecological integrity of forests by cutting into areas where fires would otherwise be suppressed. They are also tasked with community protection by cutting in areas that might otherwise result in catastrophic burns. This is not to say that having multiple stakeholders involved in fire governance is implicitly harmful. Rather, we suggest that processes aimed at finding the ‘correct balance’ of social, ecological, economic, and institutional risks (i.e. in this instance, the risk posed by foresters’ political clout) are likely to favour particular ways of living with fire over others. Thinking of fire as a highly relational, elemental process can thus attune us to worlds made possible through contemporary practices of risk governance.

### **3: Fire as alternative place-making**

Fire features prominently in colonial and postcolonial struggles over the world’s forests. To turn again to Pyne’s words, the work of authorizing the right kind of fire for specific places forms a central part of ‘the ancient debate between elites and folk.’<sup>39</sup> A brief survey of the literature that grapples with varied forest conflicts bears out how such contestations are, at heart, often elemental struggles over where fire belongs in place.<sup>40</sup> Control of combustion often means control of landscape and its use. This centrality raises a question: If fire is already so deeply embedded in the social and material dynamics of resource conflicts, though peripherally, what are the possibilities that arise from analytically re-centring combustion? One entry point is in the tendency to treat fire-use as interchangeable with many other criminalized practices. A more expansive vision of elemental politics might work to ‘take seriously’ the implications of fire’s tangible effects and the specific materiality of its genesis in place. Beyond a more general turn towards materiality, the essential quality of an elemental analysis might foster, Adey suggests, attention to ‘unlikely affinities, marriages and disjunctures between art, industry, poetics and conflict’.<sup>41</sup>

Debates surrounding the proper place of fire have been particularly intense within tropical forest ecology. While an uneasy truce between scientists and policy-makers surrounding prescribed burning has emerged over the course of the twentieth century in temperate zones, the role of fire within tropical landscapes remains intensely divisive. Tropical forests of Southeast Asia are not strangers to fire, even if they are clearly less prone to the kinds of conflagrations that regularly unfold in temperate nations such as Australia, Canada and the United States. Archaeological evidence throughout the region has demonstrated the longstanding and recurring nature of wildfires alongside and beyond human occupation. This evidence, gleaned from the sedimentation of pollen and charcoal stretching back at least 300,000 years, suggests that wildfires often occurred in concert with recurring El Niño events and other changes in climate that have periodically sapped moisture from fuels.<sup>42</sup> The ubiquity of indigenous, fire-adapted plant species such as the Benguet Pine (*Pinus kesiya*) and some varieties of the ubiquitous *dipterocarpaceae* also point to a much longer history of fire in these tropical forests, before humans began making incursions 65,000 years ago.<sup>43</sup> However, despite a growing body of evidence supporting a more complex deep time of tropical fires, the colonial-era explanations for forest fire that remain firmly lodged in the region's resource management institutions understand fire as a fundamentally unnatural feature. In these views, high levels of precipitation, densely crowded canopies and forest microclimates prevent combustion outside of human agency.<sup>44</sup> These narratives position fire as an aberration that enters solely through humans' careless modifications or malice. Any kind of fire in these landscapes is therefore the unnatural product of human mismanagement.

This framing of elemental agency reverberates throughout contemporary environmental politics with highly uneven effects. In Southeast Asia, national discourses surrounding regular El Niño-driven wildfires make few distinctions the between fire use of state- or corporate-sponsored palm oil expansion, long histories of industrial logging, and the much-maligned practice of swidden cultivation, a rotational form of agriculture in which sections of forest are annually cut and burned to sequester nutrients into the soil. These reductive understandings conflate the conditions for burning, such as larger shifts in forest composition, with any use of fire. In this context, marginalised ethnic minorities who reside on state forest lands and rely heavily on fire-dependent swidden agriculture for subsistence often endure disproportionate blame as the proximate cause of forest degradation and excess smoke. More than impacting biodiversity, prominent forest governance schemes such as the United Nations' 'Reducing Emissions from Deforestation and forest Degradation and enhancing forest carbon stocks' (REDD+) program also identify and manage swidden

agriculture's carbon impact as a threat to humanity's survival. REDD+ and the powerful drive towards Climate Smart Agriculture—boosted by The World Bank and the Food and Agriculture Organisation of the United Nations—aim to secure a certain idea of tropical futures through the elimination of fire and enforcement of 'no burn' landscapes.<sup>45</sup> These projects represent an increasingly strict governance of elemental exchange, forests for carbon, in the name of climate mitigation that position fire as solely a malign agent of destruction. In doing so, the implications of these moral claims surrounding fire extend far beyond the margins of policy debate. In 2018, for example, the Indonesian military authorized a 'shoot on sight' policy in Sumatra against what were termed 'arsonists' to prevent the spread of choking smoke haze.<sup>46</sup>

In the Philippines, control of fire was historically a key focus of the Spanish and later American colonial efforts to exploit forests. Prior to colonization, *kaingineros* or swidden farmers who purposely modify forests by clearing and drying vegetation, dominated much of the archipelago. Removing the canopy rendered the typically moist duff and humus of the forest floor combustible. In doing so, small-scale farmers created the conditions necessary to burn, simultaneously creating space and nutrient-rich soil for food crops. For the colonial and later national Philippine authorities, this form of agricultural production set off a chain reaction of environmental degradation. Colonial scientists and administrators during the late nineteenth and early twentieth centuries reasoned that, by diminishing tree cover, *kaingineros* promoted the growth of fire-adapted grass species whose combustion would further erode the margins of the forests. These ideas have had a significant afterlife. Today, Philippine efforts to rehabilitate once-forested areas have emerged through a series of 'national greening' programs that aim to restore ecological values by intensively commodifying upland areas. Regular grassland and forest fires that impact project sites are blamed on a hard-headed peasantry who carelessly, or even intentionally, allow fire to escape their control.<sup>47</sup> These recriminations are not relegated to technocratic foresters either. An emerging social movement of middle-class Filipino mountaineers, seeking to defend their own recreational use of forests, regularly point to Indigenous *kaingineros* as the source of forest fires.<sup>48</sup>

However, as Vayda state, not all ignitions lead to wildfire.<sup>49</sup> An elemental re-reading of swiddening and colonial histories, oriented towards the specificities of fire-use and deep environmental histories, might come to a different conclusion: the fire-dependent agriculture of indigenous peoples in the Philippines and throughout the region are sophisticated practices of micro-climatic transformation.<sup>50</sup> Far from the desperate use of fire for subsistence envisioned by colonial and contemporary state foresters, many Indigenous peoples

throughout the archipelago continue to wield combustion in precise combination with seasonal variations, topography, careful arrangement of vegetation types, and the construction of elaborate fire breaks. Through these processes, fire's biochemical alchemy reconfigures forests into ash, rich in nitrogen, potassium, phosphorus and other nutrients, thereby rendering otherwise unproductive tropical soils fertile and producing mosaics of forest succession across mountainous landscapes. This variegation has led some tropical forestry researchers to rework established narratives of fire-driven degradation. As Padoch et al. note hopefully, rather than a stage in a linear process of environmental decline, the 'illegibility of ...patchy [swidden] landscapes' could represent 'biodiversity' itself to conservationists.<sup>51</sup> In this alternative vision, the visible disturbance and landscape variability produced by swiddening practices can host a wider range of plant and animal species than might otherwise be supported by a mythical 'untouched' and uniform rainforest.

The claims of Padoch and others remain largely ungrasped. Instead, climate change mitigation schemes such as REDD+ and the push for fire-free landscapes in Climate Smart Agriculture have reproduced and intensified older efforts to constrain fire by linking Southeast Asian forests in to global efforts to govern elemental exchange. Problematically, international efforts to address climate change reduce fire to a malign agent of degradation and destruction. The kind of elemental political ecology deployed here might help reorder issues of blame and causality in enduring debates over the decline of tropical forests. A focus on the specificities of fire in the region can, to borrow a phrase from anthropologist Anna Tsing, further bolster arguments for a 'contaminated diversity and slow disturbance' in Southeast Asian forests<sup>52</sup>. Addressing old but persistent misconceptions that Indigenous peoples' use of fire was irrational helps put focus on longer colonial histories of logging and contemporary plantation agriculture that degrades forests and promotes fire at a much larger scale. While 'cultural burning' by Aboriginal peoples in Australia has recently enjoyed a partial rehabilitation in the popular imagination and fire management bureaucracies of that nation, the use of fire for swidden agriculture in Southeast Asia is still awaiting an elementally revisionist moment.

## CONCLUSION

There are many dangers to the Anthropocene, both as an era and concept. But even if geologists have gifted the world with a poor diagnosis of this epoch, fraught with potential to

further sediment anthropocentrism, there is both social and analytical force in the ‘charismatic mega-category’ yet.<sup>53</sup> As Hecht summarises, the term offers a broadcast method for signalling human responsibility for present ecological predicaments, but without asserting control. It can act as an invitation to diplomacy, as Stengers might say, around the potential composing of better worlds together.<sup>54</sup> The true danger for scholarship, Hecht suggests, is that our Anthropocenic excursions risk submitting to geologists’ abstractions thereby ignoring the need to keep things ‘in place’; that is, the arrival of the Anthropocene concept actually represents a vital opportunity for formulating emplaced narrations of present predicaments while also ‘keeping the planet and all of its humans in the same conceptual frame’.<sup>55</sup> As for the protagonists of sci-fi films like *Fantastic Voyage* (1966) and *Innerspace* (1987), such narrative work requires the selection of appropriate ‘interscalar vehicles’, in this case meaning objects or entities whose journeys across scales illustrate how temporal and spatial bounds govern worlds. This is an elemental task in that it is a search for fundamentals.

In this essay, we have sought to test wildfire’s fitness to act as one such vehicle. Our choice of wildfire was based on three factors. First, while our respective research commitments are grounded in different continents, they all centre on sites where concerns about wildland combustion are bound up with political questions about life in a changing climate. Higher temperatures, more extreme rainfall, and other effects of anthropogenic climate change socially redistribute wildfire’s impacts and benefits according to familiar colonial and capitalist patterns. Subsequently, and second, we have a common sense that fires physically and symbolically act differently across different sites and scales, variously glossed as natural, unnatural, destructive, regenerative, aberrational, unavoidable, fungible, and wasteful. In short, fire is already the target of significant storytelling, particularly within science, about shared pasts and futures. Third, our pursuit of wildfire is also informed by an intuition that it has something useful to tell us about the value and limits of thinking elementally. In the recent efflorescence of literature in the humanities on ‘the elemental’, it has sometimes been hard to discern how elementality differs from materiality as an analytical frame.<sup>56</sup> Is this budding interest in the elemental just a ‘revitalisation’ of new materialism? Perhaps, but not necessarily.

The significant difference between materialism and elementalism, we suggest, is that the elemental contains a distinction between the fundamental and its other. As against the generalised vibrancy of matter in new materialism, in which all the world is alive, an elemental philosophy gambles that some matter is not contingent; that some matter, following Braun, is ‘determined to be determined’.<sup>57</sup> As we signalled in the opening of this essay, fire is

not a substance but a conjunctural, durational and transformative biochemical reaction. It is a product of time and space, a deterministic process of inputs and outputs, and while it can feed new life it cannot be reversed to revive what it has consumed. Thinking with wildfire—a process entangled in the formation, perpetuation and possible extinction of life on this planet—arguably avoids the materialist trap of seeing everything as ‘emergent,’ requiring us instead to stay with the specificity of actual earthly exchanges. By thinking elementally, we attempt to foreground difference, emphasizing the particularity of fire and its many relations

If, as Dalby suggests, maintaining the planetary boundaries suitable for human life requires us to ‘constrain’ combustion, we first need to understand the manifold ways in which fire and its elemental exchanges are governed. Our survey of several fire-prone contexts in this essay has sought to demonstrate the diversity of ways in which this process and its elemental exchanges have been socially incorporated and on whose terms this incorporation takes place. These examples, we suggest, are more than the sum of their parts. Our case studies point to an international fire politics, in which regional specificities increasingly join up to global economies concerned with the governance of combustion to constrain risk, avert climate disaster or even make profit.

Denser and denser bureaucratic regimes of combustion governance are being transposed onto existing geopolitical rifts and economic unevenness. Russian aircraft are deployed to help fight fires in Borneo. North American fire managers, under the imprimatur of the United Nations, travel to Indonesia and Thailand to instruct communities in fire prevention. German companies offset their emissions by purchasing carbon credits dependent on the creation of fire-free landscapes in Latin America. Australian scientists and bureaucrats travel to southern Africa to test the export potential of savanna fire-emissions-abatement techniques and economies. By attending to such sites—sites where the governance of fire is the issue at hand—we can come to a better understanding of how people and their futures after being governed through fire and, in this way, how another politics of fire might be possible.

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<sup>26</sup> Henry Rothstein, Michael Huber, and George Gaskell, 'A Theory of Risk Colonization: The Spiralling Regulatory Logics of Societal and Institutional Risk,' *Economy and Society*, vol. 35, no. 1, 2006, pp. 99-106.; Author, 2016.

<sup>27</sup> Author et al. 2016.

<sup>28</sup> The exception to this is lands of federal responsibility, such as National Parks or First Nations reserves, though, in these instances, agreements have been made with the provinces to engage in fire management on the Government of Canada's behalf.

<sup>29</sup> Saskatchewan Environment, *Fire and Forest Insect and Disease Management Policy Framework Document*, Regina: Minister of Environment, 2003, pp. 15.

<sup>30</sup> Canadian Council of Forest Ministers, *Canadian Wildland Fire Strategy: A Vision for Innovative and Integrated Approach to Managing the Risks*, Ottawa: Canadian Council of Forest Ministers, 2005, 2-5.

<sup>31</sup> Saskatchewan Environment, pp. 1-5.

<sup>32</sup> Prince Albert Grand Council, *Fighting Forest Fires in Northern Saskatchewan: Task Force Interim Report*. Prince Albert: Prince Albert Grand Council, 2018, pp. 1-5.

<sup>33</sup> This refers to risk management protocols of listing and protecting what are called 'values-at-risk'. This is not to say that Indigenous folks are 'at-risk' or endanger of disappearance, which would be an incorrect assertion and what Tuck and Yang refer to as a 'settler move-to-innocence'. Rather, Indigenous people continue to actively engage in what Author (2016) refers to as 'calculative re-integration', 'wherein figurations of the future are rebooted, reconstructed or calibrated' through their various involvement in fire management practices (as lobbyists, firefighters, practitioners, scientists, and more). Eve Tuck and K. Wayne Yang, "Decolonization is not a metaphor," *Decolonization: Indigeneity, Education & Society* 1, no. 1 (2012), 22-23; Author 2016.

<sup>34</sup> Anders Blok, Moe Nakazora & Brit Ross Winthereik, 'Infrastructuring Environments', *Science as Culture*, vol. 25, no. 1, 2016, pp. 2-4; Davis and Todd, following the work of Indigenous thinkers refer to a similar process of what they refer to as 'terraforming', which they link directly to the building and severing of relationships. Heather Davis and Zoe Todd, 'On the importance of a date, or decolonization the Anthropocene,' *ACME: An International Journal for Critical Geographies*, vol. 16, no. 4, pp. 770-772.

<sup>35</sup> Rothstein et al., 'A Theory of Risk Colonization', pp. 99-106.

<sup>36</sup> Ibid, pp. 93. Note: the authors are referring to institutional arrangements that coalesce in response to risks and not forms of colonization, such as settler colonialism, that are characterized by the domination of one group over another.

<sup>37</sup> See also Author, 2016.

<sup>38</sup> Nicole Klenk, Gary Bull, and Dave Cohen, 'What is the "END" (emulation of natural disturbance) in forest ecosystem management? An open question,' *Canadian Journal of Forest Research*, vol. 38., no. 8, pp. 2159-2168.

<sup>39</sup> Stephen J Pyne. *Vestal Fire: An Environmental History, Told through Fire, of Europe and Europe's Encounter with the World*. Seattle: University of Washington Press, 2012, p. 411.

<sup>40</sup> James Fairhead and Melissa Leach. *Misreading the African Landscape: Society and Ecology in a Forest-Savann Mosaic*. Cambridge: Cambridge University Press, 1996; Sivaramakrishnan, K. "The Politics of Fire and Forest Regeneration in Colonial Bengal." *Environment and History* 5, no. 2, 1996; Kull, Christian A. *Isle of Fire: The Political Ecology of Landscape Burning in Madagascar*, University of Chicago Press, 2004.

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- <sup>53</sup> Elizabeth Reddy, "What does it mean to do Anthropology in the Anthropocene?," *Platypus* (2014), <http://blog.castac.org/2014/04/what-does-it-mean-to-do-anthropology-in-the-anthropocene>.
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- <sup>55</sup> Hecht, "Interscalar vehicles," 135.
- <sup>56</sup> e.g. Cohen and Duckert, "Eleven principles."; Engelmann and McCormack, "Elemental aesthetics."
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