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Fire Trace

Plans and Practices of Conservation and Development in Belize's Coastal Savanna, 1920 to Present

Cathy Smith

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Declaration of Own Work

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely my own.

Signed: 

Date: 08/10/2019

Abstract

This thesis examines the past century of wildfire management of the coastal pine savanna in Belize. Combining political ecology with historical geography, it draws on archival evidence, interviews, and ethnographic enquiry into an international development project in Belize. It considers contemporary approaches that seek to use prescribed fire with the participation of local communities in relation to past practices. The Belizean savanna has long been shaped by human fire use. Its flora is ecologically adapted to fire. Yet fire has been repeatedly cast as a problem, from c. 1920, by British colonial and, later, USA foresters, and, most recently, by international and local non-governmental nature conservation organisations. Informed by different schools of thought, each of these organisations has designed programmes of fire management as a form of conservation and/or development. Yet little has changed; Belize's diverse and growing rural population has continued to use fire, and the savannas burn, year upon year. While the planned aims and methods differed, each programme of fire management has, in practice, been similarly structured and constrained by its genesis within colonial or international development. Funding for fire management has been inconsistent and has favoured 'expert'-led technocratic approaches that could not address the specific context of wildfire in Belize. Each programme has been shaped by a specifically Belizean ecology and politics, in excess of its definition of the fire 'problem' and 'solutions' to it. Powerful political elites and fire users in Belize have not granted the same authority to technical experts, nor have they seen clear incentives for the fire management that these experts envisaged. Belize's political elite has sought to retain control over land and resources, even at the expense of policies (including those of fire management) they officially endorse to satisfy

international funders. This analysis highlights that, when examining environmental management, it is important not to isolate study of ideology and discourse in plans and policies, but to also attend to the conditions of their materialisation in practice.

Lay summary

This is a thesis about the past century of wildfire management of the coastal pine savanna in Belize. The research involved examining archival material, conducting research interviews and observations of an international development project in Belize, with which I was involved. The thesis considers this international development project in relation to past practices.

Some ecosystems depend on wildfire. The savanna found along Belize's coast is such an ecosystem. Fire maintains the savanna as a patchwork landscape of open grassland, grassland with pine trees and broadleaf forest. The savanna's plant species have adaptations that help them to survive wildfires and to propagate following fire. In Belize, human fire use is, and has long been, the most common cause of fires in the savanna. Yet over the past century, wildfires have conflicted with the aims of forestry and nature conservation organisations managing protected areas within the savanna. From 1920, the colonial, and then the independent state Forest Department believed that fire was suppressing the growth of pine trees and preventing the development of a pine timber industry. Since the 1990s, the Forest Department and non-governmental nature conservation organisations have recognised that fire is important in the savanna but argued that fires are so frequent that they nonetheless constitute a conservation threat. These organisations have all tried to reduce the number of wildfires, yet they have largely been unsuccessful.

This research compares the aims, proposed methods and realisation of these Belizean savanna fire management programmes since 1920. There has been a gradual recognition of the importance of fire, a move away from aims of complete fire suppression, and attempts to enrol local fire users. Yet this research highlights that each programme of fire management has been similarly technical and largely

designed by foreign experts. There has, repeatedly, been a significant gap between the fire management designed in policies and plans and fire management in practice on the ground. The thesis argues that this gap is partly explained by the way in which fire management has been designed within colonial or international development-funded projects. These projects have been short-term and inconsistent. They have promoted approaches based on general principles that did not account for the local context. The savanna environment has presented unforeseen logistical challenges, and its ecology been poorly understood. Local political elites and fire users have not granted the same authority to foreign experts as have international funders. While policies of fire management have been endorsed by the Belizean government, they have not been locally funded and realised, when this has threatened political control of savanna resources. This analysis challenges assumptions in some social science literature, that dominant ideologies in conservation and development powerfully shape environmental practices.

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Glossary of acronyms

BEC: The Belize Estate and Produce Company

CDW: Colonial development and welfare

CIDA: The Canadian International Development Agency

DEFRA: The UK Department for Environment, Food and Rural Affairs

DFID: The UK Department for International Development

GEF: The Global Environment Facility

GFI: The Nature Conservancy's Global Fire Initiative

KBA: The World Bank-funded Key Biodiversity Areas Project

NGO: Non-governmental organisation

ODA: The UK Overseas Development Administration

ODM: The UK Ministry of Overseas Development

TIDE: The Toledo Institute for Development and Environment

TNC: The Nature Conservancy

UNDP: The United Nations Development Programme

UN-FAO: The Food and Agriculture Organisation of the United Nations

USAID: The United States Agency for International Development

YCT: The Ya'axche Conservation Trust

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Introduction

> *It's a li [sic] bit a science and art, fire management. The art is where you put fire on the ground.* (Protected Areas Manager at TIDE)

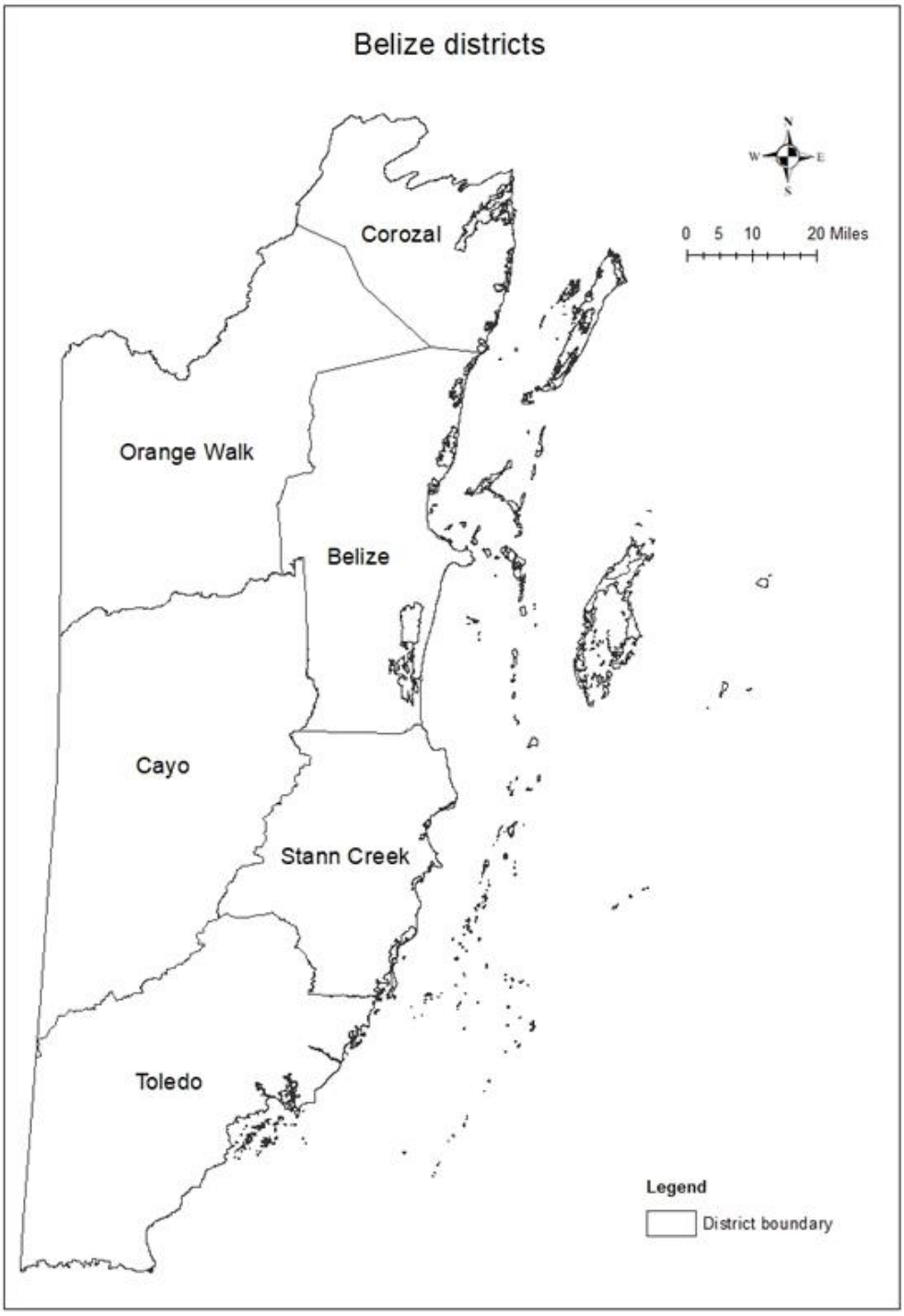
> *The true fundamentals of fire are not scientific questions. They involve values, social norms, and cultural expectations as synthesised by politics.* (Pyne, 2015, 445)

Between 2015 and 2018, I was the Project Officer for a UK Darwin Initiative Project entitled 'Conserving Pine Woodland Biodiversity in Belize through Community Fire Management'.[1] This Project took place in Belize's southernmost district, Toledo (see map Figure 1.1). The Project focused on the tropical pine savanna in three protected areas, the Payne's Creek National Park, the Deep River Forest Reserve, and Swasey-Bladen Forest Reserve, and on five villages bordering these protected areas: Bladen, Trio, San Isidro, Medina Bank and Bella Vista (see map Figure 1.2). The 'problem' that the project proposal identified and sought to address was that Belize's 'pine savannas are being degraded to grasslands without pine by intense wildfires which are occurring more frequently due to increasing anthropogenic burning caused by agricultural expansion in bordering areas and fires deliberately set by local hunters'.[2] The project proposed to increase local capacity for fire management by introducing ecological monitoring for fire effects in the

[1] The Darwin Initiative is a grants scheme funded jointly by two UK government departments, the Department for Environment, Food and Rural Affairs (DEFRA) and the Department for International Development (DFID). It funds projects worldwide that aim to fulfil both biodiversity and poverty alleviation objectives. In this thesis I refer to the project I worked for (Darwin Initiative Project 22-013) as 'The Darwin Project'.

[2] Project proposal, submitted in 2014, for Darwin Initiative Project 22-013, p. 6.

Figure 1.1



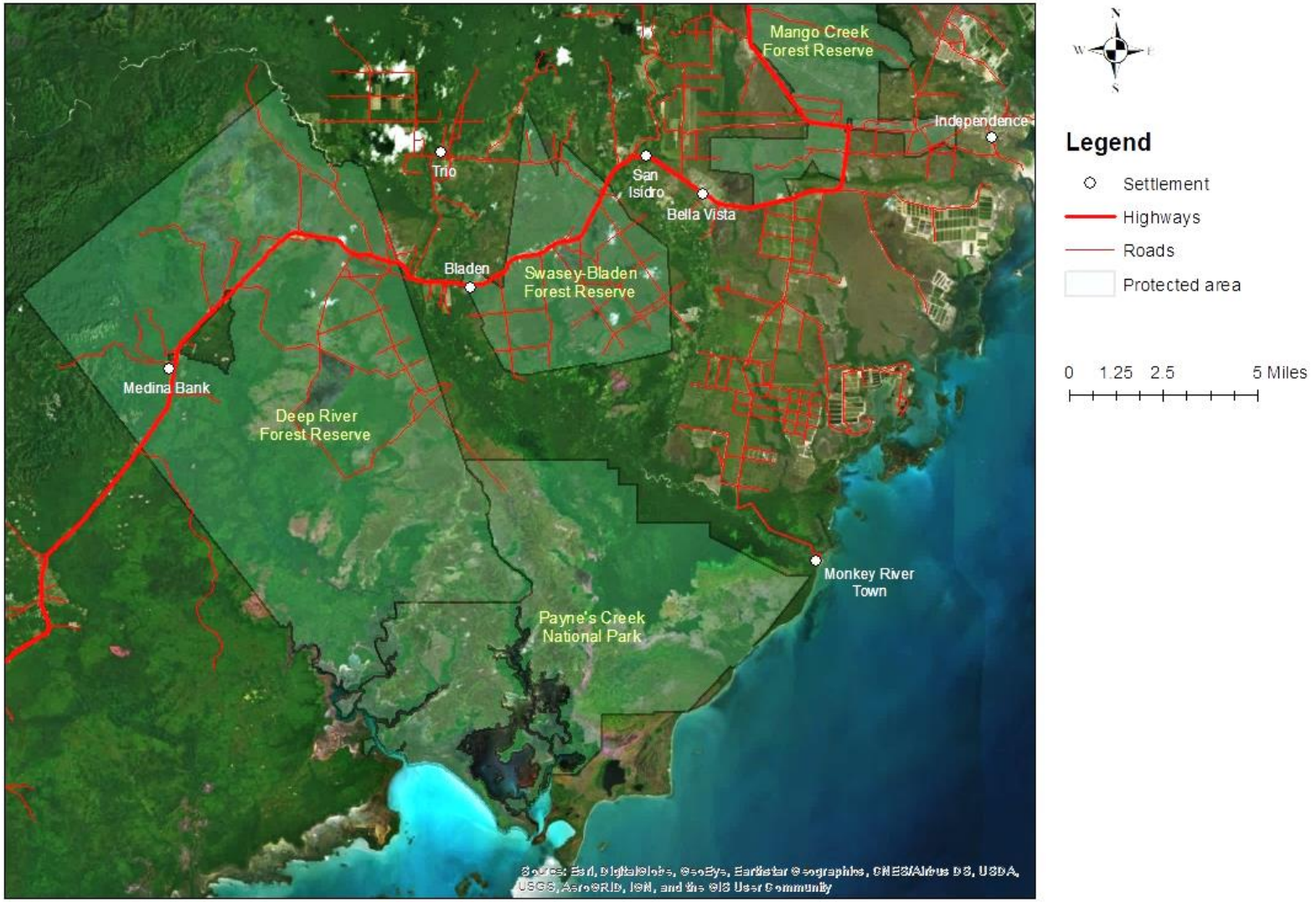
Source: Map created in Arc GIS by author, using Belize Basemap shapefile (Meerman & unknown sources, 2013), available at http://www.biodiversity.bz/, [accessed 11/02/2019].

protected areas and training local villagers in prescribed fire use.[3] It also planned to develop 'small forest enterprises' with groups of villagers, and partner with the Belize Government's Forest Department to revise national fire legislation and pilot a community concession agreement for the harvest of palmetto berries from the protected areas.[4] These activities were intended to be mutually beneficial: local people would gain livelihood benefits, and this would incentivise participation in nature conservation in the form of better fire management. The project sought partnership between a Belizean NGO, the Toledo Institute for Development and Environment (TIDE), to lead the work on the ground and provide expertise in fire management; the University of Edinburgh, to manage the project reporting, finances and provide research expertise; the Belize Forest Department, to use the project to trial community access to forest reserves and revise national legislation; the International Institute for Environment and Development (IIED), to provide consultancy in community business development; and the University of Belize's Environmental Research Institute (ERI), to embed training and monitoring resources created for the project at a national level. Before I recount how my initial experiences as the Darwin Project Officer drove this PhD research, let me provide some context to wildfire management in savannas and to community-based approaches in conservation.

[3] 'Prescribed fire' is fire applied to the environment in pursuit of certain management aims.
[4] Since 2001, these villagers have collected palmetto berries between August and October for casual sale to a single Belizean buyer based in the Belize District who has a license to export them, granted by the Forest Department. This license does not specify who has the rights to harvest the berries in which areas. The palmetto harvest is not organised at the village level, but provides a small, supplementary income to individuals and their families.

Figure 1.2

Protected areas and villages in the northern Toledo and southern Stann Creek districts



Source: Map created in Arc GIS by author, using Belize Protected Areas shapefile (Meerman, 2017), Belize Roads shapefile (GFDRR, 2013), and Belize Point Settlements shapefile (Meerman 2010), all available at http://www.biodiversity.bz/. [accessed 11/02/2019].

1.1 A brief introduction to savannas, wildfire management and 'participatory' conservation

Ecologists today understand wildfire as an important and constructive process in some ecosystems but destructive in others.[1] In a 'Global Fire Assessment' led by global conservation NGOs and the University of California, the world's 'ecoregions' were categorised on the basis of the role assumed by fire in their evolution.[2] 'Fire-dependent' ecoregions, defined as 'those where most of the species have evolved in the presence of fire, and where fire is an essential process for conserving biodiversity (e.g., tropical savannas, such as those in Belize, or temperate coniferous forests)', were found to cover 53 percent of global terrestrial area. 'Fire-sensitive' ecosystems, defined as 'those where most of the species have not largely evolved in the presence of fire…. [where] the introduction of ecologically-inappropriate fire can have an extensive negative impact on biodiversity (e.g., tropical moist broadleaf forests)', were found to cover 22 percent of global terrestrial area. 'Fire-independent' ecosystems, as defined as 'those that naturally lack sufficient fuel or ignition sources to support fire as an evolutionary force (e.g., deserts, tundra)', were found to cover 15 percent of global terrestrial area.[3]

Since their evolution, humans have used fire in the landscapes they have settled, to clear and/or renew vegetation for farming, hunting, pastoralism, access and for other reasons. Wildfires started by human agency have thus shaped environments on evolutionary timescales.[4] While most contemporary ecologists accept fire as an inherent part of many ecosystems, conservationists fear that, largely due to human agency, the frequency and intensity of fires in many places

[1] Cochrane (2009).
[2] 'Ecoregions' as defined by the World Wildlife Fund (WWF).
[3] Shlisky *et al* (2006), p. 4.
[4] Bird & Cali (1998); Pechony & Shindell (2010); Bowman *et al* (2011); Coughlan & Petty (2013); Scott *et al* (2013); Archibald (2016).

worldwide differs significantly from a more 'natural' historical fire regime, and thus poses a threat to ecosystem health and biodiversity.[5] The savanna that spans the length of Belize's coastal plain is no exception. Today, most wildfires in Belize's lowland savanna are started by human agency, and it is likely that such fires have played an important role in the evolution of this landscape.[6] Though very little empirical scientific research or monitoring has been carried out in Belize on this issue, conservationists characterise an 'ecologically appropriate' fire regime for Belize's pine savannas as one of low intensity surface fire at a return interval of one to ten years.[7] Recent analysis of satellite imagery suggests that the present fire return interval in the coastal savanna of southern Belize is under three years.[8] Human fire use is thus deemed a conservation threat to Belize's savannas.

Jay Mistry loosely describes tropical savannas as 'ecosystems with a continuous and important grass/ herbaceous stratum, a discontinuous layer of trees and shrubs of variable height and density, and where growth patterns are closely associated with alternating wet and dry seasons'.[9] The key ecological determinants of savanna are understood to be climate, water and nutrient availability, fire and herbivory, although different conceptual frameworks have been presented for how these factors interact (see Chapter two). Savanna landscapes are understood to comprise a patchwork of habitats, such that the term may be applied at a wide spatial scale to include pockets of woodland.[10] Disturbances like fire are understood

[5] Shlisky *et al* (2006).
[6] Myers & Rodríguez-Trejo (2009).
[7] Myers & Morrison (2006).
[8] Roper (2016).
[9] Mistry (2000), p. 1. Other recent definitions emphasise that the C4 grass stratum, specifically, determines a savanna. C4 grasses are characterised by a form of photosynthesis that is evolutionarily derived from C3 photosynthesis, but which includes an additional mechanism for actively transporting CO2 into specialized cells where photosynthesis occurs, making them more tolerant of high temperatures, low water availability, and/or low CO2 concentration. See Lehmann *et al* (2011); Ratnam *et al* (2011); Parr *et al* (2014).
[10] Furley (2016).

to constructively *maintain* savannas as dynamic mosaics. In the case of Belize's savanna, this mosaic includes grassland with and without pine trees and shrubs, as well as pockets of broadleaf forest.[11]

Savannas were understood differently in the past. In its Amerindian origins, the term 'savanna' solely referred to treeless grassy areas.[12] In the early twentieth century, many ecologists understood savanna as grassland that would become forest in the absence of disturbances like fire. From this perspective fire management was understood to prevent or reverse the *degradation* of forests to savanna (a point I develop in Chapter two). Similar interpretations were made of the coastal savanna in Belize. In the 1950s, Charles Wright, leader of a team commissioned by the British Colonial Office to survey and classify land and soils in Belize, wrote how 'the literature of this colony fairly bristles with the peculiar botanical terms employed by the early settlers on the coast'.[13] Most nineteenth and twentieth century writing by foreign ecologists and foresters described the Belizean coastal plain using the local terminology to describe vegetation: 'cohune ridge' for the broadleaf; 'broken ridge' for less dense scrubby forest; 'pine ridge' for the grassland with pine.[14] The term 'savanna' was generally reserved for treeless grassland areas. In 1887, for example, Hooper wrote that 'nearer the coast … it is open country containing vegetation of a mixed type but poor and stunted growth with *areas of treeless savannah interspersed*'.[15] In this thesis, however, I apply the term

[11] Wright *et al* (1959); Stuart, Barratt & Place (2006); Goodwin *et al* (2013).
[12] Mistry (2000).
[13] Diary of Charles Wright from his time as part of the British Honduras Land Survey team, 1954 [BARS BAD/CHW/225], p. 104.
[14] See for example Hooper (1887); Hummel (1921); Stevenson (1927); Bartlett (1935). Wright *et al* (1959), despite developing a novel vegetation classification system, use the local terminology throughout their text. Today these terms are still used locally.
[15] Hooper (1998), p. 4. Emphasis added.

savanna to the broader shifting mosaic of trees and grasses at the landscape scale, in line with its current use in ecology.[16]

I use the term 'fire management' for any approach to suppress or control fire in the environment in pursuit of specific environmental goals. Fire management has a long history and has been practised by many cultures (as is explored in Chapter two). From the seventeenth century, a strong anti-fire discourse developed in Europe, by which fire was deemed to hinder conservation and development of the environment.[17] First European, and, by the late nineteenth century, North American state institutions sought to eliminate human fire use and wildfires from diverse environments, including in Empires worldwide. 'Shifting' forms of agriculture involving fire use were deemed primitive, compared to settled, 'improved' agriculture. Foresters sought to exclude fire from forests to enable sustained production of timber. Nature conservationists saw fire as a threat to the 'balance' of nature. These institutions largely followed policies of fire suppression, but after the mid-twentieth century, led largely from the USA and various British colonies, a gradual revolution took place in official fire management policies.[18] Ecologists were beginning to see fire as an inherent part of many ecosystems in that they were deemed non-equilibrium systems. Environmental managers noted that fire suppression caused the build-up of fuel to levels where its ignition caused fires of dangerous intensity. Thus, by the 1970s, 'prescribed fire' management was accepted as a policy in the USA and in some other countries, among land managers with diverse management objectives. The term described the application of fire to the environment in pursuit of certain land management goals, such as the reduction of fuel levels. Generally, prescribed fire use was deemed the prerogative of

[16] Furley (2016) stresses that 'savanna' be applied at the landscape scale, and that savannas can thus include multiple component vegetation types.
[17] Pyne (1997); Kull (2004).
[18] Pyne (2003, 2015); Pooley (2014).

specialist technical agencies, and not of people seeking to use fire as part of their livelihoods. Pyne describes how the term ‘prescribed fire’ indicated

> that fire could be targeted – could be scientifically directed – to distinguish useful burning from the generic woodsburning that, to foresters' eyes, plagued the landscape. As with medicine each prescription had a specific purpose…. In this way several interests converged: those who wanted to control conflagrations, those who thought that the best way to reduce fires was to reduce their fuels, and those who believed burning could be an acceptable technique if it was legitimated by quantitative science. Prescribed burning could count only if it was countable.[19]

Despite the emergence of prescribed fire management, a narrative promoting fire suppression remained dominant in many places worldwide (and continues to do so).[20] In Belize, following training from The Nature Conservancy (TNC) under its ‘Global Fire Initiative’ (GFI) in the early 2000s, TIDE developed a programme of wildfire suppression and prescribed fire use in the savannas of the Payne’s Creek National Park. With the objective of nature conservation, TIDE now aims to recreate an ‘ecologically-appropriate’ fire regime of low intensity fire every three years.

In the 1970s, new environmentalist social movements decried dominant technocratic approaches to conservation and development. They argued that such approaches had denied local people access to environments upon which their livelihoods depended. A new discourse of ‘sustainable development’ emerged as the mandate of global conservation and development organisations.[21] Sustainable development suggested that development and conservation should be pursued concurrently: development should not degrade environments for future generations; conservation should recognise local cultures and livelihoods. By the late 1980s, ‘Participatory’ development and conservation emerged from this mainstream discourse. ‘Community-based natural resource management’ and ‘integrated

[19] Pyne (2016b), pp. 42-3.
[20] Donovan & Brown (2007); Fill *et al* (2015).
[21] Adams (2008).

conservation and development projects' were terms used to describe such projects.[22] These discourses also touched fire management: 'community-based fire management' and 'integrated fire management' emerged, which aimed to involve local fire users in fire management and to recreate ecologically and culturally appropriate fire regimes.[23] It is against this backdrop that the Darwin Project in Belize began, a project which sought to train and enrol local fire users in prescribed fire management of the coastal savannas.

1.2 The Darwin Project and the motivation for this research

I was the Project Officer for the Darwin Project was from September 2015 to April 2018. The position involved drafting bi-annual progress reports to the funder and generally assisting with, but never taking main responsibility for, all project activities that took place while I was in Belize.[24] I co-facilitated, contributed to and provided logistical support for fire management and business training events, meetings with community groups, the Forest Department and other project partners, and dissemination events.[25] Being involved with these activities gave me the oversight necessary to write the progress reports to the funder. At the same time, I maintained a certain distance from the activities, often observing and taking notes. I publicly kept a distance from TIDE, making it clear that I did not work for the NGO, but was affiliated with the University of Edinburgh. This distance made it possible for me to think and write about the project for this research.

[22] Brosius, Tsing & Zerner (1998); Adams (2008); Brockington, Duffy & Igoe (2008); Dressler *et al* (2010); Raymond *et al* (2010); Calfucura (2018).
[23] Myers (2006); UN-FAO (2011).
[24] Originally, it was also intended to conduct livelihood surveys at the start and end of the project which would demonstrate its impact in local communities. When it became apparent that this would be a difficult task, given the size of the villages and the marginal quantifiable benefits the project would provide, this output was revised. Instead I wrote an initial baseline report on the villages based on information gathered from village leaders and my own observations, and at end of project an independent reviewer conducted interviews with participants to assess the project's impact.
[25] As most of the project activities and my own visits to Belize were timed for the dry season, I was present for the majority of these events.

The Project Officer position funded my PhD, though without constraining my research questions (beyond providing general themes and a context, and because I had to consider how my colleagues would receive academic discussion of their work). The historical direction for this thesis emerged from my first experiences of Belize in 2016. In the autumn of 2015, in Edinburgh, shortly after having been appointed to the Project Officer role and accompanying PhD scholarship, I and my supervisors envisaged that my PhD research might examine the motivations and incentives for local participation in the project and the extent to which it represented a 'win-win' for conservation and local livelihoods. It is worth noting that my previous academic training was in the natural sciences, and I had little familiarity with social science literature. That Autumn I read widely about social science research methods. I imagined that my research methodology might combine quantitative household surveys and more qualitative interviews.

Having never visited Belize, I also sought, through reading reports and academic texts, to understand the Belizean context ahead of my first visit from January to April of 2016. I struggled to find material to contextualise the villages where I would be working. The Darwin Project proposal provided minimal information: 'Belize's Poverty Elimination Strategy recognises that communities living in these pine woodlands are among the poorest in Belize and wildfire poses a serious risk to their security and livelihood'.[26] In the Darwin Project texts I encountered the Belize Forest Department as an organisation committed to trialling community-based conservation: 'the Forest Department sees this Darwin project as a means to evaluate the feasibility and implications of granting greater access and benefit sharing to communities in its forest reserves and national parks'; lacking only 'capacity to implement its national wildfire management strategy'.[27]

[26] Project proposal, submitted in 2014, for Darwin Initiative Project 22-013, p. 6.
[27] Ibid.

Without discounting that human-set wildfires have shaped Belizean savannas and have consequences for people living in and around them, in 2016, my first experiences in Belize led me to question the simplicity with which the project's paperwork presented the wildfire 'problem' and its 'activities' and 'outputs' to address it. I found noteworthy a lack of attention to the history of fire management, and environmental management more broadly, preceding present interventions in Belize. The Darwin Project proposal made no reference to this history. As I probed these questions with staff at TIDE and the Forest Department, I found little knowledge locally regarding the history of management of the coastal savannas or of the Forest Department as an institution, established in British colonial Belize (then British Honduras).[28] This history was also unexplored in the academic literature.[29] My interest deepened as I read accounts of the history of failed colonial and post-colonial agricultural development projects in Belize.[30] From occasional conversations, I ascertained that fire management had been carried out by the colonial Forest Department in Belize. I felt that understanding this history could have important implications for understanding the Belize fire 'problem', because it might have left environmental, discursive and political legacies.

As a scientist-in-training, I realised the uncertain and fragmented nature of the empirical science upon which TIDE's fire management rested. The ecological role of fire in Belize's savannas was poorly understood. I observed that, rather than relying upon empirical measurement of the savanna to guide prescribed fire management, TIDE's work was driven by a combination of general principles that staff had learned from external technical experts and their internalised observations

[28] British Honduras became Belize in 1973 and gained full independence from Britain in 1981. Throughout this thesis, even when referring to periods before 1973, I refer to the country as Belize.
[29] Beyond two short papers on the history of forestry published in Belizean Studies (Benya, 1979a, 1979b). Since 2016, another paper has also been published, with brief detail on the history of forestry in Belize (Wainwright & Zempel, 2018).
[30] Wainwright (2008); Grandia (2012).

of the savanna. Although the Darwin Project sought to address this by introducing fire-effects monitoring, it struck me that TIDE had institutionalised such general principles.

It also became apparent to me that local access to and fire use in the savanna were intimately tied to local politics, with important implications for the Darwin Project's objective to successfully incentivise fire management by local people. We had project meetings with Forest Department officials, who spoke the appropriate rhetoric regarding community fire management, but these meetings were never followed up with action on their part. Despite government policies calling for more equitable community benefit from protected areas, it became clear to me that it was common practice for government officials to grant land and resource access to villagers based upon their political allegiance. The Forest Department, ostensibly the co-manager of the protected areas in which we were working, neither conducted active management in these areas, nor upheld legislation forbidding fire use. Local people clearly felt little threat of punishment for using fire in savanna areas. They had little direct stake in fire management for the purposes of nature conservation or pine forestry (though there was the possible benefit to them of reducing wildfire damage to their property, and to the palmetto resource which some people harvested from protected areas). The project's approaches of technical training and business support neither directly confronted inequitable access to savanna areas, nor the way in which elite stakeholders in Belize directed access and use of this land to their benefit. Though the project sought to negotiate community palmetto concessions for forest reserves, to the villagers, this represented little real change, given that they were anyway making unrestricted use of these areas to harvest the palmetto. In any case, the Forest Department showed little commitment to granting such concessions.

In March and April 2016, I re-entered the 'virtual' world of the project's documentation, as I wrote my first annual report to the project funder. I was required to report against the project proposal's log frame of measurable indicators for each specified 'outcome', 'output' and 'activity'. Because of the format of these indicators, for example in reports or training materials produced or numbers of people attending training events, I could report 'success' against most of them (despite my reservations about the impact of the activities in practice). Yet it was becoming clear, for a number of reasons, that for one output, we would be unlikely to be able report success by end of project: 'community non-timber forest product concessions involving ≥50 community members are established and yielding ~420,000 lb palmetto seed per annum (generating £49,000-63,000 per annum for community members and £8,400 per annum for the Forest Department)'.[31] This output had two associated activities, to 'formalise license agreements with the Forest Department whereby community members are granted concessions to harvest non-timber forest products within forest reserves', and to 'establish and monitor non-timber forest product concessions involving ≥50 community members and 'establish a concessionaires committee'. My manager suggested that we might submit a 'change request' form to the funder of the project, to attempt to change this output to a more achievable one: if accepted before the project report was due, we could change the log frame against which we had to report. Together we removed the reference to concessions and replaced the output with the vaguer 'the palmetto seed harvest is secured for community members into the future, through a formal agreement with the forest department, and more sustainable harvesting practices'.[32] We changed the associated activities to 'consult with palmetto harvesters to establish the areas that are currently harvested by each community, the numbers of harvesters in each

[31] Project proposal, submitted in 2014, for Darwin Initiative Project 22-013, p. 6.
[32] Change request for Darwin Initiative Project 22-013, submitted 15th March 2016.

community and to discuss how the harvest could be best secured from the community perspective' and 'discussion between TIDE and the Forest Department regarding the most suitable legal agreement for securing the palmetto harvest for community members into the future'. The change request was accepted by the funder. By proposing only to research the situation and advise the Forest Department, we had crafted a pathway to 'success', despite the political barriers encountered. The following year, we amended the output further to remove any suggestion of an agreement being reached during the project. I was both frustrated and fascinated by the way in which I, as the Project Officer, was required and enabled to engineer the project's documentation to present the project's interventions as successful, despite the political barriers to real incentivisation of local participation in fire management. I had experienced the gap between plans and practice in Belizean fire management.

1.3 Outline of the thesis

The direction for this research emerged out of these experiences and observations. This thesis became a space in which I could present a fuller account of fire management in Belize, to that in the constrained reports I was required to write for the Darwin Project's funder. I had identified a clear knowledge gap regarding the history of fire management and, more broadly, of forestry in Belize. Wildfires and their management in Belize were manifestly both an ecological but also a political phenomenon, linked to wider issues of land and resource access. Yet, both the *specifically Belizean* ecological and political elements of fire management were neglected in contemporary policies and documentation, which were predominantly informed by general principles derived outside Belize. I wanted to discover whether, and if so, why, historical fire management had also failed to

address contextual factors in Belize. From initial curious forays into the archive, history gradually became the primary focus of this thesis.

The broad academic discipline of political ecology provided a platform for my analysis. Political ecology is the study of human efforts to manage the environment, and environmental conditions, as the outcome of both socio-political and ecological processes operating at multiple scales.[33] Political ecology engages explicitly with the power relations inherent to environmental management, which is used, with unequally distributed costs and benefits, to shape the environment for certain purposes. Political ecologists are specifically interested in how dominant environmental narratives shape environmental practice in specific contexts. To do so they must interrogate the relationship between discourse and practice (a point developed in Chapter two). Political ecology thus 'focuses heavily on case studies that stress idiosyncrasies, contextual outcomes, and local surprises that precisely fly in the face of general theory building'.[34] These studies often include examination of the historical context to contemporary environmental issues.[35]

Wildfire and its management have been analysed in a handful of studies within political ecology, none of which examine the Belizean context. These studies demonstrate how, in different contexts, official colonial and post-colonial policies and legislation have, for economic and ideological reasons, criminalised fire use in the environment.[36] They also demonstrate that official discourse surrounding fire use has not been all-powerful in suppressing fires or changing local fire use behaviour. This is because wildfires are, by their nature, difficult to attribute to individual fire

[33] Stott & Sullivan (2000); Forsyth (2004); Watts & Peet (2004), Robbins (2012), Bryant (2015).
[34] Robbins (2012), p. 84.
[35] Brannstrom (2004); Offen (2004); Davis (2015); Mathevet *et al* (2015).
[36] Kull (2004); Kepe (2005); Mathews (2005); Kosek (2006), Ch. 6; Eriksen (2007); Eloy *et al* (2019).

users, and because of corruption and internal inconsistencies within the states possessing these official policies.[37]

This thesis is intended both to inform contemporary Belizean fire management (and environmental management more broadly) and to speak to current debates in political ecology regarding the importance of policies and discourse in shaping material environmental practice. It has two primary aims. The first is **to examine how colonial and post-colonial fire management have addressed the ecological and political context of wildfires in Belize**. I realised this by exploring how this context has been presented in plans, policies and reports and how this context has presented itself in the way fire management has been practised. The second is **to consider the Darwin Project in the light of previous fire management in Belize**. I addressed this by assessing whether the project's approach (prescribed fire for nature conservation, with community participation) departed from earlier approaches to fire management in Belize, in objectives, methods and enrolment of different forms of expertise. These aims led to five principal research questions with respect to fire in Belize's coastal savannas, in the period from 1920 to present:[38]

1. which organisations and actors have funded and organised fire management?
2. how has wildfire been cast as a 'problem' in the texts of these organisations, and with what aims has fire management been designed as a solution?
3. what expertise has been called upon in planning and implementing fire management, and what context has granted this expertise the authority to do so?
4. what methods of fire management have been planned and practised?

[37] Kull (2004); Mathews (2005).
[38] 1920 being the year in which state-organised fire management was first proposed in Belize.

5. how can discrepancies between the texts and the actual practices of fire management be explained?

The central argument of the thesis is as follows. Over the past century the purpose of fire management in Belize has changed, on paper, from the conservation of timber for capitalist exploitation and state revenue, to the conservation of nature and the benefit of local communities. Yet, in this period, fire management in Belize has been largely designed based on ideologies and policies deriving outside Belize and which have failed to recognise the evolving and specifically Belizean ecology and politics contributing to these wildfires and their management. Often, this has been because this fire management has been financed and designed within the contexts of colonial development, and later, international development, both of which valued general and technocratic approaches, and provided only short-term and inconsistent funding. Shaped in practice by Belizean ecology and politics, these externally-derived approaches to fire management have often failed to suppress fires or reduce fire frequency in line with their objectives. Belize's political elite long sought to retain control over land and resources, even at the expense of policies (including for fire management) which they have officially endorsed to satisfy colonial and international funders.

The structure of the work is as follows. The thesis begins with two chapters that provide further context to the research. Chapter two reviews the history of fire management as developed by institutions in Europe, European colonies and North America from the seventeenth century. It examines how fire management came to be conflated with 'conservation' and 'development'. It then reviews how the field of political ecology has approached the study of environmental management and governance. It situates this thesis within recent political ecology literature that seeks to overcome the limitations of earlier work that focused too intently, I argue, on the study of dominant discourses in environmental management. Chapter three turns to

my research methodology, highlighting the importance of being critically reflexive in relation to the processes by which I gathered and presented evidence. This is followed by three empirical chapters examining Belizean fire management since 1920. These chapters address three successive periods, and, thus, each provides partial answers to each of my research questions. Chapter four recounts the origins of the Belizean state Forest Department. After analysing how the Department's first Conservator of Forests cast savanna fires as a problem in an influential report of 1921, it examines how local factors frustrated the Department's attempts to manage savanna fires in the period from 1920 to 1941.[39] Chapter five examines how, from 1942 to present, the Forest Department's fire management was part of planned projects seeking international funding. This funding enabled a programme of fire management to be maintained despite limited local political support but constrained the approaches and consistency of that fire management. Chapter six explores the promotion of 'integrated' and 'community-based' fire management in Belize since the 1990s, and the role of local NGOs in leading these fire management projects. The thesis conclusion, chapter seven, more explicitly addresses each research question in turn.

This research grapples with fundamental questions of how structural constraints and local agency shape environmental management. Which are more important? Broad discourses and policies or local ecological and political forces? The desires of international funders or the relationships and intentions of actors in Belize? The answer is always that both play a role, yet the different lines of evidence upon which I draw in this thesis each provide only a partial view. Being textual in format, archival material commonly foregrounds the discourses and policies of the colonial administration, international funders and development actors in Belize. Oral histories

[39] Hummel (1921).

and ethnography give greater insight into local politics and agency. Each of these lines of evidence is time-constrained in different ways. I was only able to combine all three in Chapters five and six, when discussing contemporary Belize.

By providing the first study of the history fire management in the context of Belizean savannas, this thesis contributes to a growing body of case studies of the political ecology of fire. More generally, as little has been published on the subject, it provides some of the first writing on the history of forestry in Belize.[40] More generally, the thesis joins other case studies that provide detailed historical contextualisation of present environmental management practices, presenting opportunities to reflect on the relevance of the past to present. In so doing, it examines both continuities and discontinuities in the broad *ideas* informing fire management, and in the *processes* by which they were translated into practice within the structures of colonial or international development and in the local ecological and political context. The research also makes a methodological contribution, demonstrating the value of reflexively combining archival research with oral histories and ethnography, to evaluate how different traces of the past speak to that past and to the present. Finally, the research is intended to have relevance for stakeholders in Belizean fire management. I intend it to inspire critical reflection on the origins of their approaches to fire management. In the design of future fire management, I hope that my research will focus greater attention on elements of Belizean ecology and politics that have rarely informed the design of fire management in this context historically.

[40] As noted, brief reviews of the history of forestry in Belize have been provided only by Benya (1979a, 1979b) and Wainwright & Zempel (2018).

2

Fire management as conservation and development

> *Europeans see fire as inextricably social, its presence an outcome of human artifice. Lightning fire is a freak of nature, an aberration, and the episodic return of wildfire an index of social unrest. Americans, by contrast, begin with an axiomatic natural fire and seek to strip away the social context that encumbers its study, like physicists contemplating an ideal frictionless surface. For Europe the sacred fire remains the fire in the hearth. For Americans it is the fire in the wilderness…. Slowly, backing into the future, both Americans and Europeans began to converge on the common ground of anthropogenic fire. Americans found they had to reconnect fire with people; Europeans people with fire* (Pyne, 1997, 5, 452).

> *I have put forth two apparently contradictory propositions about micromanagerialism: that it is strongly determined by unequal power, and that the goals of the powerful often fail in practice. I think most anthropologists would agree more or less with both points, favouring one or the other at different times but rarely confronting their paradoxical simultaneity* (Heyman, 2009, 181).

Today most people in Europe and North America do not commonly use fire in the landscape as part of their livelihoods, as many human societies have historically. Most people understand fires in the landscape as a threat. This can broadly be attributed to influences, that, together, created a mentality by which fire use no longer fitted into a ’rational’ system of land use: fire became something to be largely excluded from the environment. This occurred as scientists, land managers and state agencies came to conflate fire’s management with ‘conservation’ and/or ‘development’. Conceived as such, fire management, as the prerogative of state and non-state technical agencies, became an attempt to shape and govern environments and people in the name of rational improvement. Fire management was also instituted in colonial settings such as Belize.

This chapter provides foundations from the literature that situate my research of the Belizean encounter with state and NGO-led fire management. The chapter has two broad aims. Firstly, in Sections 2.1 – 2.4, it provides historical context to the changing aims and methods of fire management as developed by institutions in Europe, European colonies and North America from the seventeenth century. I explore the history of the complex dialectical interplay between 'conservation' and 'development' in Anglo-American thought. I review how, as these terms have shifted in their meaning, so, too, the rationale for and approaches to fire management changed within forestry and nature conservation. Focusing on tropical savannas, I examine the influence of changing theory in the science of ecology on approaches to fire management.

Secondly, to ground my research approach, the chapter reviews how the field of political ecology has studied environmental management and governance. Section 2.5 examines the implications of the postmodern emphasis on knowledge and discourse for the study of colonial and international conservation and development. Such studies have been criticised for attributing 'Western' knowledge, discourse and plans for environmental management too much power to remake the world in line with their representations. Sections 2.6 and 2.7 review more recent literature to which my research contributes, work that explicitly confronts the relationship between discourse/plans and materiality/practice in environmental management. This literature suggests that we should approach Belizean fire management as shaped, in practice, by a specifically local ecology and politics.

2.1 Fire as an ecological and socio-political phenomenon

Fire is a chemical reaction sustained by the 'triangle' of heat, oxygen and fuel.[1] A wildfire is shaped by weather, topography and fuel: reciprocally, a wildfire consumes and modifies its physical and biological setting. Fire ecologists describe the longer-term character of fires in an ecosystem as its 'fire regime'.[2] At the scale of a fire regime, fire can have evolutionary ecological impacts. Fire acts selectively on species to produce vegetative adaptations such as heat protection or the ability to re-sprout following fire; disseminule-based adaptations such as fire-induced flowering or below-ground seed or rhizome survival; competitive adaptations, such as increased flammability to kill neighbours.[3]

Knowledge of fire's behaviour, and its use, for example, to facilitate hunting, agriculture, pastoralism, physical access or protest, have been central to many human societies throughout history. Many of these societies have recognised the elements of fire regimes given technical terms and quantification by modern fire ecologists, such as 'fire return intervals' or 'fuel composition'.[4] For some, fire has been imbued with spiritual value.[5] Some societies have also applied fire to the landscape as a fire management strategy, ensuring that the landscape is frequently enough burnt and sufficiently patchy to prevent large and catastrophic fires.[6] Human relationships with fire are subject to influence and change: it is neither useful nor appropriate to consider fire use as 'traditional' or 'primitive'.[7] For example, fire is of

[1] Fire is a form of combustion, an oxidation process. Fire requires heat transfer by conduction, convection or radiation, which processes depend for example upon the density of the combusting material, wind speed and topography. Fuel feeds fire, and its type, moisture, biomass on the landscape, arrangement and continuity, influence fire behaviour. Oxygen rarely limits wildfire, but a rapid supply by wind can intensify the flames.
[2] Whelan (1995); Cochrane & Ryan (2009); Scott *et al* (2013).
[3] Noble & Slatyer (1980); Bond & Midgley (1995); Bond & Keely (2005); Cochrane & Ryan (2009).
[4] Huffman (2013); Fowler & Welch (2018).
[5] Huffman (2013); Pyne (2016a); Fowler & Welch (2018).
[6] Laris (2002); Putz (2003); Whitehead *et al* (2003); Rodríguez (2007); Butz (2009); Walters (2010); Fowler & Welch (2018).
[7] Eriksen (2007); Coughlan & Petty (2013); Walters (2010, 2015); Petty *et al* (2015); Fowler & Welch (2018); Pooley (2018).

important cultural value to the Pemon people in Venezuela, who use fire in and around savannas in diverse ways that sustain their livelihoods, and also as a fire management strategy. This is not a timeless system, but one which has developed and changed over the past 400 years.[8]

Fire in tropical savannas long pre-dates human evolution.[9] Fire adaptations in tree species that characterise some tropical savannas today pre-date even the evolution of grasses. For example, thick, fire-resistant bark arose in pines at around 120 Mya, coincident with increased fire levels resulting from increased atmospheric oxygen.[10] Grasses emerged in the late Tertiary (60-70 Mya), and the C4 grasses that dominate tropical savannas became ecologically significant from 5-8 Mya. The first members of the genus Homo are dated to 2.5 Mya, the first anatomically modern humans to 200,000 years before present, though it was some time before humans migrated to reach all parts of the globe.[11] Since their evolution, human practices have shaped fire environments.[12] People are a cause of ignition and they shape and modify fuel environments - by grazing animals, deforesting, introducing new species, or building roads that break fuel continuity. Humans have also changed fire environments by modifying the climate. As human populations and the forms, organisation and scale of their land-use practices have changed, so has the nature of human influence on fire regimes. At different places and times, the natural influences on fire regimes, such as climate, differ in strength, altering the potential for human influence to be important.[13] Human influences on fire regimes are not easily quantified: it is difficult to isolate human signals in the palaeorecord or in

[8] Rodríguez (2007); Bilbao, Mendez & Delgado-Cartay (2009).
[9] Horn & Kappelle (2009).
[10] He *et al* (2012).
[11] Edwards *et al* (2010); Lehmann *et al* (2011); Furley (2016).
[12] Bird & Cali (1998); Kepe (2005); Butz (2009); Pechony & Shindell (2010); Bowman *et al* (2011); Coughlan & Petty (2013); Scott *et al* (2013); Archibald (2016).
[13] Whitlock *et al* (2010).

contemporary fire studies.[14] It is clear, nonetheless, that human fire use has substantially influenced ecosystems such as tropical savannas on evolutionary timescales.[15] In many landscapes, human fire use has historically promoted diversity in vegetation structure and species composition.[16] Fire has been a medium through which human institutions, economics and politics have shaped ecologies.

Steven Pyne urges modern fire managers to cast away two false 'slogans' for fire: 'fire as natural' and 'fire as tool'.[17] The first insists that human fire does not belong; the second ignores fire's environmental setting and assumes that people can have complete control of fire. Pyne instead calls for what he terms 'fire as biology', a perception of fire that understands that it exists because of its environment, social and ecological. It is fundamental to this thesis that fire is an ecological and socio-political phenomenon. This perspective of fire challenges the conventional categories of 'nature' and 'culture'. Over the past century, this dichotomy has also been denounced by social theorists who have offered various ways to reimagine nature *as* social, in both its discursive and material construction.[18]

The move to understand nature as social can be linked to the emergence in the 1970s of the broad academic discipline of political ecology.[19] Political ecologists remain divided over how best to approach the categories of nature and culture. Some follow the posthuman and 'more-than-human' turns in social theory to discard conventional dualisms and understand the world as comprised of socio-natural hybrids, allowing for non-human entities, such as fire, to have agency and/or

[14] Bowman (2011); Murphy & Bowman (2012); Marlon *et al* (2013).
[15] Bird & Cali (1998); Pechony & Shindell (2010).
[16] Kepe & Scoones (1999); Laris (2002); Bird *et al* (2008); Butz (2009); Walters (2010); Nigh & Diemont (2013).
[17] Pyne (2003), p. 9.
[18] Castree (2001, 2013).
[19] Stott & Sullivan (2000); Forsyth (2004); Watts & Peet (2004), Robbins (2012), Bryant (2015).

politics.[20] Others argue that such ontologies present an apolitical 'flat immanence where everything becomes equivalent with everything else', and prefer to keep a dialectical distance between nature and culture.[21] I take this second position, which sees human agency as integral to the political, and always related in contingent ways to the natural.

To take a political ecological approach to wildfire entails engaging with the power relations inherent to fire management, in that it is used to shape the environment for certain purposes.[22] As I explore in this chapter, in Anglo-American fire management such purposes have usually been framed in terms of conservation and development. In Sections 2.2 – 2.4, I draw upon studies by political ecologists, environmental historians and historical geographers, to review the history of conservation, development, the science of ecology and the articulation of these with fire management. In Sections 2.5 – 2.7, I turn to the social theory employed by political ecologists to understand how power and expertise operate in environmental management.

2.2 The evolving concepts of 'conservation' and 'development'

Some scholars have argued that European thought since the Enlightenment has been characterised by dualisms, including the separation of 'nature' and 'culture'.[23] This separation had roots in the Christian tradition, in which the Earth was created for the benefit of, and for stewardship by, humankind. From the thirteenth century, describing nature and creating botanical gardens, were understood as ways for a fallen mankind to find heaven on Earth and so become closer to God. From

[20] Haraway (1991); Latour (1993, 2005); Whatmore (2002). See Booth & Williams (2014) and Minor & Boyce (2018) for more-than-human studies of wildfire.
[21] Neyrat (2014), also Chagani (2014); Lave (2015); Swyngedouw & Ernstson (2018).
[22] See for example Kepe & Scoones (1999); Kull (2004); Kepe (2005); Mathews (2005); Kosek (2006), Ch. 6; Eriksen (2007); Eloy *et al* (2019).
[23] Glacken (1973); Castree (2014).

these largely Judaeo-Christian religious foundations grew a moral imperative for humanity to 'improve' nature. The global voyages and empire building of Europeans from the fifteenth century were highly influential in shaping new ways of understanding nature. Encounters with new environments necessitated new, scientific, ways of describing and cataloguing nature, and fuelled a romantic imaginary of distant tropical Edens. Man's improvement of nature took on a new role as ideological justification for the settlement and exploitation associated with empire-building. By the seventeenth century a rational and utilitarian basis was being added to the religious foundations of improvement.[24]

This rationality was characterised firstly by the emergence of new scientific methods and the belief in scientific knowledge and technology for the mastery of nature. Scientific knowledge was to be pursued and applied for the 'relief of man's estate' and not purely as an intellectual exercise.[25] Standardised approaches to physical measurement of the environment made it possible to compare and categorise, territorialise and administer distant places and empires. A second dimension to rationality was the principle of possession based on improvement and use: 'God gave the world to men in common; but since he gave it them for their benefit … it cannot be supposed he meant it should always remain common and uncultivated. He gave it to the use of the industrious and rational'.[26] Improvement justified enclosure of common lands in favour of state land ownership and fixed, private property rights for agrarian improvers and settlers of empires. Between the seventeenth and nineteenth centuries, nature's improvement increasingly became the prerogative of states and social elites. Scientific institutions and botanical

[24] Glacken (1973); Grove (1996); Drayton (2000); Driver (2001); Iliffe (2003); Stewart (2003); Gascoigne (2011).
[25] Bacon (1605), in Gascoigne (2011), p. 49.
[26] Locke (1690) in Drayton (2000), p. 59.

gardens became increasingly inflected with the management of the 'natural economy' and departments of executive government were created to manage agriculture and forestry on state land.[27] Laws were elaborated that established legal definitions of rational use and restricted access for those deemed irrational users of resources.[28]

From this ideology calling for the rational improvement of nature there emerged a dialectical relationship between two broad concepts: 'development' and 'conservation'. The word 'development' entered the English language in its modern usage in the eighteenth century. It carries a normative inflection, signifying the unfolding of something *essential,* but also implies an intervention; *managed* change.[29] By the nineteenth century, development was strongly associated with the deepening of capitalist social relations. Development was a relational concept, 'predicated on the assumption that some people and places are more developed than others and therefore those who are "developed" have the knowledge and expertise to help those who are not'.[30] In the context of the British Empire, colonial development signified 'civilisation' and 'modernisation' in the image of Britain.

From roots in colonial development, international development took on a new urgency after World War II, as USA, Soviet and European states and financial organisations sought to inject capital and encourage structural reforms to enable industrialisation and 'modernisation' in the Global South. Throughout the twentieth and into the twenty-first century, development continued to be associated with the application of science and technology. From the 1950s it was increasingly considered the domain of technical specialists and 'development professionals'.[31] In

[27] Carl Linnaeus used the phrase 'the economy of nature' in 1751 in describing how a balanced nature was created for man's rational use.
[28] Shapin (1994); Drayton (2000); Gascoigne (2011).
[29] Binder (1986); Cowen & Shenton (1996); Cullather (2000); Wainwright (2008); Adams (2009).
[30] Kothari (2005), p. 427.
[31] Kothari (2005).

its colonial and post-colonial recapitulations, the ideology of development has been associated with the maintenance of the cultural and economic hegemony of the Global North.[32]

In various forms, 'conservation' has been a reactionary attempt to mitigate against the destructive effects of deepening capitalist social relations and industrialisation: a 'reasoned awareness of the wholesale vulnerability of earth to man'.[33] Between the seventeenth and nineteenth centuries, environmentalism grew out of the visibility and physical measurement of environmental changes resulting from overexploitation of natural resources and industrialisation in Europe and its colonies and overseas territories. This environmentalism was also imbued with a romanticism and moralism that built on earlier ideas of Eden to decry industrialisation as a 'corruptor' of nature and of the 'less developed' inhabitants of empire. Mauritius under the Dutch in the seventeenth and French in the eighteenth and nineteenth centuries, and St Helena under the British in the eighteenth centuries are early examples of state initiatives to conserve soil, water and climate in response to localised instances of degradation. Such examples influenced the development of more standardised institutions for state-led environmental conservation by the nineteenth and twentieth centuries.[34]

Forestry was one of these subjects for the nexus of state-led conservation and economic development.[35] Integrating conservation with timber production, forestry 'resolved the tension between romantic preservationist notions and laissez-faire policies'.[36] Forestry often represented local forest users as destructive and so restricted access to reserved forests, which it argued should be managed for the

[32] Binder (1986); Oman & Wignaraja (1991); Cullather (2000); Wainwright (2008); Adams (2009); Escobar (2011); Hodge (2016).
[33] Grove (1996), p. 2.
[34] Glacken (1973); Grove (1996); Drayton (2000); Barton (2002); Adams (2009).
[35] Barton (2002); Rajan (2006); Bennett (2015).
[36] Barton (2002), p. 1.

'greater good'. Laws restricting access by peasants to forests had been established in Europe from the middle ages, but by the seventeenth century nation states such as France had created new forest reservations and plantations in response to timber shortages.[37] In the eighteenth and nineteenth centuries, forestry became a science and profession, and schools teaching standardised silvicultural methods were established, beginning in Germany. Informed by the French and German models, Britain established state forestry in India in the mid-nineteenth century. The USA followed the European lead, establishing its Forest Service in 1905.

In the late nineteenth and early twentieth centuries, building on the approach it had developed in India, Britain gradually introduced forestry to its other colonies. By 1920, when the first of a series of British Empire Forestry Conferences was convened, the term 'Empire Forestry' was used to denote the model of forestry in use across the British Empire.[38] In 1922 the British *Empire Forestry Journal* was established. In 1924 the Oxford Imperial Forestry Institute was founded for research and information-gathering about the colonies and to give specialised training to all foresters entering the Colonial Service. In the 1930s, standard statistical reporting forms were issued to all colonial forestry departments. The proponents of 'Empire Forestry' held that a standardised and centralised empire-wide approach to forestry was possible. They linked the concept to the economic and political model of a self-sufficient, unified Empire.

Conservation as wildlife or wilderness preservation arose alongside forestry's model of conservation integrated with timber production. In Britain, the first formal institutions and reserves for nature conservation were established in the

[37] Published in the same decade, in Britain, John Evelyn's *Sylva* (1664), and, in France, the Forest Ordinance (1669), urged the state and landowners to plant trees in response to timber shortages: see Glacken (1973).
[38] Furse (1962); Barton (2002); Powell (2007).

nineteenth century.[39] Concurrently, and on a larger scale, in the USA, the first National Parks were established to protect 'wilderness', which became a romantic ideal.[40] Within the British Empire, the first protected areas for nature conservation were created in late nineteenth-century Africa, to conserve game for hunting by colonial elites.[41] Growing out of this, the first international organisations to promote wildlife conservation were established in the early twentieth century.[42] By the 1960s, international conservation organisations began to broaden their concerns from species conservation to the environment more broadly. The typical model of 'fortress' conservation excluded local people from protected areas, just as forestry did.[43]

While it was built upon prior epistemic concerns, drawing, for example, on ideas from scientific forestry, ecology emerged in the late nineteenth century as a named science.[44] Closely aligned with the nature conservation movement, ecology provided a framework to underpin thinking about the environment and human impacts upon it. Early ecologists understood nature as, essentially, static, made up of 'types' of vegetation. Building from these foundations, Frederick Clements' influential theory of succession and climax strongly influenced development and conservation thought in the twentieth century.[45] For Clements, each vegetation type had a 'climax' state in which it was balanced and at equilibrium. Human activity was an external force that could act as a disturbance halting the succession of

[39] In Britain, for example, the Royal Society for the Protection of Birds was established in 1893, and the National Trust in 1894. Sheail (1976); Adams (2009; 2013); Brockington, Igoe & Duffy (2012).
[40] The first National Park was Yellowstone, established in 1872. The romanticising of wilderness is evident, for example, in the writings and work of John Muir and George Perkins Marsh. Oelschlaeger (1991); Cronon (1996); Nash (2014).
[41] Neumann (1996); Adams (2009; 2013); Brockington, Igoe & Duffy (2012).
[42] The first, formed within the context of the British Empire in 1904, being the Society for the Preservation of the Wild Fauna of the Empire, today Flora and Fauna International. Adams (2009; 2013); Brockington, Igoe & Duffy (2012).
[43] Brockington, Igoe & Duffy (2012).
[44] The term 'ecology' was coined by Haeckel (1866). See Worster (1994); Adams (2003, 2008).
[45] Clements (1916, 1936)

vegetation towards its climax state. Most ecologists in the early twentieth century subscribed to the paradigm of 'equilibrium ecology'.[46]

In the late nineteenth and early twentieth centuries, many ecologists understood tropical savannas as solely climatic in origin.[47] Clements' succession theory sparked a new generation of ecological thought about savannas. The implication was that savannas were viewed as degraded forests, or in transition to forests, and not as an 'end-point' in and of themselves.[48] Though placing their emphasis on different factors, a variety of deterministic theories to explain the occurrence of savanna were put forward under the paradigm of equilibrium ecology. Savanna was generally defined as a characteristic vegetation structure (treeless grassland), and ecologists often used observations from certain localities to make general statements about savannas everywhere.[49] In the 1940s and 1950s, it was popular to focus on edaphic factors. Some scholars focused on soil nutrient or drainage conditions, explaining the succession from forest to savanna as resulting from soil nutrient leaching.[50] Others believed the converse – that the direction of succession was the converse, from savanna to forest, the result of soil enrichment.[51] Yet others placed emphasis on soil drainage, suggesting that the development of impervious layers in the soil caused the succession from forest to savanna.[52] Many

[46] There was, nonetheless, some debate, for example, Cowles (1901, 1911) saw succession as 'a variable approaching a variable rather than a constant' (in Pulsford, Lindenmayer & Discoll (2016, p. 9), and Gleason (1927) disagreed that vegetation tends towards a climax, instead seeing it as subject to constant variation. Pooley (2018), notes how some ecologists subscribed to 'equilibrium ecology' at an abstract level, but made more nuanced readings of ecosystems in the field. See Worster (1994); Adams (2003, 2008).
[47] Grisebach (1872); Schimper (1898); Warming (1892, 1909). The writings of these early ecologists are analysed by Beard (1953) and Veldman (2016).
[48] Though the 'biome' and 'ecosystem' concepts were coined by ecologists in the 1917 and 1935 respectively, it was not until the 1970s that savannas began to be considered a biome or ecosystem in their own right. On the history of the biome and ecosystem concepts see Willis (1997); Egerton (2017); Mucina (2019)
[49] Beard (1953), for example, emphasised that all American savannas could be treated as a single physiognomic formation.
[50] For example, Lizerman (1931); Lanjouw (1936) and Hardy (1945), all discussed in Beard (1953).
[51] For example, Waibel (1948) discussed by Beard (1953).
[52] For example, Bennett & Allison (1928); Charter (1941); Beard (1944, 1953), all discussed in Beard (1953). See also Veldman's (2016) discussion of Beard's theory of savanna formation.

ecologists, particularly after the 1950s, understood savannas as a 'fire dis-climax'.[53] For example, for Edward Stebbing, professor of forestry at the University of Edinburgh, writing of West Africa in 1934, 'even the "savannah forest"' was 'fully capable of being reconstituted into high forest by the two agencies of closure and strict fire protection'.[54]

Equilibrium ecology strongly influenced conservation and development thought in the twentieth and twenty-first centuries. Ecology cast human activity as a degrading force, and the concept of the 'ecosystem', coined in 1935 and in popular use by the 1950s, provided the foundations for a new environmental managerialism: 'nature was a system whose state was maintained by processes of internal feedback, but it was also susceptible to external control. Human action could upset the machine, but fortunately the ecologist could predict how and where this upset might occur and diagnose how to put the balance right'.[55] Training in ecology lent conservationists legitimacy as managers of nature. In that it contributed to 'the rational use of biotic communities', colonial and post-colonial states found ecology a useful framework in planning economic development.[56] Ecology could be applied to maximise environmental production and extraction.

Conservation and development were aligned in forestry and ecology. Yet, as development acquired new political agency after WWII, there was an evident epistemic divide between forestry, which became more intensive and plantation-oriented, and environmental and nature conservation movements.[57] By the 1960s and 1970s, environmental movements in the Global North were vocalising a growing dissatisfaction with modernisation and development amid fears of global

[53] For example, Bews (1929); Christoffel (1939); Rawitscher (1948); Budowski (1956, 1966); Nye & Greenland (1960); Munro (1966), see, again, discussion by Beard (1953) and Veldman (2016).
[54] In Pyne (1997), p. 495.
[55] Adams (2009), p. 42. See also Willis (1997) and Egerton (2017).
[56] Phillips (1931), in Adams (2009), p. 44. See also Anker (2009).
[57] Bennett (2015).

environmental crisis.[58] Emerging grassroots social movements in the Global South, particularly in postcolonial settings, further criticised both development and 'fortress' conservation, for their exclusion of local people from the management and use of resources.[59] In reaction, a new discourse of 'sustainable development' emerged in the 1970s and 1980s. This suggested that development should 'meet the needs of the present without compromising the ability of future generations to meet their needs'.[60] Sustainable development promised a 'win-win' in which conservation could and should be achieved alongside human use of the environment. It enshrined a discourse of ecological modernisation, positing that economic development was compatible with, or even beneficial to environmental protection.[61] Since the 1980s, as the mandate of many international organisations, 'mainstream' neoliberal sustainable development has advocated less involvement by the state, a new reliance on market-based and technological solutions to environmental problems and for public participation in conservation and development.[62]

A number of terms describing such 'participatory' approaches became commonplace by the 1990s, including 'integrated conservation and development projects' (ICDPs), 'community-based conservation (CBC) or 'community-based natural resource management' (CBNRM), and protected areas co-management.[63] In practice, these approaches varied a great deal in their underlying motivation and objectives, and as to the methods by which participation was conceptualised. In a review of participatory approaches in environmental management, Reed found approaches to differ in the degree of public engagement sought and in their

[58] Captured, for example, in Rachel Carson's 'Silent Spring' (1962). See Fischer (2000).
[59] Agrawal & Gibson (1999); Hickey & Mohan (2004); Brockington, Duffy & Igoe (2008); Berkes (2010); Dressler *et al* (2010).
[60] Brundtland (1987).
[61] Hajer (1995); Adams (2008); Dryzek (2013).
[62] Igoe & Brockington (2007); Adams (2008).
[63] Brosius, Tsing & Zerner (1998); Adams (2008); Brockington, Duffy & Igoe (2008); Dressler *et al* (2010); Raymond *et al* (2010); Calfucura (2018).

theoretical underpinning (some more strongly pragmatic and others normative). Pragmatic arguments for participation differed in their emphasis. Some argued that direct involvement in management brings benefits and engagement that make people more likely to agree with a largely externally devised intervention, and less likely to act unsustainably. Others emphasised that an understanding of local needs or priorities is necessary to adapt technical interventions to context. Yet others suggested that public knowledges themselves have something more fundamental to add in defining environmental problems or in finding technical solutions to those problems. Approaches underlain by normative arguments emphasised democracy, citizenship, equity, empowerment and resource rights.[64]

After a burgeoning of 'participatory' conservation and development schemes in the 1990s there was growing disillusionment with the concept both from academics and funding agencies (which will be explored further in Section 2.5).[65] It is important for this discussion of the recent evolution of mainstream sustainable development, that participatory approaches often failed because they were pursued concurrently to the increasing 'professionalisation' of the development industry.[66] As is discussed further in Section 2.7, the valorisation of technical expertise in 'development professionals' (to the extent that even 'facilitating participation' came to be considered an area of technical expertise in its own right) limited the extent to which local knowledge could truly inform development. Paradoxically, entering the twenty-first century, the reaction of many development agencies to the failure of participatory development projects was an attempt to make development more 'accountable'. This was often by introducing stricter monitoring and evaluation

[64] Reed (2008).
[65] Dressler (2010)
[66] Kothari (2005); Nightingale (2005); Lund (2015).

requirements that narrowed the terms on which a development project can be considered 'successful' and further limited local participation.[67]

From the 1970s, there was also a transition in mainstream ecology away from the equilibrium model towards understanding ecosystems as non-equilibrium systems. Within this, still dominant, paradigm in ecology, disturbance and variation are viewed as inherent to ecosystems, change being 'without any determinable direction and [going] on forever, never reaching a point of stability'.[68] Disturbances are understood to produce heterogeneous effects and ecosystems to be comprised of 'dynamic patches'.[69] With the transition to non-equilibrium ecology, ecologists began to understand tropical savannas as ecosystems or biomes in their own right; inherently dynamic and maintained by fire and herbivory.[70] The boundaries between vegetation types within the savanna mosaic, and between savanna and continuous broadleaf forest, are subject to continual change.[71] Presently popular theories to explain the occurrence of savanna relative to broadleaf forest combine climatic or edaphic factors with disturbance by fire or herbivory using the concept of 'fire-vegetation feedbacks'.[72] In such models, climatic and edaphic factors (the strength of which vary locally) act only indirectly, in that they alter the counteracting rates of canopy closure (woody growth) and frequency of disturbance (the fire regime and herbivory) that directly control savanna distribution. The relationships between climatic or edaphic factors and savanna distribution are, therefore, not linear or deterministic: positive feedbacks exist between fire and savanna vegetation structure. The mechanisms by which these positive feedbacks exist are many:

[67] Mosse (2004).
[68] Worster (1990), p. 8. See also Scoones (1999); Adams (2003); Pulsford, Lindenmayer & Driscoll (2016).
[69] White & Pickett (1985).
[70] Egerton (2017).
[71] Furley, Ratter & Proctor (1992).
[72] See Lehmann *et al* (2011, 2014); Murphy & Bowman (2012); Hoffman *et al* (2012); Fill *et al* (2015); Oliveras & Malhi (2016).

competition favouring grasses over trees in post-fire nutrient, moisture and light conditions, direct mortality or propagation effects of fire on grasses vs trees, and flammable grass establishment.[73] Because species traits create these positive feedbacks, the savanna vegetation and its links with fire are reinforced on evolutionary timescales: 'The natural fire regime is therefore not simply an exogenous, climate-initiated disturbance … but is modified by biotic components that are intrinsic, and often endemic'.[74]

The tension between stability and instability remains difficult for ecologists to resolve and there is little theoretical agreement in non-equilibrium ecology.[75] There is, for example, much contention in savanna fire ecology, rooted in a diversity of methods of study and their differing temporal and spatial scales of consideration.[76] Experimental or plot-based studies have allowed for detailed measurement of particular and diverse variables, but have often been at a small spatial scale and few studies covered more than a few decades.[77] Palaeoecological studies allow for longer term analysis but spatial extent or resolution may be limited, as are the factors available for analysis. [78] GIS and computer modelling studies have allowed analysis at regional or global scales, but are often constrained by the availability of data to no more than a few decades and as to the factors that can be included. [79] Cross-scale analysis of fire patterns demonstrates that interpretation is dependent on the scale of analysis, but few studies have integrated findings on various scales for savannas.[80] The result of these different scales of consideration is that different

[73] Balch, Nepstad & Curran (2009).
[74] Fill *et al* (2015), p. 58.
[75] White & Jentsch (2001); Moore *et al* (2009); Pulsford, Lindenmayer & Driscoll (2016).
[76] As Pooley notes, 'fire ecology' did not develop as a unified field, but was developed 'by foresters and agricultural researchers as applied science, in isolation from mainstream ecology and biology' (2015, p. 8).
[77] Furley *et al* (2008); Horn & Kappelle (2009); Laris & Wardell (2006).
[78] Horn & Kappelle (2009); Whitlock *et al* (2010).
[79] At national park level, for example Russell-Smith, Ryan & Durieu (1997). At global level, for example Carmona-Morena *et al* (2005) and Bond, Woodward & Midgley (2005).
[80] Falk *et al* (2007, 2011) and Morgan *et al* (2001) are rare examples of such cross-scale analyses.

factors have been emphasised, different levels of universality sought in theory, differing levels of emphasis placed upon historical contingency, and different baselines set for 'natural' vs 'degraded' savannas.

Non-equilibrium ecology has been slow to influence environmental management. The notion of an inherent balance in ecosystems remains a major influence in nature conservation, which has traditionally sought preservation or restoration of certain target environmental states.[81] Non-equilibrium ecology has, nonetheless, found expression in some notions of 'rewilding' landscapes by restoring processes of environmental disturbance, rather than aiming towards a pre-determined environmental state.[82]

I have broadly and briefly reviewed the history of the notions of 'conservation' and 'development', their changing relationship, and their articulation with the science of ecology. This history provides a basis, in Sections 2.3 and 2.4, for an exploration of how land managers in Europe, European colonies and North America have designed fire's management in the name of conservation and/or development, and for understanding contemporary diversity in fire management approaches.[83]

2.3 Forestry's fire management

Fire was once used by rural labourers across Europe in a variety of shifting fire-fallow, or 'swidden' practices, that combined cropping and livestock rearing, and was used by nomadic pastoralists, particularly in the Mediterranean. As Europeans settled new colonies from the fifteenth Century, they there too used fire for land

[81] Wallington, Hobbes & Moore (2005).
[82] Sandom *et al* (2013); Lorimer & Driessen (2014); Jepson (2016); Svenning *et al* (2016).
[83] The emphasis in sections 2.3 and 2.4 is on forestry and nature conservation institutions because these had the greatest influence in Belize. It is worth noting that elsewhere, state agriculture institutions also had a significant influence on fire management policies.

clearance and agriculture, and encountered and often assimilated the fire-use practices of indigenous peoples.[84] From the seventeenth century, in line with new conceptions of rational land-use, new attitudes towards fire, and justifications for its control by state institutions, appeared in Europe and in its colonies.[85] Swidden agriculture and nomadic pastoralism did not sit easily with European notions of rational agrarian improvement: 'swiddeners, pastoralists, long hunters, trappers, settlers - all exploited fire as part of seasonal or secular travels that shredded principles of fixed property ownership and that mocked a social order in which, as with garden crops, everyone has his time and place'.[86] Particularly in the colonies where Europeans encountered highly flammable environments, such as tropical savannas, fire also came to represent environmental degradation. For example, fire use was blamed for environmental degradation by the French administration in eighteenth-century Mauritius.[87]

The use of fire, either by European peasants and colonial settlers or by indigenous peoples in the colonies, became the scourge of the state forestry institutions established from the seventeenth century. In forestry, fire was a disturbance: 'It saw something that threatened trees, degraded soils, destabilised rivers and climates. It saw a social and, perhaps political, failure because, for temperate Europeans, fire existed on the land only because people chose to put it there. It saw fire as unnatural'.[88] The technical methods of forestry developed in eighteenth and nineteenth-century France and Germany, included measures of fire management. Forestry legislation forbade the use of fire in and adjacent to reserved, planted and managed forests. Foresters surrounded forest blocks with fire

[84] Sluyter & Duvall (2015).
[85] Pyne (1997).
[86] Pyne (2003), p. 70.
[87] Pyne (1997).
[88] Pyne (2003), p. 6.

lines and stationed guards in towers to watch for forest fires. Some foresters used controlled fire as a tool to fight wildfire. In nineteenth-century France, foresters created the practice of '*petit-feu'*, firing defined strips of forest in rotation, as a protective measure against future fires.[89]

When it was less 'close to home', and involved indigenous peoples, more so than in Europe, foresters could conceive of eradicating human fire use and pursued ideals of fire exclusion from forests. In nineteenth-century British India for example, efforts were made to eradicate shifting agriculture and the construction of fire protection lines was taken to new levels.[90] By the twentieth century, the model of fire suppression that originated in Europe had become dominant in forest management and had left its mark in the reduction of wildfire activity globally.[91] Fire management was a key topic for discussion at the British Empire Forestry Conferences, the first of which was held in 1920.[92] At these conferences most foresters advocated policies of complete fire suppression. Clements' theory of ecological succession provided a new way of articulating the rationale for fire suppression: to 'recover' forests, which were generally deemed to be the natural vegetation climax in most environments.[93]

In the early twentieth century, and influenced by European models, the USA too developed a system of state-managed forestry. A policy of total fire suppression was issued by the US Forest Service, particularly following the devastating 'Great Fires' of 1910, which burned large areas of National Land in the western USA.[94] The Forest Service was a 'benign hegemon' with strong moral authority.[95] It managed huge areas of public land and sponsored most fire research. Anti-fire mascot

[89] Pyne (1997, 2003); Bennett (2015).
[90] Barton (2002).
[91] Pechony & Shindell (2010).
[92] Pooley (2014).
[93] Pyne (1997); Kepe & Scoones (1999); Kull (2004); Kepe (2005); Pooley (2014).
[94] Pyne (2003, 2015).
[95] Pyne (2015), p. 4.

‘Smokey the Bear’, who first appeared in 1944, was a powerful symbol around which public opinion was shaped.[96]

By the mid-twentieth century a gradual revolution was occurring in fire management, especially in the USA and some British colonies. There had been some critics of complete fire suppression from the nineteenth century. For example, in 1877 and 1895, in British India, the forester Dietrich Brandis had advocated for controlled burning, akin to the French practice of ‘*petit-feu*’.[97] In 1890s South Africa, the forester David Hutchins deemed fire a natural process that only got out of hand if poorly managed.[98] In the first half of the twentieth century the critics of complete fire suppression became increasingly vocal. Some ecologists suggested to the state forestry agencies that fire was inherent and ‘natural’ to certain ecosystems. Field staff of some forestry agencies were noting that the increasing fuel loads that followed fire suppression in forests made fires increasingly difficult to manage.

The question of whether to allow policies of controlled burning received repeated attention at the British Empire Forestry Conferences between 1920 and 1950.[99] Gradually, some state agencies began to accept controlled or ‘prescribed’ burning. It was in use in Australia by the 1920s, and in Florida, where there remained a strong culture of fire use, state agencies were granted exemption to allow fire into protected areas from the 1930s.[100] General policy and public opinion proved difficult to shift, however, and not until 1978 was full reform effected in the fire policies of the US Forest Service. Prescribed fire policies were also instituted elsewhere, such as in South Africa, by the 1970s.The use of prescribed fire by fire technicians became an acceptable means to reduce fuel loads and prevent

[96] Kosek (2006), Ch. 6.; Minor & Boyce (2018).
[97] Pooley (2014).
[98] Ibid.
[99] Ibid.
[100] Pyne (2003, 2015, 2016b); Pooley (2014).

catastrophic wildfire.[101] As Stephen Pyne argues, the term legitimised only a certain form of human fire use: scientifically-directed, pre-designed and the sole domain of specialist technical agencies.[102] The US Forest Service took the global lead in developing technologies and methodologies for prescribed fire management, with military-like organisation, specialised equipment, large numbers of personnel, and aircraft. As I review in the following section, prescribed burning evolved differently in pursuit of different management aims. Certainly, the amount of planning, mathematical modelling, and use of mechanical equipment for prescribed burning differ significantly in different contexts today.

Since the 1970s, prescribed fire has, nevertheless, failed to take strong cultural hold in the US and elsewhere.[103] In the public imagination, fire is strongly associated with degradation and destruction, and there is still a strong culture of fire suppression, particularly surrounding residential areas. For example, in South Africa, although controlled burning policies were already advocated by the Forestry Department in 1948 and implemented in some areas by the 1970s, opposition from the public and local government have prevented its implementation on a large scale.[104] In the late twentieth and early twenty-first century the paperwork and liability surrounding prescribed fire use mounted following several catastrophic incidents of escaped prescribed fire in the US.[105] The late twentieth century and early twenty-first century have also seen frequent 'megafires', exacerbated under changing climatic conditions, and consuming the dense fuel built over a century of fuel suppression.[106] These megafires have elicited state responses of measures of fire suppression on new scales.

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[101] 'Prescribed fires' are applied to fulfil particular land management objectives, such as reducing fuel loads, or ensuring early-season rather than late season fires.
[102] Pyne (2016b), p. 42.
[103] Donovan & Brown (2007); Pyne (2015).
[104] Pooley (2014).
[105] Pyne (2015).
[106] Donovan & Brown (2007); Pyne (2015); Abatzoglou & Williams (2016).

2.4 Fire management for nature conservation and sustainable development

State and non-state nature conservation institutions in the late nineteenth and early twentieth centuries deemed fire unnatural in and attempted to exclude it from the wilderness and wildlife protection areas they managed. Yet, in the USA, the National Parks and Fish and Wildlife Services, like the Forest Service, gradually came to realise that fire might be 'natural' in some of these areas. These agencies adopted prescribed burning by the 1960s, and, again, set a global example. As with the US Forest Service, prescribed fire use for nature conservation was deemed to be the sole remit of technical land management agencies. For these agencies, although prescribed fire could substitute for 'natural fire', 'it derived its legitimacy from lightning fire'.[107] Fire use by indigenous people, or the acceptance of human fire use as a historical shaper of ecosystems, did not initially fit into this model.[108] Although conservationists became increasingly aware of the historical role of human-set fire in the environments they aimed to preserve or restore, they remained divided in their interpretations of when human use of fire should be cast as a 'degrading' force. The level to which human-set fires are considered 'degrading' continues to depend upon where baselines or targets for an ecosystem are set, and which time periods are considered. For example, contemporary assessments carried out for carbon offsetting schemes may consider human fires in tropical savannas as degrading because they reduce tree cover (and hence carbon storage). Meanwhile, ecologists advocating the preservation of savanna biodiversity consider fire suppression to degrade savannas because it results in tree growth.[109]

[107] Pyne (1997), p. 450.
[108] Pyne (2015). Similar assumptions were made by national parks managers in Africa; see Van Wilgen *et al* (2004).
[109] Ratnam *et al* (2011); Parr *et al* (2014); Veldman (2015a, 2015b, 2016); Lehmann & Parr (2016).

As ecologists began to understand fire as inherent within non-equilibrium ecosystems, some environmental managers integrated this thinking into prescribed fire management schemes aimed at re-creating an 'ecologically-appropriate' fire regime. Accompanied by the mantra 'pyrodiversity begets biodiversity', 'patch-mosaic burning' emerged in the late 1990s, in reference to attempts to create heterogeneous patterns of fire in the landscape.[110] In the early twenty-first century, reintroducing fire as an ecological process was considered a form of 'rewilding' in some places.[111] In recent decades, many of those fire managers who attempted to put non-equilibrium theory into practice have been confounded by practical challenges and the underlying theoretical diversity in ecology.[112] It has been questioned whether prescribed fire management regimes can recreate the randomness of natural or historical fire patterns. The existence of positive feedbacks between vegetation and disturbance processes means that simply applying a historical or 'ecologically appropriate' form of prescribed fire, be that by changing its seasonality, frequency or patchiness, does not necessarily lead to a return to a historical or ecologically appropriate vegetative state or fire regime. In grasslands, for example, prescribed fire may not reverse the encroachment of woody vegetation following fire suppression.[113]

Despite an awareness of the historical role of human fire in ecosystems, contemporary local fire users have not necessarily been called upon to participate in the design or implementation of fire management. In Pilanesberg National Park in South Africa patch-mosaic burning is designed using mathematical modelling

[110] Parr & Brockett (1999), Brockett, Biggs & Van Wilgen (2001), Parr & Andersen (2006).
[111] Although in Europe the term 'rewilding' has mostly been associated with reintroducing large herbivores and predators. Fuhlendorf *et al* (2009).
[112] Parr & Brockett (1999); Van Wilgen *et al* (2004); Parr & Andersen (2006), Moore *et al* (2009), Driscoll *et al* (2010); Donohue *et al* (2016).
[113] Suding, Gross & Houseman (2004); Twidwell *et al* (2013).

techniques and is carefully recorded and monitored.[114] Nonetheless, aligning with the rise of sustainable development and participatory environmental management, new fire management models emerged in attempts to consider the needs of and the involvement of local fire users.[115] Today, the terms 'integrated fire management' and 'community-based fire management' are applied to such approaches.[116] 'Integrated fire management' brings together '(1) the three technical components of fire management: prevention, suppression and use with (2) the key ecological attributes of fire, i.e. the ecologically appropriate fire regime and (3) the socio-economic and cultural necessities of using fire along with the negative impacts that fire can have on society'.[117] Although the terms are not discrete, 'community-based fire management' more explicitly refers to cases where communities are envisaged as active participators in fire suppression and prescribed burning.[118] There was no single underlying rationale for a move towards such approaches. In some cases, there was recognition that local, often indigenous, fire users possessed their own 'expertise' in fire management, one that aligned with efforts to recreate 'ecologically-appropriate' fire regimes, or with biodiversity conservation. For example, fire management in the Kakadu National Park in Australia, has, since the 1990s, aimed to recreate traditional Aboriginal land management.[119] In other situations, local fire use practices were deemed degrading, and the rationale for engaging and involving people was changing practices through training. Given the variety of ecological and cultural contexts globally, attempts to involve local people in fire management have,

[114] Brockett, Biggs & Van Wilgen (2001).
[115] Moura *et al* (2018). Examples in South America: Huffman (2010); Rodríguez-Trejo *et al* (2011); Rodríguez *et al* (2013), Mistry, Bilbao & Berardi (2016); Eloy *et al* (2018); Mistry *et al* (2018), Africa: Kull (2002a); Moore *et al* (2002) and Australia: Petty, deKoninck & Orlove, (2015); Petty *et al* (2015); Russell-Smith *et al* (2013).
[116] Both terms have been used in Belize.
[117] Myers (2006), p. 9.
[118] UN-FAO (2011).
[119] Petty, deKoninck & Orlove, (2015); Petty *et al* (2015); Russell-Smith *et al* (2013).

unsurprisingly, taken diverse approaches. For example, in contemporary Mexico, where the agricultural fire-use practices of different rural peoples differ in their ecological consequences, integrated fire management projects engage differently with different groups in quite localised areas.[120]

Local 'participation' in fire management has thus involved different levels of recognition of local knowledge. In the Canaima National Park in Venezuela, for example, while Pemon people have long been employed as staff and have thus 'participated' in fire management, only recently has their knowledge affected the design of that management.[121] Programmes have often remained highly technical and so risked treating local people as 'workers executing plans developed by others'.[122] The different conceptions and priorities of different stakeholders have not proved easy to integrate.[123] While it is undoubtedly a key part of historical and contemporary human fire regimes, 'the recreational nature of fire has received little attention from serious researchers, perhaps because they themselves are so serious'.[124]

Both non-equilibrium ecology and 'integrated fire management', while popular concepts in the contemporary academic literature, have yet to influence many fire management institutions. The fire management models of complete fire suppression or prescribed burning to restore a desired 'natural fire' or to reduce fuel loads, remain dominant both in managed nature conservation areas and forestry plantations globally.[125] Historical patterns of thought are important; fire policy is often shaped by 'received wisdoms' that assume that fire, and in particular fire of human

[120] Rodríguez-Trejo *et al* (2011).
[121] Mistry, Bilbao & Berardi, (2016); Mistry *et al* (2018).
[122] Petty, deKonnick & Orlove (2015), p. 140.
[123] Kull (2002b); Eriksen (2007); Devisscher, Malhi & Boyd (2018); Pooley (2018); Eloy *et al* (2019).
[124] Putz (2003), p. 12.
[125] Donovan & Brown (2007); Fill *et al* (2015).

origin, is a cause of environmental degradation.[126] As demonstrated by a long history of different prescribed fire management approaches in the Kruger National Park, most fire management has rarely been informed by direct empirical measurement of its effects within that ecosystem.[127] There have been few long-term studies to monitor the effects of fire management on savanna ecology, and few land managers have the resources to conduct such studies.[128]

In academia, in recognition of the importance of human fire in shaping fire regimes, there are recent commitments to integrate the natural and social sciences in fire ecology in a 'holistic, ongoing, interdisciplinary and international scholarly framework for fire research'.[129] In my research, in taking a political ecological approach, my central focus is the socio-political aspects of wildfire, and the power relations of fire management regimes in Belize. In studies that have explicitly attempt to integrate social and physical aspects of fire, there are disagreements over approach, rooted in different understandings of social theory, and historical debates over how to describe cultural evolution.[130] I turn now to reviewing the social theory and literature that ground my research.

2.5 Knowledge and power in environmental governance

The history examined above demonstrates that fire management has often been an element of wider environmental governance and management regimes, designed by state and non-state institutions, that have shaped how local people are viewed, and altered their relationships with land and resources.[131] From the

[126] Fairhead & Leach (1996); Kull (2000, 2004); Laris & Wardell (2006); Veldman (2016); Moura *et al* (2018).
[127] Van Wilgen *et al* (2004).
[128] Furley *et al* (2008).
[129] Scott *et al* (2016), p. 3.
[130] See the extended debate between Bowman *et al* (2011), Coughlan & Petty (2012, 2013), Roos *et al* (2014) and Coughlan (2015).
[131] Kepe & Scoones (1999); Kull (2004); Kepe (2005); Kosek (2006), Ch. 6; Eriksen (2007).

viewpoint of a political ecologist, I am interested in the power relations inherent to such regimes, which have privileged certain representations of the environment and certain environmental users. At the same time, it should not be assumed that the broad ideologies or policies here described have, in practice, necessarily been implemented successfully to control or manage fire or suppress local fire use. Studies of the history of fire management in diverse settings demonstrate the continued human use of fire, despite official policies aiming to restrict it.[132] The remainder of this chapter examines some of the social theory from which political ecology has drawn in approaching the relationship between ideology/policy, and materiality/practice in environmental management, a central focus of my study in Belize.

Since the 1980s, many studies of environmental governance, have drawn inspiration from Michel Foucault's writing on the relationship between knowledge and power.[133] Foucault understood linguistic representations of material and ideational phenomena to derive their social meaning from wider 'discourses', interrelated sets of understandings, texts and gestures that determine what it is possible to say about entities in the world in a given social context.[134] The term 'epistemic community' has been used to describe groups that work to create and maintain discourses, and to communicate them more widely. This work is inherently political, 'in the sense that it involves contestable, value-laden choices – about profound issues pertaining to what is "normal", "interesting", "relevant", "good", "right", "permissible" or "moral" for us and other people. These are also choices about what not to represent'.[135] As an example, Anker examines the emergence of

[132] Kull (2002b, 2004); Kepe (2005); Mathews (2005); Eriksen (2007); Pooley (2018).
[133] Stott & Sullivan (2000); Robbins (2012); Winkel (2012); Leipold (2014); Valdivia (2015); Fletcher (2017); Van Assche *et al* (2017).
[134] Braun & Wainwright (2001), Phillips & Hardy (2002).
[135] Castree (2013), p. 51.

two broad and competing schools of ecological science in the early twentieth century: British 'mechanism' and South African 'holism'.[136] Each sought to explain scientifically the human place in nature, but each was linked fundamentally to a particular social context, and used to further a certain administrative purpose: the first, centralised control of a diverse colonial empire, the second, justification for the social division of different human 'races'.

What Anker's study demonstrates, and what was critical for Foucault, is that discourses can produce change. When knowledge is applied – in environmental management for instance – this involves shaping the world in line with certain hegemonic representations, at the expense of others. If 'power' is, broadly, the capacity to produce or prevent change, then discourses created by epistemic communities can have social power.[137] Foucault understood discourse as a means by which power is exerted and diffused throughout society. This is a form of 'soft power' that seeks to 'elicit cooperation without commanding it'.[138] For Foucault, governance involves this indirect 'conduct of conduct' as much as it involves direct rule: a discourse creates 'subjects' and empowers and disempowers them as it produces their realms of action.[139]

Foucault's texts do not lay out a clear research methodology and his ideas have been taken on in diverse ways, often only tangentially, or in combination with other philosophies.[140] A broadly-defined poststructuralist political ecology has examined the discourses of hegemonic institutions in environmental governance, including colonial states and development and conservation organisations. This work has often drawn upon the postcolonial literature that has posited that

[136] Anker (2001).
[137] Miller (1992), p. 241, in Castree (2013), p. 182.
[138] Pellizoni (2001), p. 2, in Castree (2013), p. 184.
[139] Li (2007a).
[140] See for example Li (2007a) and Ekers & Loftus (2008), who develop conversations between Foucault's thought and the Marxism of Antonio Gramsci.

specifically colonial discourses have been a key enabling component of such regimes.[141] A seminal example is Edward Said's work exploring the discourse he terms 'Orientalism', which he suggests, in its representation of a romantic and timeless Orient and its people as the 'other', created a sense of detachment that enabled the colonisation of Asian and Middle Eastern territories.[142] Many scholars note the perpetuation, following decolonisation, of such colonial discourses and relations, including within international conservation and development.[143] Some have built upon Said's work to suggest that orientalist discourse was objectified by scientific discourse, to appear as 'a set of factualised statements about a reality that existed and could be known independent of any subjective, colonizing will'.[144] This argument has been applied, more generally, to examine how the authority afforded to science in European and North American ideology, grants states and other hegemonic organisations the power to employ scientific simplifications of reality in the form of data or maps – the 'administrative ordering of nature and society' – to remake those socionatures.[145] Scott terms this ideology 'high modernism':

> a strong, one might even say muscle-bound, version of the self-confidence about scientific and technical progress, the expansion of production, the growing satisfaction of human needs, the mastery of nature (including human nature), and, above all, the rational design of social order commensurate with the scientific understanding of natural laws…. High modernism must not be confused with scientific practice. It was fundamentally, as the term "ideology" implies, a faith that borrowed, as it were, the legitimacy of science and technology.[146]

While discourse analysis has revealed important insights regarding power in environmental governance, some political ecology, with the post-development and

[141] Ashcroft, Griffiths & Tiffin (2000); Gregory (2001); Loomba (2007).
[142] Said (1979).
[143] See for example Mosse (1999); Li (1996, 2007a); Adams & Milligan (2003); Kothari (2001); Mohan (2001); Wainwright (2008).
[144] Ludden (1993), p. 252.; Appadurai (1993).
[145] Scott (1998), p. 4. See also Nandy (1988); Adas (1989); Fairhead & Leach (1996); Edney (1997); Prakash (1999).
[146] Scott (1998), p. 4.

postcolonial literatures, has come under criticism for treating 'development', 'colonialism', 'science' and other entities *solely as* discourse. To illustrate the basis of these criticisms, let me focus on the treatment of development in the 1990s post-development literature, which treated 'development' as a discourse.[147] For Arturo Escobar, the 'discourse of Development', similarly to Said's Orientalism, has been a 'mechanism for the production and management of the Third World … organizing the production of truth about the Third World'.[148] The post-development scholars posited that it is possible to reject the notion of development while promoting 'alternatives to development' in localised grassroots movements, cultures and knowledge. Even when grounding their analysis in certain contexts they still treat development as a discursive entity independent of those contexts.[149]

Critics contend that treating development *as* discourse risks ascribing it too much power.[150] They argue that the post-development literature presents development as homogenous, monolithic and unchanging. They point to a tendency to romanticise and essentialise indigenous or local knowledges. In making these generalisations, the post-development literature re-inscribes false binaries between 'the West' and 'the rest', colonial centre and periphery. It is charged with not attending to the relations between and within these categories. In parallel, in recent decades, an academic critique of participatory approaches in sustainable development has termed 'participation' 'the new tyranny'.[151] Critics of 'participation' argue that such approaches essentialise, homogenise and inscribe false dichotomies between 'local' or 'indigenous' versus 'scientific' or 'Western'

[147] Pieterse (2000); Ziai (2004, 2007); Hodge (2015). Examples of the post-development literature are Sachs (1992); Rahnema & Bawtree (1997); Esteva & Prakash (1998); Escobar (2011); Rist (2014).
[148] Escobar (1992), pp. 413-14.
[149] See for example Ferguson (1990), and discussion in Hodge (2015).
[150] Pieterse (2000); Ziai (2004); Hodge (2015); Asher & Wainwright (2018).
[151] Cooke & Kothari (2001).

knowledges.[152] This may be particularly problematic in post-colonial settings. Various case studies and critiques trace to pre-existing colonial discourse those notions of community and trusteeship seen as central to participatory approaches.[153] Participatory approaches often aspire to overcome traditional power relations between the 'expert' and the 'layperson', the 'developed' and 'developing'. In reality, in the often public settings for participation, power relations based on class, race, gender, age or other social categories may alter the abilities of different actors to participate meaningfully, or to capture benefits at the expense of others.[154] Gayatri Spivak's work raises an important challenge to post-development scholars who have sought to retrieve the voice to the 'other' as a strategic reversal of power. For Spivak, any such attempt is fundamentally constrained by the discourse in which the subject is constructed as sub-altern: '"being made to unspeak" is also a species of silencing'.[155] A similar critique argues that in participatory development the very act of inclusion and definition of categories of knowledge for participation symbolises an exercise of power.[156]

As Aram Ziai observes, critics of the post-development literature have, perhaps, been unfair in their treatment of this as a singular body of work.[157] The ambivalence of post-development notwithstanding, its criticism has provided important foundations from which recent literature has developed more nuanced treatments of power, knowledge and practice in environmental governance. My research on fire management in Belize speaks to this literature. It follows in political

[152] Agrawal (1995); Robbins (2000); Kothari (2001); Mogan & Stokke (2000); Mohan (2001); Gelcich, Edwards-Jones & Kaiser (2005); Ghimire, McKey & Aumeeruddy-Thomas (2005); Briggs et al (2007); Raymond *et al* (2010).
[153] Agrawal & Gibson (1999); Mosse (1999); Mohan (2001); Li (2007a); Wainwright (2008).
[154] Mosse (2001); Berkes (2004); Dressler *et al* (2010); van Kerkhoff & Lebel (2015).
[155] Spivak (1999) in Wainwright (2008), p16. See also Spivak (1988); Kapoor (2004); Asher & Wainwright (2018).
[156] Li (1996, 2007a, 2007b); Kothari (2001); Henkel & Stirrat (2001).
[157] Ziai (2004).

ecology's tradition of interrogating the relationship between the ideational and material, plans and practice.

2.6 The ideational and material, plans and practice in environmental governance

Cooper argues that poststructuralist scholars emphasising discourse have been

> content to let unchanging and unmediated images of reason, liberalism, and universality stand in for a much more convoluted trajectory, in which the status and the meaning of such concepts were very much in question. The not-so delicious irony is that the critique of modernity aimed at destabilizing a smug, Europe-centred narrative of progress has ended up preserving this category as a defining characteristic of European history to which all others must respond. Only a more precise historical practice will get us out of the involuted framing of such a debate.[158]

In reaction, in recent decades, scholars have examined the relationship between ideologies/discourses and material practices of 'development', 'colonialism' and 'science' in specific historical contexts. For example, the 'new imperial history' and scholarship on the history of colonial science from within science and technology studies and historical geography examine the tensions inherent to colonial discourses and development policies, the networked nature of knowledge production within empires and the practices of colonial scientists and officials.[159] They have also engaged more seriously with the content of colonial environmental science as 'an exciting field of practice and research, which has left historians a legacy of concepts, and documentation, for the exploration of environmental change'.[160] Meanwhile, anthropologists have examined practices of conservation and development, including the practices by which dominant development narratives

[158] Cooper (2005), p. 6.
[159] Beinart & Hughes (2005); Beinart, Brown & Gilfoyle (2009); Folke Ax et al (2011); Goldman, Turner & Nadasdy (2011); Bennett & Hodge (2015); Hodge (2016).
[160] Beinart & Hughes (2007), p. 3.

are maintained by development actors.[161] Political ecologists have borrowed from these fields to empirically examine practices of environmental management.

Derrida has provided a foundation for some scholars interrogating the tensions inherent to discourses of development and colonialism. For Derrida, discourse is inherently unstable and provisional. The meaning of a text is never closed, because it is not drawn from a stable centre, but rather from a whole host of separate texts and images. Ruling rationalities have a 'constitutive outside'.[162] This instability drives the constant reworking of discourse and materiality, even if it is to maintain the semblance of coherence. Ann Stoler draws on Derrida in her examination of the colonial 'anxieties' evident in the records of the Dutch administration in the nineteenth-century East Indies. For Stoler these archives are filled with the tension between 'rationality' and 'affect': 'if an homage to reason was a hallmark of the colonial, it was neither pervasive nor persuasive, nor was it empire's sole guiding force. Dutch colonial authorities were troubled by the distribution of sentiment, by both its excessive expression and the absence of it'.[163] As another example, much as it ideologically aspired to universalism, nineteenth- and twentieth-century forestry was hindered by what it left out of its models and explanations. Some German foresters, to whom the silvicultural model of forest plantation is attributed, themselves saw and debated the potential effects of monoculture to increase risk of pests, heavy winds and drought.[164] Leading foresters in British India disagreed fundamentally about the rights of local people to use state forests.[165] British foresters in Malaya argued fiercely about the value of artificial plantations over 'natural regeneration' in protected areas.[166]

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[161] Lewis & Mosse (2006); Carrier & West (2009); Fechter & Hindman (2011); Mosse (2004, 2011, 2013); Lippert, Krause & Hartmann (2015); Kiik (2018).
[162] Braun & Wainwright (2001).
[163] Stoler (2010), p. 58.
[164] Hölzl (2010).
[165] Beinart & Hughes (2007).
[166] Vandergeest & Peluso (2006b).

Other studies have demonstrated that discourse and knowledge are dynamically shaped within networks of assimilation and resistance. These replace the 'diffusionist' hypothesis of knowledge flow from 'centre' to 'periphery' in empires, or from 'the west' to 'the south' in international development, with models that recognise multiple and more dispersed centres of knowledge production, and reverse or sideways flows of knowledge.[167] Richard Grove, for example, demonstrated in his examination of the origins and development of 'Western' environmentalism that knowledge production by both colonists and indigenous people at the peripheries of empires was often crucial in shaping the identity of the centre.[168] Peder Anker examines how the early-twentieth-century science of ecology was shaped by dialogue between opposing schools in South Africa and Britain.[169]

Detailed empirical studies by historians of science and the 'new imperial historians' demonstrate that colonial or development ideologies, science and policies were expressed differently in different ecological, economic and political contexts. Vandergeest and Peluso, for example, examining colonial forestry in a diversity of settings in British South-East Asia, find that forestry was shaped by specific political contexts that determined the nature of territorial control over forests, state budget allocations and the nature of control of the means and labour for forest production.[170] Pooley, examining colonial fire management in South Africa, points to the discrepancies between colonial ecologists' 'abstract' theories and their thinking and practice in the field and between official land management policies and real land management practices.[171] Other studies demonstrate the constant reworking and application of 'indigenous' knowledges and practices in relation to changing socio-

[167] McManus (1999); Goldman & Turner (2011); Hodge (2011a); Vandergeest & Peluso (2011).
[168] Grove (1996). See also Dirks (1993); Drayton (2000); Vetter (2011).
[169] Anker (2009).
[170] Vandergeest & Peluso (2006a). Also Hansen & Lund (2017).
[171] Pooley (2014, 2018).

economic, political and environmental contexts. Bedouin communities in Egypt have changed their farming knowledge and practice from dry to wet farming in changing conditions.[172] Q'eqchi communities in Belize have entered into and out of subsistence farming, marketed agriculture and wage labour in response to changing economic conditions.[173] Botanical knowledge in Himalayan villages differs in relation to the different harvesting methods employed by different social groups.[174]

Just as this historical literature attends to the specific practices of development and colonialism, so the anthropology of development examines the practices by which policies and projects are enacted. The ethnography of development overcomes an 'instrumental view of policy as rational problem solving' and 'a critical view that sees policy as a rationalizing discourse concealing hidden purposes of bureaucratic power or dominance', asking instead 'not whether but how development projects work; not whether a project succeeds, but how success is produced'.[175] As David Mosse argues, policies and plans are not 'implemented' in development projects. Rather, project actors must constantly work to maintain the image that a project's outcomes represent the implementation of policy, interpreting and presenting events through their predefined measures of 'success' and 'failure', constructing 'interpretive communities' that can represent the project as required.[176]

For Mosse, the role of policy is to mobilise and maintain political support: 'development policy ideas are important less for what they say than for who they bring together, what alliances, coalitions and consensuses they allow'.[177] For example, Mathews examines the 'public secret' that official fire suppression policy in Mexico is not adhered to either by the Forest Service or fire users. The policy

[172] Briggs *et al* (2007).
[173] Wilk (1991); Zarger (2009).
[174] Ghimire, McKey & Aumeeruddy-Thomas (2004).
[175] Mosse (2004), p. 641 & 646.
[176] Mosse (2004), also Mitchell (2002); Lewis & Mosse (2006); Li (2007, 2016); Van Helden (2009).
[177] Mosse (2004), p. 649. Also Li (2016).

nevertheless serves a purpose, in that it allows the Forest Service to maintain influence and justify its control of forests.[178] Similarly, Vandergeest and Peluso argue that forestry policies in Indonesia were maintained after the Dutch colonial period in part because civil officials and foresters could use them to make both legal and illegal personal gains.[179]

Anthropologists of development have also examined how development actors values and relationships shape development practices and outcomes.[180] Some of this literature examines the role of development actors' personal values and personal reflections on development processes.[181] As Fechter emphasises,

> aid practitioners are not only well aware of what they do, but expend substantial efforts reflecting on what they are doing, why they are doing it, and what they should be doing. In this sense, the realm of beliefs, motivations and commitments represents a veritable underbelly of professional development discourse. Comments and deliberations on these issues typically appear in informal conversations, at social gatherings and on the margins of workshops and meetings, while remaining excluded from policy documents, consultants' reports or programme documentation.[182]

In a similar way, historians of colonial development and colonial science have focused on individual officials and scientists. Pooley, for example, explores the deliberation and insecurity over fire management policies as evident in the writing of colonial officials and scientists in South Africa.[183] Anthropologists have also emphasised the importance of personal relationships and friendships between development actors and participants in shaping development outcomes.[184]

[178] Mathews (2005, 2011). See also a similar argument by Kull (2004).
[179] Vandergeest & Peluso (2006a).
[180] Fechter & Hindman (2011); Lewis (2011). Literature is also beginning to examine in conservation actors in a similar way (Kiik, 2018).
[181] Eyben (2012, 2018); Fechter (2012).
[182] Fechter (2012), p. 1393.
[183] Pooley (2018).
[184] Eyben (2006); Girgis (2007); Heuser (2012).

2.7 Knowledges, expertise and authority in environmental governance

This thesis examines how fire management policies came to be instituted in Belize, including recent policies that call for local participation in fire management. Central to this are questions of why and how certain knowledges have been privileged as 'expert' and granted the authority to inform policy and practice. In this section I briefly review sociological and anthropological literature regarding what constitutes 'expertise' and examine how changing notions of expertise and authority relate to the emergence of 'participatory' conservation and development.

Fleischmann and Briske define 'knowledge' as a 'combination of experiences, values, contextual information, and intuition, which provides a framework to evaluate and incorporate new experiences and information'.[185] Many categorisations of knowledge domains exist in the academic literature, but many of them recognise a broad spectrum between 'scientific' and 'local' knowledges.[186] Fleischmann and Briske define scientific knowledge as that which 'is derived from organized, systematic inquiry and aims for generalizable objectivity, explicitness, abstraction, mechanistic description, and transferability across contexts', while local knowledge is 'developed through resource users' experiences and informal observations of resources', and tends to be 'subjective, holistic, place based, problem oriented, but highly implicit thus complicating attempts to define, encode, and transfer this knowledge'.[187] To these broad ecological knowledge domains, Fleischmann and Briske add a third, which they term 'professional ecological knowledge', that is 'founded upon codification of broad ecological principles, but not necessarily scientific evidence, to legitimize agency programs, support operational efficiency, and encourage user compliance'.[188] They stress that this differs from both

[185] Fleischmann & Briske (2016), p. 2.
[186] Raymond *et al* (2010).
[187] Fleischmann & Briske (2016), p. 2.
[188] Ibid., p. 1.

scientific and local knowledge in that it has fewer and less direct information feedbacks to create new knowledge about the environment. In this thesis I examine the role of these three broad knowledge domains in the creation and evolution of fire management policies in Belize.

The knowledge of 'experts' is often granted authority in any given society. The sociological and anthropological literature provides two broad ways of understanding 'expertise': as something socially constructed and as something real. Anthropologists argue that expertise should be conceptualised not only as something people possess, but also as something achieved socially, as 'something that people do'.[189] Expertise must perpetually be enacted, be it through the undertaking of institutionalised training or the employment of language to naturalise particular forms of knowledge.[190] For example, Uma Kothari charts how, in the transition from colonial to international development, development actors no longer came to derive their authority from the cultural capital associated with the colonial 'centre', but, rather, as professional technical experts.[191] If expertise is socially constructed it follows that the contestation of expert knowledge can be about more than an interrogation of the knowledge they are deemed to possess, and a rejection of the social practices by which they enact their expertise.[192] Similarly, the acceptance of expert knowledge can be a pragmatic social response, one not based upon the quality of the knowledge itself.[193]

Ideology and discourse can play a part in defining certain forms of knowledge authority as 'expertise'. Above I presented Scott's argument that an ideology of 'high modernism' lends authority to scientific discourse. The wider

[189] Summerson Carr (2012), p. 18.
[190] Wynne (1992); Shapin (1994); Mitchell (2002); Li (2007a); Mosse (2011).
[191] Kothari (2005).
[192] Wynne (1992).
[193] Fischer (2000).

implications of such an argument are that environmental narratives can ‘become accepted as 'fact' in the absence of what most natural scientists today would acknowledge as the praxis of science, the standardised and 'transparent' collection of data to explore propositional or 'testable' statements’.[194] This is akin to the process by which the ‘professional ecological knowledge’ that Fleischmann and Briske describe comes to guide institutions.[195] As another example, for previously colonised peoples, their active positioning as possessors of ‘indigenous knowledge’, thus framed by discourses of indigeneity, can be a strategic alignment, to win benefits within participatory sustainable development projects for instance.[196]
While expertise may in part be socially constructed, sociologists Harry Collins and Robert Evans stress that expert knowledge is also something real. They argue that becoming expert involves developing tacit knowledge that can only be gained through deep social immersion in groups who possess it.[197] This can be the ‘ubiquitous tacit knowledge’ common to a society (for example, the ability to speak a language or understand cultural norms) or ‘specialist tacit knowledge’ gained through enculturation and deep experience within a specialised group and context (for example, an ecology department at a university, or Cumbrian sheep farming).

Collins and Evans’ typography provides a broad conception of the types of knowledge that can constitute expertise, beyond the scientific. For them, some ‘local’ knowledge should be considered expertise. Their work, with studies of the social construction of expertise, can be understood within a broader movement, since the latter twentieth century, that has challenged the assumption that technical experts should direct policy making and implementation.[198] This is linked, as

[194] Sullivan (2000), p15. See also Forsyth (2011).
[195] Fleischmann & Briske (2016).
[196] Sundberg (2004); Wainwright (2008); Li (2004, 2007a).
[197] Collins & Evans (2008).
[198] Fischer (2000); Kleinschmidt, Böcher & Giessen (2009).

discussed in Section 2.2, to the emergence of 'participatory' conservation and development in the 1980s. As I discussed there, it has been argued that the 'professionalisation' of the mainstream development industry has undermined participatory development. For Kothari, 'although the intentions of many participatory advocates and practitioners are concerned with decentring the authority of the development professional, its co-optation into mainstream development discourse and practice and incorporation onto the neoliberal development agenda has ironically reinforced the centrality of Western knowledge and expertise'.[199] In this thesis I am concerned with identifying the forms of knowledge and expertise that have directed fire management in Belize. This enables me to analyse the extent to which contemporary 'participatory' fire management in Belize represents a departure from previous approaches by decentring technical expertise. In conducting my research I thus aimed to identify real, tacit, expertise in understanding fire and its management, as well as the social contexts and practices which have granted authority to certain fire managers at the expense of others.

2.8 Conclusion

This chapter has examined fire management since the seventeenth century in the context of the history of conservation and development in European and North American thought. Wildfire was deemed adverse to the environmental conditions desired by foresters and nature conservationists. Since the mid-twentieth century, if only gradually, some environmental managers have come to accept fire as an inherent element of ecosystems. They have begun to make use of prescribed fire in environmental management. Some have also recognised the cultures of local fire users and enrolled them in fire management. Fire suppression, nonetheless,

[199] Kothari (2005), p. 437. See also Green & Lund (2015); Lund (2015); Scheba & Mustalahti (2015).

remains dominant in environmental policy worldwide. The broad narrative I have presented, of a century of fire management globally, demonstrates that historical approaches to fire management have left discursive, environmental and social legacies and thus have contemporary relevance.

This analysis demonstrates that fire management *policies* have been influenced by ideology and discourse. Historians and anthropologists show that environmental management *in practice* is the outcome of local ecological, political and economic contexts. Speaking of fire management, Eloy *et al* call for more research to 'understand fire policies, norms, sciences and use practices in the context of the territories in which they are enacted, each with its own dynamics and logics'.[200] My contribution to this literature in this research is from empirical study of the specific context to Belizean fire management policies and attention to their workings in practice. As noted, I did so through a combination of ethnographic work, oral history and archival research. The following chapter details how this research methodology enabled me to study present-day Belizean fire management in its historical context, critically assessing the relevance of historical sources to historical fire management *in practice*.

[200] Eloy *et al* (2019), p. 6.

3

Research methodology: retrieving ideas and practices of fire management in Belize

> *The paradoxical 'resolution' of the realist-constructivist contradiction … lies not in choosing sides nor in searching for some elusive balance, but rather in admitting, in true paradoxical fashion, that both sides are basically correct as they stand yet neither is fully correct without the other. It is thus a resolution that defies resolution. Paradox suggests that many important truths have their shadow, and that they and their shadow constitute a more whole - though certainly also a more tense and twisted - truth* (Proctor, 2001, 235).

> *The past exists not only in records of the past, but survives in buildings, objects and landscapes of the present day* (Cohn, 1987, 4).

This chapter discloses my research process, and attends to the production, transcription and interpretation of the various lines of evidence that I turned to. I visited archives in the UK and Belize. I conducted 26 interviews with officials, scientists and NGO staff from Belize, the UK and the USA, 42 interviews with farmers and 367 household surveys in the villages of Bladen, San Isidro and Trio. I spent a cumulative thirteen months living in Belize to conduct the research and work part-time for the Darwin Project. During this time, I was able to make ethnographic observations of the Project activities, TIDE's fire management work and local fire use.

My research questions required me to take seriously both the ideological construction and justification of fire management in policies, plans and reports and the materialisation of fire management in the practices of different actors. I examine what these questions demanded and depended upon ontologically and epistemologically: the paradoxical combination of realist and constructivist positions. The chapter stresses the importance of carefully and critically comparing different

sources to draw conclusions about the past. For the earlier history, particularly, I drew predominantly upon archival material. The addition of oral histories and ethnography to my research methodology shaped my analysis of these archived texts, enabling me to avoid over-emphasising the importance of ideas and policy in shaping fire management on the ground. The chapter demonstrates the important of reflexivity throughout my research process.

3.1 Epistemology and research ethics

For Paul Robbins,

> political ecology occurs at that moment when the human–environment accounts that we assemble become precarious and unstable. There is always a need to empirically explain important outcomes in land change, human vulnerability, environmental hazards/risk, and human health, especially relative to the role of power in causing these outcomes. But this need, or drive, is inevitably accompanied by the necessary counter-urge to advance scepticism about any such explanation, its implication in perverse systems of power, and its complicity in reproducing the very systems of power it seeks to unmask. The name we give to these simultaneous urges … is political ecology…. Political ecology is a symptom of the larger problem inherent in the rigorous pursuit of knowledge in a world filled with contradictions.[1]

Political ecology thus works in and emerged from explicit study of the entanglements between nature and culture, the material and ideational. Wainwright and Barnes suggest that, faced with such dualisms, we should not aim to collapse them, but should make it our explicit aim 'to call into question the effect of that distinction on our thought'.[2] Borrowing from Derrida, Wainwright uses the term 'aporia' to describe the resulting position in which a researcher critiques yet 'inhabits intimately' certain discourses.[3]

In this thesis I acknowledge the importance of understanding the ways in which people know and discursively represent their environments but do not rule out

[1] Robbins (2015), p. 97-8.
[2] Wainwright & Barnes (2009), p. 968. Also Braun & Wainwright (2001).
[3] Wainwright (2008), p. 269.

a separate reality that shapes and constrains those ways of knowing: I combine ontological realism with epistemological relativism. I understand the social construction of nature to include the ways in which societies materially produce their environments. This position has been variously termed 'soft', 'weak' or 'mediated' constructivism.[4] While not suggesting that knowledge can ever be purely objective, it allows for limits to its construction, allowing for knowledge claims to have differing levels of subjectivity. It draws attention to the ways in which scientific knowledge is socially produced but accepts the scientific method as a useful approach in many contexts. This form of constructivism aligns with the stratified notion of reality of a critical realist ontology.[5] Employing a critical realist ontology in my research meant that, while most of the sources with which I worked were textual or oral and so inherently infused with the social, I took seriously the reality of the savanna ecosystem, and the academic theory that has engaged with its ecology.

For Robbins, political ecologists have a 'Jekyll and Hyde persona', carrying a critical 'hatchet' to take apart certain accounts of environmental change, but simultaneously sowing 'seeds' for alternatives.[6] This dual persona makes for a philosophically and ethically challenging position. That political ecologists are often activists, with aims towards environmental justice, means that they must constantly negotiate critical and normative positions. In conducting this research, I gradually found a position as critic. My resultant thesis dissects the way in which Belizean fire management has been treated in policy as apolitical and attends to the political dynamics that nonetheless shaped fire use and management in practice. I critically examine the ways in which fire management policy and practice privileged certain users and uses of the savanna and of fire at the expense of others. In highlighting

[4] Proctor (1998); Demeritt (2001, 2002).
[5] Proctor (1998); Forsyth (2001).
[6] Robbins (2012), p. 20.

these dynamics, I hope to open the possibility to stakeholders of a more just approach to Belizean fire management: one that accounts for the needs of local fire users and for the ecological necessity of fire in the savanna ecosystem. Yet the thesis is not a prelude to policy recommendations. Following Tania Li's approach in *The Will to Improve*, I do not believe that

> every critical scholar should also be a programmer, coming up with new plans to improve the world … I made an argument for keeping the roles of programmer and critic distinct. I think both are valid and important, and the same person can do both over a lifetime, or perhaps on different days of the week. But if I had been obliged to end the book with a prescription for how to do development better, I could not have stood back far enough.[7]

This is not to say – as I note in the concluding chapter – that I don't think this thesis 'useful' to stakeholders in Belizean fire management, both in the research process, and in its written form.[8]

In my research I inevitably faced an ethics of choice in how I presented and discussed material. As Li notes, there is 'no pure space from which to speak or write, and no avoiding the consequences'.[9] A reflexive awareness of researcher positionality, and the way that it limits research practically, epistemically, and discursively is the basis from which research ethics proceed. Since the late 1980s, feminist and postcolonial studies in particular have stressed the importance of a researcher explicitly acknowledging her positionality.[10] They note that researcher positionality is not fixed but constantly reworked in the process of conducting research.[11] Before visiting Belize for the first time in 2016, I did not comprehend the ways in which such journeys 'transport us over enormous distances [and cause] us

[7] Li, pers. comm. to Robbins in 2010 (Robbins, 2015, p. 227.).
[8] On what 'useful' might mean in political ecology research see Blaikie (2012).
[9] Li (1996), p. 522.
[10] Within feminist geography, for example Harding (1987); Stacey (1988); Mc Dowell (1992); Katz, (1994); Nast (1994); Sundberg (2015); within postcolonial studies for example Spivak (1999); Sidaway (1992).
[11] As demonstrated very clearly by Sundberg (2004).

to move a few degrees up or down in the social scale…. the colour and flavour of certain places cannot be dissociated from the always unexpected social level on which we find ourselves in experiencing them'.[12] My personal research experiences were influenced particularly by my gender, by being white and British in an ex-colony where US and European tourism is now the largest sector of the economy, by my connections with the DFID Darwin initiative project and NGO TIDE, and by my ambition of writing a thesis within a British academic institution. On a material level, positionality influences the kinds of texts, people and situations to which researchers have physical access and shapes our social encounters with these sources. Positionality influences our ability to comprehend, access or combine knowledges. We may wish to 'recover' the knowledges of our research subjects: yet their ways of knowing the world may not accommodate our own epistemologies. Briggs and Sharp provide an example in relating how their understandings of the concept of distance were challenged by their research with the Bedouin in Egypt.[13]

Faced with the 'aporia' of critiquing that which we ourselves 'inhabit intimately', Spivak's writings call for a 'hyper self-reflexive' deconstructivist approach, which looks for the ways in which our own discursive categories are constantly subverted in our everyday research experiences.[14] Spivak calls this 'unlearning': 'to learn to read anew, to learn apart from knowledge production in the mode of empirical data collection'.[15] In this way we might see research as a two-way process in which we do research 'with' and not 'on' our research subjects.[16] This leads us to question our notions of research 'impact' or 'dissemination' to understand that research shapes *us* and can 'give back' to or influence other actors

[12] Levi-Strauss (1989) in Sidaway (1992), pp. 403-404.
[13] Briggs & Sharp (2009). See also Nadasdy (1999) and Cram (2009) for discussion of the incompatibility of particular indigenous knowledges with Western research epistemologies
[14] Kapoor (2004); Wainwright (2008); Asher & Wainwright (2018).
[15] Spivak (2006) in Wainwright (2008), p. 202.
[16] Clegg & Slife (2013), p. 37.

throughout, and not just in its final written form.[17] It may make what is traditionally considered research 'failure' a central part of what it means to do research.[18] It might also mean attending to the ways in which our emotions shape and drive our research; attending to our emotional reactions can enable us to interrogate the moral arguments with which we and others align.[19] As De Leeuw demonstrates, these emotional reactions may not only be to people and contexts that we access face-to-face', but also to material in the archive.[20] In the following sections, I illustrate some of my own 'unlearning' experiences in conducting this research, and, from this use, reflect on the research process, and indeed, upon the later writing of the research in this form.[21]

3.2 On my research methodology

This study draws upon historical and contemporary evidence of ideas and practices of fire management in Belize: ecological and archaeological research (accessed secondarily via the limited academic literature); political or institutional texts and newspaper articles; surveys and interviews and ethnographic observations undertaken by me. As noted in Chapter one, the direction for my research emerged in reaction to my experiences in Belize working as the Project Officer for the Darwin Project. As my interest in the history of Belizean fire management emerged and grew throughout the research, so too did the relative importance of archival material to my analysis. I spent a total of thirteen months in Belize conducting this research alongside the Darwin Project work: in 2016 from January to April and August to September; in 2017 from January to June; in 2018 from January to April. I also

[17] Pain, Kesby & Askins (2011); Staddon (2014).
[18] Harrowell, Davies & Disney (2018).
[19] Anderson & Smith (2001); Bondi (2005); Smith (2014); Askins & Blazek (2017).
[20] De Leeuw (2012).
[21] I found the personal and honest reflections of a series of PhD students in the collection of essays edited by Lunn (2014), and Fine (1993), for example, to be supportive reading while conducting my research.

visited UK-based archives. During this time in Belize, my time spent attending activities and writing reports for the Darwin Project took on average two or three days a week.

I conceive of my access to 'knowledge' about fire management in three stages. The 'raw' material with which I worked had an initial *creation* (sometimes elicited by me), and subsequently, possible decay, reworking, reordering and preservation. Secondly, I chose elements of the material to attend to in making my own *transcription* of it. Finally, I made *interpretations* from the combined transcriptions. These three stages were not necessarily chronologically or completely distinct from one another and sometimes underwent several iterations. Each stage involved 'performative' elements on behalf of human actors as well as exposure to 'stochastic' elements.[22]

The following sections outline my research methodology by following the textual, oral and ethnographic material that informed this thesis through these three stages. That allows me to present and understand something of the constraints and the 'room for manoeuvre' I was afforded in conducting and presenting this research. For several reasons, my methodology was not clearly outlined before the research began. As I described in Chapter one, I had not visited Belize before my PhD began in 2015, and the direction of my research emerged gradually from my experiences there. Moreover, I have no formal training in the social sciences. I developed an understanding of the processes of conducting archival research, research interviews and ethnography through iterative reading and practice during the research. I thus present my methodology in the past tense to reflect that it could only be *articulated as* such as I came to write this thesis. Let me demonstrate with a 'vignette' the

[22] Matthews (2016), p. 214.

initially unplanned nature of my research process as it shaped the knowledge I present in this thesis.

Determined to 'understand' local culture and fire use and early into my first visit to Belize in 2016, I arranged homestays for myself in the five villages targeted by the Darwin Project. Over my first breakfast in Bladen village, my host, a village leader, also one of TIDE's rangers, explained to me that in his village most 'people won't know how to talk to you'. He described the process of acculturation by which he learned to follow and contribute to the type of meetings he was frequently required to attend with the Maya Leaders Alliance, TIDE and external organisations. At the time, I did not fully comprehend what he meant; I had met plenty of English speakers in Belize (such as my host), and felt that, with their assistance in translation from the languages of Q'eqchi or Spanish, I should be able to answer questions I had: Why did local people use fire? How frequently was fire used for hunting?

These homestays, and work with the Darwin Project, enabled me to develop friendships and working relationships in the villages. Many insights had already followed from my conversations and observations: Yet, by 2017, perhaps influenced by my background in natural science, I felt that to have more 'conclusive' evidence of fire use in my thesis, I needed to employ a more 'formal' research methodology. I designed a short survey to administer to most households in the villages of Bladen, San Isidro and Trio. Knowing that use of fire for hunting (being illegal) was something that people were unlikely to want to confess to me, among other questions, I included one specifically designed to give people anonymity using an 'unmatched list'.[23] Half of the households would be shown and read the items in the

[23] The 'unmatched list' technique is used to give respondents anonymity when answering sensitive questions. Among its applications it has been used in conservation science to obtain data, for example, about illegal hunting. See Glynn (2010); Nuno *et al* (2013); Nuno & St. John (2014).

list to the left in Figure 3.1, and half of them those on the right (which contained, in addition to the other items, the 'sensitive' item: fire use for hunting). I would then ask them to indicate only the total number of the statements on the list that applied to them. With a large enough sample size, data from questions like this can be used to obtain an estimate of the fraction of respondents to whom the sensitive item applies. I designed the question carefully: To avoid the likelihood that a respondent had to answer '0' or '5', I balanced items so that at least one item would generally apply to both poorer and richer, Q'eqchi and Spanish-speaking, households; I used pictures to accompany statements for illiterate respondents; I worked with local people to translate the statements and questionnaire instructions into Spanish and Q'eqchi. I found and trained local research assistants as translators and lived in the villages for a month while I conducted the survey with over 350 households.

This 'fire use for hunting' question proved incredibly difficult to administer. Most respondents did not understand that I did not want them to indicate directly which of the items on the list applied to them; they failed, in other words, to understand that I was trying to give them anonymity. Q'eqchi respondents, particularly, found it difficult to answer the question posed, with a single total number of items. My translators frequently had to reframe each statement as a 'yes' or 'no' question, which negated the purpose of using an unmatched list technique. Suspicion of any kind of survey, particularly among Spanish-speaking respondents, meant that some respondents simply said 'none' to any list they were shown. Nevertheless, I persevered with the survey as planned, because of the other questions, and because I did not want to admit 'defeat'; I felt a sense of accountability to my research plan. After a month of intense and tiring fieldwork, I had collected demographic and agricultural fire use data (which, as described in Section 3.4, I used to identify households for follow-up interviews), but my survey had not produced a dataset that could robustly answer my question of how many

Figure 3.1

'Unmatched list' question from my fire use survey. Households in group A were shown the uppermost list, and those in group B the lower list. Households were asked to give the total number of items on the list that applied to them.

households used fire for hunting. By the time I came to write my thesis, I had nonetheless gained ample insight into local social relations and fire use. These insights were gained not via pre-conceived statistical methods, but by building trust and making more intuitive and spontaneous observations and conversations with people in Belize.

My use of the unmatched list technique was a research 'failure' in the traditional sense, but an unexpected source of insight into the dynamics that operate similarly when activities are pre-conceived in development projects. The barriers between me and my respondents were greater than language. Methods that, to me, seemed simple and well-meaning, did not provide easy channels for respondents' participation. Similarly, development project proposals often contain activities that, it is assumed, will enable the participation of local people, but which may exclude certain groups or individuals.[24] The experience made me more attentive to gaps between policies and plans and practices in development; ultimately, a phenomenon of importance in this thesis. By implication, just as my research methodology could not be pre-conceived, the research questions articulated and addressed in this thesis emerged and evolved through the research.

3.3 Using archival traces

Postmodernism has overthrown the 'archival myth' that we can turn to collections of documents as neutral repositories of information.[25] This paradigmatic shift from viewing 'archive-as-source to archive-as-subject' demands a new attention to the agency, and therefore power, involved in the practices of creation, collection, reworking, ordering and displaying of records.[26] It broadens our notions of the

[24] Nadasdy (1999); Mohan (2001); Mosse (2001); Lund (2015); Van Kerkhoff & Lebel (2015).
[25] Cook (2001); Schwartz & Cook (2002); Withers (2002); Lorimer (2009); Mills (2013).
[26] Mills (2013), p. 2.

archive itself, both drawing attention to the 'topological' (physical) sites in which records are located, as well as the wider 'nomological' (discursive) spaces that they occupy and that attribute them meaning.[27] The archive, is after Derrida and Prenowitz, 'spectral', removed from the events and objects to which we make it speak: a 'trace always referring to another whose eyes can never be met'.[28] This section makes explicit the processes behind my encounters with the archival traces drawn upon in my research. See Table 3.1 for a summary of the archives and digital sources accessed.

Each of the documents I drew upon in my research had undergone an iterative process of inscription, from its original creation, to possible reworking, ordering, decay, preservation and cataloguing. I could not always know much about the production and archivisation of the sources I accessed, but it was important to understand as much as possible about these processes.[29] To do so, where available, I referenced published research guides to particular archival sites and spoke with staff and other researchers who knew the collections.[30] If the archive is both a topological site and nomological space, then there are many elements of an archival trace that can be influenced by its processes of creation and archivisation, and, thus, many ways in which these processes can present themselves in research. A record has more than content. It has a certain *form*. It is physically located in a site, which can include structures, such as searching aids or filing cabinets that influence access to it.[31] It is situated within the discourses of its creators and official or unofficial archivists.

[27] Osborne (1999).
[28] Derrida & Prenowitz (1995), p. 54.
[29] As a demonstration of why this is important, Portuondo (2016) describes how the original purpose or 'telos' of a record collection can survive subsequent re-working.
[30] The one case where a published research guide existed was for the Colonial Office records at the UK National Archives: Banton (2008).
[31] See DeSilvey (2004); Lorimer (2009) and Cresswell (2012) for discussion of archival sites.

Table 3.1 Sources consulted for historical texts

Archive or source of material	Physical location	Type of material of held and time spanned by collection	State of 'archivisation' and implications for finding relevant material	Material used in the research	Date(s) of visit
UK National Archives (TNA)	Kew, London, UK	Holds records of the British government, including those relating to the British Empire. The material is organised by government department, and then by type of record into chronological series. While various government departments may have created and collected material about Belize, most important are the records of the Colonial Office. This material is voluminous and includes series of despatches received from Belize (within which reports, small maps etc. may be included), records of legislation passed, sessional papers from government in Belize, some annual reports of government departments, 'blue books' of statistics. The series' of material under the Colonial Office and specifically about Belize variously span the dates 1630-1977 (though the Colonial Office was not founded until 1854, earlier material pertaining to overseas territories from the Privy Council and War and Colonial Office is labelled as 'Colonial Office' material).	Official government archive, with an online catalogue called 'discovery'. The Colonial Office material is mostly catalogued in series' by 'type', e.g. general correspondence, legislative records, and many of the records are not catalogued online in any detail beyond their date (though following the introduction of system of filing despatches by subject in 1927, the very general topic of a series of despatches is summarised in one or two words in the online catalogue). The indexes to the record books, as created by the Colonial Office, aid searching a large record book (which may cover up to several years of records) once it has been ordered in the archive. Due to the huge volume of material in the national archives, the archivists are can only be familiar with a small fraction of the records and could only give me general information about the Colonial Office records.	I consulted a wide range of material in this archive (see also Bibliography). Most records I looked at were from the Colonial Office series, though the online catalogue threw up an occasional record from another department, such as several economic advisory reports created for the Treasury. The most useful records for my research were the despatches, which do not go past 1951, in which I found miscellaneous reports from the Forest Department and could read something of the Colonial Office's reaction to and funding of fire management programs. I accessed the annual reports of the Forest Department in a series of administrative reports. I found much material pertaining to savanna fires after 1920 (owing to the establishment of the forest department, and initiation of governmental fire management): it was by consulting earlier records that I was able to choose this date as the 'natural' starting point for the detailed narrative in my thesis.	27 – 29/10/2016 06/12/2016 10/12/2016 13 – 16/12/2016 04 – 06/01/2017 29/08/2017

Belize Archives and Records Service (BARS)	Belmopan, Belize	Holds records of local administration during colonial period, of government after independence, and other miscellaneous reports deposited by organisations and individuals. Early colonial records are sparse, and many were destroyed in 1962 by the colonial administration (Cobain, 2016). Few documents have been deposited by government since independence. The archive also holds near complete collections of most Belizean newspapers (at least post 1900).	This is a state-managed national archive, though depositing material in it is not attempted seriously by any government departments. There is a digital catalogue of the archive, though it is available only at the site and not online. There is sufficient detail in the catalogue that it was possible to use keyword searches to find relevant material. The exception was for the newspaper archive, which is catalogued only by date, and many of which are on microfiche. The staff of the archive have familiarity with many of the records and were able to assist me with contextualisation.	I consulted a wide range of material in the archive, in particular minute papers from the Colonial Secretary's office (for the limited years where material remains- the 1920s and 1950s only), miscellaneous governmental and non-governmental reports from the second half of the twentieth century and newspapers. Because the newspapers are catalogued only by date, I often had to work my way through whole years of material to find particular events of which I only knew the year, and not a more precise date.	13 – 14/03/2017 20 – 24/03/2017 27 – 28/03/2017 19 – 23/06/2017 29/06/2017 03 – 05/07/2017
Belize National Heritage Library	Belmopan, Belize	Holds various publications pertaining to Belize, including some governmental reports. Also holds newspaper collections (though more limited in scope that those held by the Belize Archives and Records Service)	A digital catalogue for the collection was available onsite but not online and contained sufficient detail for me to use keyword searches to find relevant material.	A handful of miscellaneous reports, particularly from development projects in the 1980s and 1990s.	18/03/2017 20/03/2017 22/03/2017
Oxford University: Weston Library Special Collections (OWL)	Oxford, UK	Among its extensive collections, Oxford University holds in its Commonwealth and African Collections material deposited for various reasons by individuals, including several foresters or politicians that studied in Oxford and later served in the Colonial Service in Belize.	There is an online catalogue, in which the material itself is not described in detail, beyond its volume. The catalogue gives detail about the careers of the people who deposited the material, and I located material of potential relevance by finding individuals where 'Belize' or 'British Honduras' featured in a description of their careers, and then using my judgement as to whether their described connection with Belize made it worth looking at the material for a mention of fire management.	This material was a useful complement to the material in the UK and Belize national archives for understanding the early history of the Forest Department. Records left by Duncan Stevenson, Assistant Conservator of Forests in Belize in the 1920s, included various reports and concession agreements and his handwritten daily work diaries for the years 1924-27. The records of Neil Stevenson, his brother, Conservator of Forests in Belize in the 1930s and 1940s, included draft forestry development plans and copies of his correspondence in the 1970s and 80s with researchers writing of the political history of Belize. The records of the forester Colin Eric Duff included a draft history of forestry in Belize written in the 1960s.	07/12/2016

SOAS special collections: Wesleyan Methodist Missionary Society Collection	SOAS, London, UK	Archives of British interactions abroad from missionary societies, NGOs and campaign groups, and business organisations, as well as the papers of individuals, including diplomats, campaigners, and academics. Of relevance is the (Wesleyan) Methodist missionary society collection, holding letters and reports from Belize covering 1804-1950	The Wesleyan Methodist missionary society collection does not have a catalogue online. At the archive, a paper catalogue orders the letters sent from missionaries to the Society by country (so the Belize letters are collected together) and then by year, by the name of the missionary and the town in which they were stationed. The catalogue does not contain information about the contents of the letters. The handwritten letters have been preserved on microfiche, making them laborious to read. I had little in the way of a search strategy at this archive and could only order material for certain dates.	I read descriptions of urban fires in Belize City, and the occasional description of indigenous communities, but the letters largely discussed life in towns, and particularly around the church. I did not, therefore, continue to look at the whole collection, and ultimately did not use any of this material in the thesis.	31/10/2017 12/12/2017
Cambridge University Library	Cambridge, UK	Cambridge University holds in its Royal Commonwealth Society Collections, textual and photographic material on the Commonwealth and Britain's former colonial territories.	There is an online catalogue 'Janus', which gives brief descriptions of the material. These vary in detail. I searched this for 'British Honduras' and 'Belize' and was able to locate a number of collections of potential relevance, including photographic collections and the records of various British colonial administrators in Belize.	I looked largely at the collections of George Arthur, Superintendent in Belize in the early 1800s (records spanning 1803–1837) and Frederick Hardiman Parker, Registrar of the Supreme Court, Provost Marshal and Keeper of Records in Belize in the late 1800s (records spanning 1775-1890). Both were useful, containing transcripts of early legislation in Belize, including regulations around fire use in Belize City from 1806. I also looked at several photograph collections made for the British government, which included imagery of the pine industry in Southern Belize in the 1950s.	08 – 09/12/2016
Royal Geographical Society Archive	Kensington, London, UK	The RGS collection includes manuscripts of papers from the Geographical Journal and presented at the Society, as well as travel writing and maps.	There is an online catalogue, which includes brief descriptions of the material, which I searched for 'British Honduras' and 'Belize' to find material of potential relevance to the research.	I looked at travel writing and manuscripts by several collectors and colonial administrators in Belize. Though fascinating insights into nineteenth and early twentieth century impressions of Belize by British visitors, these largely had no direct relevance for the research. I also looked at several maps. Unfortunately, I was not able to take photographs of these, and my visit came too early in the research to take very useful notes from them. Luckily, I was later able to look at most of these maps again in other collections.	01/11/2016

Kew Garden Archives	Kew Gardens, London, UK	The Kew Gardens archive includes letters from the Directors of Kew Gardens to scientists and collectors abroad (spanning 1809-1928), as well as miscellaneous reports and correspondence and rare publications.	There is an online catalogue, which includes brief descriptions of the material, which I searched for 'British Honduras' and 'Belize' to find material of potential relevance to the research. The Directors' letters have been digitised (though only some have been transcribed) and can be accessed online.	This collection was useful for insights (in the director's letters) into early interest in savanna species, such as Caribbean pine, by Kew Gardens. I also found many of the Forest Department's annual reports, and other official reports on forestry and agriculture in Belize in the early twentieth century. There was some correspondence with the Colonial Office over the appointment of the first forestry officials in Belize.	02/11/2016 06/01/2017
British Library	Euston, London, UK	The British Library holds rare publications and newspaper collections.	There is an online catalogue for the British Library. I searched this for specific publications I had already seen reference to but that I had not been able to access elsewhere.	Most of the publications I read in the British Library were journal articles that I had not been able to find online. The Belizean newspapers in the collection are identical to those in the Belize Archives and Records Service in Belmopan (which were copied from the British Library), where I had already looked at newspapers.	10/11/2017
Belize Estate and Produce Company Archive	Ladyville, Belize	As many of BEC's lands were bought by Bowen and Bowen, the company's records are held in a warehouse at the Belikin beer/ Coca Cola Factory. There are four metal boxes of material including financial records, annual reports from managers in Belize, meeting minutes of the board and other miscellaneous letters and reports, dating from the 1870s to the 1960s.	I obtained access to the material by permission of the factory manager. There is no catalogue of the material. It was sorted by type – e.g. financial reports were all together, but they were not in date order.	Of relevance to the research were several reports of visits to Belize by company board members in 1904 and the 1930s, as well as board meeting minutes from the 1940s and 1950s, from which I was able to track something of the development of the pine industry on BEC's lands.	30/06/2017
Belize Forest Department Belmopan Office	Belmopan, Belize	At the Forest Department's main office are the remnants of the Department's library of books and journals as well as a host of reports, data, aerial photographs. The material spans the past century.	I obtained access to the material by permission of the Forest Department. There is no catalogue of the material (though stickers on the older books suggest the library was once organised and catalogued) and it is unsorted on the shelves. None of the staff I spoke to knew of the contents of the material. I went through all the material. I also supervised an intern from the University of Belize's Environmental Research Institute (ERI) in May and June of 2017, to create a catalogue of the material. The ERI may at a future date scan certain reports for their digital repository of material about the Belizean environment.	Looking at this whole jumbled collection (even the material that was not of direct relevance to my research) was an interesting insight into the history of the Forest Department as an institution and of its external influences. Alongside colonial reports and publications written by the Imperial Forestry Institute, were manuals, for example for fire management, from the US and Canadian Forest Services, dating from 1960-80. I found much of interest among the reports I found.	15 – 17/03/2017

Belize Forest Department Augustine Office	Mountain Pine Ridge Forest Reserve, Belize	At Augustine I found a huge array of records of the Forest Department's work, including piles of exercise books containing the daily work diaries of Forest Guards and Forest Officers, financial records, correspondence with other forest offices, reports, maps, aerial photographs, datasheets and copies of scientific journals. The material spans a period from the 1940s to the 1990s.	I obtained access to the material by permission of the Forest Department. There is no catalogue of the material. It is completely unsorted and in condition of decay in several abandoned buildings and in a back-room of the current office (Figures 3.3 – 3.6 show these conditions). None of the staff I spoke to knew of the contents of the material. There is a lot of material, and I was not able to look through more than a fraction of it in the time I had there.	Looking at these records of local administration of the Forest Department was a very useful complement to the more official reports I viewed at the UK National Archives. It gave me an insight into the administrative structure of the Forest Department in the colonial period. Their decay was also evidence of the irrelevance placed on these records by the present staff of the department. Though much of the material pertained to the Mountain Pine Ridge Forest Reserve rather than the Southern Coastal Plain (which was under the administration of Melinda Forest Station, now closed, and from which no records remain), there was nonetheless some very useful material about the Southern Coastal Plain, particularly in correspondence with other Forest Stations discussing development or working plans, and in departmental conference minutes.	26/03/2017
Belize Forest Department Machaca Office	Machaca Forest Reserve, Belize	At Machaca I found records of the Forest Department's work, including correspondence with other forest offices, reports, maps and datasheets. The material spans a period from the 1930s to the 1990s.	I obtained access to the material by permission of the Forest Department. There is no catalogue of the material. It is unsorted and in condition of decay in several filing cabinets and boxes in a back-room at the Forest Station (Figure 3.2 shows an example of such material). None of the staff I spoke to knew of the contents of the material. I looked through all of the material and examined things of relevance in more detail.	Looking at these records of local administration of the Forest Department was a very useful complement to the more official reports I viewed at the UK National Archives. Their decay was also evidence of the irrelevance of these records to the present staff of the department. Though much of the material pertained to the area around Machaca rather than the Southern Coastal Plain (which was under the administration of Melinda Forest Station, now closed, and from which no records remain), there was nonetheless some very useful material. Some records from the 1930s were particularly interesting, including field data and a report of a pine enumeration of the southern coastal plain.	09/06/2017
Neil Bird's collection of records	Oxford, UK	Neil Bird worked in Belize for 6 years in the 1990s for a UK-funded development project with the Forest Department. He has a collection of records of that project and earlier material relating to forestry in Belize that he collected during his time there.	Neil Bird kindly shared his collection with me and discussed its contents to me. I went through all the material, examining items of relevance in greater detail.	Neil's collection contained many reports I had already seen elsewhere (the visit being late in my research), but I found several useful reports from the 1990s about the establishment of the Payne's Creek National Park.	11/06/2018

E-book sites: Digital library of the Caribbean, Google Books and others.	Online (sometimes accessed via Edinburgh University Library)	There are several travel accounts of Belize from the seventeenth to nineteenth centuries available online.	Most of the e-books I accessed online I had searched for specifically, having seen reference to them elsewhere.	I used a variety of seventeenth to nineteenth century travel accounts in the research.	Throughout the research
Online scientific journal publications	Online (sometimes accessed via Edinburgh University Library)	Visiting scientists, and colonial forestry staff published about Belize in the Empire Forestry Journal, Geographical Journal, Tropical Woods, and other scientific journals.	Most of the journal articles I accessed online I had searched for specifically, having seen reference to them elsewhere.	I used a variety of journal articles in the research. These were useful for understanding changes in scientific accounts of the savanna over the past century, and for understanding the work of the Forest Department in Belize.	Throughout the research
Digital records held by organisations	Online	TIDE, the Ya'axche Conservation Trust, the Statistics Institute of Belize and other organisations have pdfs of reports and other documents on their websites.	I accessed this material on an ad-hoc basis, when it came up from internet searches, or when recommended to me.	For the more recent decades, organisation websites were generally a more useful source of project reports and other documents than the archives I visited.	Throughout the research

Let me illustrate, by reference to records I examined of the Colonial Office at the UK National Archives, the importance of the form of a record in shaping encounters with it. At various points, the Colonial Office introduced new systems or issued instructions for record creation. In 1868, 'minute sheets' were introduced, which were attached to series of incoming correspondence to track discussion within the Office about successive despatches. Prior to this, decision making was, on the whole, by personal discussion rather than a matter formally recorded on paper; any written comments by Colonial Office personnel were generally written directly onto the incoming despatches.[1] The presence of minute sheets shapes the interaction a researcher has with the material, because it foregrounds the thoughts of the Colonial Office personnel as the topmost sheet in any file.

Each element of an archival trace is the result of a tension between a 'performative' element of human intent, and exposure to stochastic processes.[2] My interaction with records in various states of decay in the unofficial archives of various offices of the Forest Department in Belize was a stark reminder of the stochastic loss and decay of records. In conversations I had with staff at these offices, it was clear that most were not aware of the content of the records and had neither interest in nor motivation for their preservation. The records that remain are mostly unsorted, and undergoing gradual decay, as evident from the insect damage to the map in Figure 3.2. Other offices, such as that depicted in Figures 3.3 - 3.6, have been completely abandoned. The regional Forest Office of Melinda, that had administrative oversight of my focus area of the savanna in the Toledo District, was closed in 2004. I was told in an interview that none of its records remain: 'We have a place that we call Melinda and after I retire, you know, everything that they didn't

[1] Banton (2008).
[2] Matthews (2016), p. 214.

want in there, turn up everything, give away the books them. I checked back there last few months ago because I find it open. Nothing in there'.[3] There has also been repeated loss of governmental records to fires and hurricanes in Belize.[4]

The performative element to record creation and keeping has been particularly emphasised in the literature about official state and colonial archives.[5] The records of the Colonial Office that I accessed at the British National Archives were left purposively for use by future staff of the Colonial Office, as evidence of past decision making on certain issues, and to set a precedent for future decision making. As Stoler writes, they were 'reference guides to administrative thinking': establishing what, or whose word, counted as proof.[6] In the Colonial Office records, a file containing a series of despatches on an issue draws on the testimony of experts, and lays out the process by which a decision was reached. In being preserved, it defines the 'expert', the necessary evidence, and, crucially, *justifies* an action. As Schwartz and Cook put it, archives are 'justification for the society that creates them'.[7] The extent to which this particular society was aware of this is borne out by the recent exposure of *Operation Legacy*, by which the Colonial Office, in 1961, issued instructions to diplomats in colonies that had, or were soon to reach, independence, to dispose of documents of local administration from the colonial period that 'might embarrass members of the police, military forces, public servants (such as police agents or informers)' or which were 'likely to be interpreted, either reasonably or by malice, as indicating racial prejudice or bias'. [8] This took place in

[3] Interview 47.
[4] For example, in 1918, when the Government buildings were destroyed by fire [TNA CO 123/292, FO 106]. Before they were moved to Belmopan, marine flooding of Belize City during Hurricane Hattie in 1961 also destroyed significant amounts of material in the Government archives (Peter Furley, pers. comm. 18th February 2019).
[5] See for example Cooper & Stoler (1989); Schwartz & Cook (2002); Stoler (2002, 2010); Berger (2013).
[6] Stoler (2002), p. 98.
[7] Schwartz & Cook (2002), p. 12.
[8] Cobain (2016); Anderson (2015).

Figure 3.2

Insect damage to a map in storage at the Machaca Forest Station, Toledo, Belize.
Source: Author 2017.

Figure 3.3

Abandoned office at the Mountain Pine Ridge Forest Station, Cayo District, Belize.
Source: Author, 2017.

Figure 3.4

Box of old maps in abandoned forest office at the Mountain Pine Ridge Forest Station, Cayo District, Belize.
Source: Author, 2017.

Figure 3.5

Box of aerial photos (probably from the 1950s) in abandoned forest office at the Mountain Pine Ridge Forest Station, Cayo District, Belize.
Source: Author, 2017.

Figure 3.6

Piles of unsorted records in the active forest office at the Mountain Pine Ridge Forest Station, Cayo District, Belize.
Source: Author, 2017.

Belize, where large amounts of material were burned in 1962. Staff at the Belizean National Archives suspect this explains, in part, the absence of decades of records in the Belizean collections.

It is important to consider my own agency in the construction of a 'Belize fire archive' to which to apply my research questions. I faced initial choices about how to search for relevant collections that I might access (involving searches online, and conversation with other researchers). The contested nature of the territory of Belize means that there are writings from both Spanish and British occupation, in diverse collections and locations. I was not able to access all of these archives, and had to acknowledge my limits, in terms of time, distance and Spanish language skills, when deciding which to visit.

Once at an archive, I faced choices about how to search for relevant material, and how to persevere. Some archives, such as the Belize National

Archives, have catalogued much of their collections, allowing for more strategic use of search terms: ‘fire’, ‘forestry’, ‘savanna’, for example. In others, much of the material of interest was not catalogued to a level of detail that allowed me to use such search terms. In the UK National Archives, for example, most material is organised chronologically and by type (for example letters between the Governor of Belize and the Colonial Office, or annual reports from government departments in Belize, are bound together), but the catalogue gives only the months covered by the material bound in a volume, and not an indication of the themes of its content. I relied on a ‘snowballing’ knowledge of the years that were of interest, and, once I had ordered a volume in the archive, on reading through its index. At other sites I faced completely unsorted and uncatalogued shelves and cabinets of material, and decisions of how much of it to trawl through in my searches (see for example the quantity of records in Figure 3.6).

In this respect, my searches did not follow a precise methodology (because they could not), but were, largely, intuitive, always influenced by prior encounters with records and a gradually increasingly understanding of what was important. Let me illustrate this with the example of my searches for material in the Belizean newspaper collection at the Belize National Archive. This collection is not catalogued in detail: I was only able to order bound volumes of a newspaper by year of publication. At the time when I examined this material, I had already gained some knowledge of the history from other records. I was thus able to create a list of years in which I deemed events I had an interest in might have been covered in the press, and to prioritise these in my searches. I searched, for example, for evidence of public discontent with the Forest Department in the late 1920s, for the catastrophic wildfires following Hurricane Hattie in 1962, and worker’s strikes in the pine industry in the early 1960s. Often I did not know the date of an event with great precision, and thus had to skim most of the newspapers from that year to search for it.

I faced choices about what to attend to in a record, and if intuiting that something would be relevant, I faced a decision about how to transcribe the trace. These transcriptions captured, whether consciously or unconsciously to me, some elements of the content or form of a record, or of the wider site. These transcriptions took the form of photographs of the records or sites themselves, of direct textual quotes from the records (drawn directly from the record or, later, from photographs), of written reflections and, of course, of memories. My choice of a medium of transcription was not always my own. In some archives, such as the Belizean National Archives, use of cameras is not permitted. Certain elements of a trace lent themselves better to preservation in certain forms of transcription: the physical form of a record was more present in a photograph, or written descriptions that attended to its form, than in selected textual fragments.

I used Excel spreadsheets to record basic details about records I had looked at in each collection and on each date. For each day spent at an archive, I created a file on my computer, in which I stored photographs and a single word document with text fragments and reflections written that day. I then transferred the text fragments and written reflections to the *Nvivo 11* software, creating a new record for each individual source. This allowed me to connect information to each record, such as its date of creation, its creator, where and when I had accessed it, any reference it had within the collection, and so on. This provided a platform by which I could look at the traces together, using text searches and queries, and add my own interpretative codes and memos. In making these iterative choices that resulted in a transcribed trace, and in organising the traces, I was already making interpretations of the material.

3.4 Using oral testimonies

In interviews and conversations, I accessed further evidence of past and contemporary fire use and management. I conducted 26 interviews with NGO staff, government officials and other individuals both from Belize, the UK and the US (Table 3.2 summarises and numbers these research interviews). I also conducted surveys of 367 households and interviews with 42 farmers in the villages of Trio, Bladen and San Isidro in Belize's Toledo District. The nature of my access to these different individuals was influenced by our relative positionalities, accompanying power relations, and by behavioural choices I felt able to make within these constraints.

Given the small size of Belize and the strong network of contacts I had developed through my position working for the Darwin project and within the University of Edinburgh, it was usually easy to contact officials, NGO staff, and scientists with a view to interview; nobody I contacted declined. I made it clear when requesting an interview that it was for my PhD work and not for the Darwin project. In 2017, I began by interviewing colleagues from the Darwin Project and, in that I asked each respondent to suggest other potential respondents, my list of potential contacts snowballed. I continued to conduct interviews throughout 2017 and 2018 as opportunities arose. For each of these interviews I prepared potential questions in advance, from my prior knowledge of the respondent and their work, but I aimed to make these interviews as open-ended as possible, while focused on savannas and fire management. Interviews with several USA-based fire technicians were conducted on Skype.

When making contact in the villages for my research I faced choices of how to present myself and the research, and to whom to go, on behalf of the village, to

Table 3.2 Interviews I conducted during my fieldwork

Number	Date	Gender	Nationality	Description
1	24/02/2017	Both male	Belizean and US	Dual interview with Protected Areas Manager for TIDE, and his friend and fire management consultant, formerly Fire Manager with TNC and US Parks Service.
2	28/02/2017	Both male	Belizean	Logging concessionaires for DRFR (father and son).
3	23/03/2017	Male	Belizean	Forest Department staff member from 1973 to 2004, Chief Forest Officer from 1999 to 2004. Now consultant forester to private interests.
4	14/04/2017	Male	Born in Guatemala	Farmer in San Isidro in his 40s. Interview with translation from spanish.
5	15/04/2017	Male	Belizean	34-year old farmer and community health worker in San Isidro. Community participant in the Darwin Project's fire management training, and community business development. TIDE ranger since 2017.
6	26/04/2017	Male	Born in Guatemala	15-year old farmer in Bladen. Interview with translation from Q'eqchi.
7	26/04/2017	Male	Born in Guatemala	45-year old farmer in Bladen. Interview with translation from Q'eqchi.
8	26/04/2017	Male	Born in Guatemala	44-year old farmer in Bladen.
9	27/04/2017	Male	Belizean	25-year old resident in Bladen, participant in Darwin Project's fire management and ecological monitoring in PCNP.
10	27/04/2017	Male	Born in Guatemala	48-year old farmer in Bladen. Interview with translation from Q'eqchi.
11	27/04/2017	Male	Born in Guatemala	45-year old farmer in Bladen. Interview with translation from Q'eqchi.
12	28/04/2017	Male	Born in Guatemala	40-year old farmer in Bladen. Interview with translation from Spanish.
13	28/04/2017	Male	Born in Guatemala	37-year old farmer in Bladen. Interview with translation from Q'eqchi.
14	28/04/2017	Male	Born in Guatemala	35-year old farmer in Bladen. Interview with translation from Q'eqchi.
15	28/04/2017	Male	Born in Guatemala	57-year old farmer in Bladen.
16	29/04/2017	Male	Born in Guatemala	40-year old farmer in Bladen. Interview with translation from Q'eqchi.
17	29/04/2017	Male	Belizean	47-year old farmer in Bladen.
18	30/04/2017	Male	Belizean	35-year old resident in Bladen, and TIDE ranger.
19	30/04/2017	Male	Belizean	75-year old farmer in Bladen. Interview with translation from Q'eqchi.
20	01/05/2017	Male	Born in Guatemala	48-year old farmer in San Isidro. Interview with translation from Q.'eqchi.
21	01/05/2017	Male	Born in Guatemala	43-year old farmer in San Isidro. Interview with translation from Q'eqchi.
22	02/05/2017	Male	Born in El Salvador	63-year old farmer in San Isidro. Interview with translation from Spanish.
23	02/05/2017	Male	Belizean	67-year old farmer in San Isidro.
24	02/05/2017	Male	Born in Guatemala	41-year old farmer in San Isidro. Interview with translation from Spanish.

25	02/05/2017	Male	Born in Honduras	65-year old farmer in San Isidro. Interview with translation from Spanish.
26	05/05/2017	Male	Belizean	24-year old farmer in San Isidro.
27	05/05/2017	Male	Born in Guatemala	61-year old farmer in San Isidro. Interview with translation from Q'eqchi.
28	05/05/2017	Male	Belizean	28-year old farmer in San Isidro. Interview with translation from Q'eqchi.
29	05/05/2017	Male	Born in Guatemala	35-year old farmer in San Isidro.
30	08/05/2017	Male	Born in Guatemala	50-year old farmer in Trio. Interview with translation from Spanish.
31	08/05/2017	Female	Born in Guatemala	58-year old farmer in Trio. Interview with translation from Spanish.
32	09/05/2017	Female	Born in Guatemala	74-year old farmer in Trio. Interview with translation from Spanish.
33	09/05/2017	Male	Born in Guatemala	25-year old farmer in Trio. Interview with translation from Spanish.
34	09/05/2017	Male	Born in Honduras	70-year old farmer in Trio. Interview with translation from Spanish.
35	09/05/2017	Male	Born in Honduras	62-year old farmer in Trio. Interview with translation from Spanish.
36	09/05/2017	Male	Belizean	Farmer in his late 20s in Trio.
37	09/05/2017	Male	Belizean	26-year old farmer in Trio. Interview with translation from Spanish.
38	10/05/2017	Female	Born in Guatemala	59-year old farmer in Trio. Interview with translation from Spanish.
39	10/05/2017	Male	Born in Honduras	55-year old farmer in Trio. Interview with translation from Spanish.
40	10/05/2017	Male	Born in Honduras	28-year old farmer in Trio. Interview with translation from Spanish.
41	10/05/2017	Male	Born in El Salvador	42-year old farmer in Trio. Interview with translation from Spanish.
42	10/05/2017	Male	Born in Guatemala	71-year old farmer in Trio. Interview with translation from Q'eqchi.
43	10/05/2017	Male	Born in Guatemala	18-year old farmer in Trio. Interview with translation from Q'eqchi.
44	11/05/2017	Male	Born in Guatemala	44-year old farmer in Trio. Interview with translation from Spanish.
45	11/05/2017	Male	Born in Guatemala	Farmer in his 30s in Trio. Interview with translation from Spanish.
46	15/06/2017	Male	Belizean	Forest Department forest ranger at Savanna Forest Station in 1962.
47	16/06/2017	Both male	Both Belizean	Two former Forest Department staff working mostly in Toledo district, one started in 1973 as a forest guard, was promoted to forest ranger in 1989 and retired in 2006, the other started in 1973 as a forest guard, was later an assistant carpenter and retired in 2004.
48	20/06/2017	Male	Belizean	Forest Department staff member from 2003 to present, currently Forest Officer.
49	20/06/2017	Male	Belizean	Forest Department staff member from 1980 to present. Currently Deputy Chief Forest Officer.
50	21/06/2017	Male	Belizean	United Democratic Party (UDP) politician and Cabinet Minister from to 1988 to 2015, including serving as Minister of Public Utilities and Transport and Communications. His family owned mahogany cutting operations in Toledo district throughout the twentieth century.

51	01/07/2017	Male	Belizean	Forest Department staff member from 1977, recently retired. Led fire management in the Mountain Pine Ridge forest reserve during his career.
52	04/07/2017	Male	Belizean	Agriculture Department staff member from 1988 to present, acting Chief Agricultural Officer at time of interview.
53	05/07/2017	Male	Belizean	1990s staff member for conservation NGOs the Belize Audobon Society and Programme for Belize. Official in Ministry of Natural Resources from 2003 to 2005. Chief Forest Officer in 2005. Independent consultant to NGOs and government in natural resources management since 2005.
54	19/12/2017	Male	British	Retired soil scientist professor in geography department at University of Edinburgh. Conducted research in Belize, from 1966 to mid-2000s. Particular interest in tropical savannas, which he also studied elsewhere in Latin America.
55	31/01/2018	Male	US	Fire manager with TNC, its Director of Fire Management since 2009. Fire management consultant in Belize under GFI in the 2000s.
56	05/02/2018	Male	Belizean	Forest Department staff member from 1976 to 1995. Chief Forest Officer from 1991 to 1995. Ministry of Natural Resources policy coordinator from 1998 to 2004. Thereafter natural resources management consultant and official at Belize National Climate Change Office.
57	15/02/2018	Male	Belizean	Ranger with TIDE since 2010.
58	15/02/2018	Male	Belizean	Worked with Toledo Maya Cultural Council and then as a ranger with Belize Audobon Society in the 1990s, as a ranger with TIDE from 2004 to 2016. Sustainable Agriculture Coordinator for the Ya'axche Conservation Trust since 2016.
59	24/02/2018	Male	US	Fire manager, formerly of the US Parks Service and TNC, now retired. Connection with Belize since his graduate work here in the early 1990s. Consultant fire manager in Belize from early 2000s, first via the GFI, and independently since it ended in 2009, working particularly with TIDE.
60	27/02/2018	Male	US	Land Manager and specialist in prescribed fire management with TNC from 1987 to 2017. Consultant in fire management in Belize during the GFI in the 2000s, continuing independently as a consultant to Belizean NGOs including TIDE, for several years after the close of the GFI in 2009.
61	01/03/2018	Male	US	Ecologist working in Belize since 1984 (largely in North West Belize). Currently professor at University of Puerto Rico.
62	01/03/2018	Male	Dutch	Resident and consultant ecologist in Belize since the early 1990s, with TNC since 2000.
64	15/03/2018	Female	Belizean	Executive Director of TIDE from 2007 to present.
65	23/03/2018	Male	Belizean	Forest Department staff member from 1959 to 1993, Acting Deputy Chief Forest Officer in his late career.
66	11/06/2018	Male	British	Forester who led the six-year UK Government funded Forest Planning and Management Project in Belize in the 1990s.
67	04/10/2018	Male	British	Former Development Director at TIDE, who wrote the Darwin Project Proposal.
68	15/12/2018	Male	British	Employee on the UK Government funded Stann Creek Land Resources Assessment in the late 1980s and the six-year Forest Planning and Management Project in Belize in the 1990s.

grant me access.[9] I chose to live in the villages for the periods of time in which I was conducting surveys and interviews there, in order to build better contextual understanding, and to demonstrate my willingness to learn in the village, and not to come in solely to 'extract information'. Importantly, my research took place alongside my attendance at meetings in the same villages, under the auspices of the Darwin Project, and at the same time as I was developing social relationships with those individuals in the villages who were active participants in the project. Though I tried to explain that I had this dual role, it proved impossible to communicate clearly to everyone. Perhaps the distinction between the two roles was also not one that most people could understand.

Although all three villages contained a mixture of indigenous and Spanish language speakers, the leadership structure of the villages differed, with all possessing a Chairperson (the state's representative), but only two also possessing an indigenous leader called an Alcalde (the representative of the Toledo Alcaldes Association (TAA) and Maya Leaders Alliance (MLA)). Under the TAA and MLA's framework for engaging with Toledo's Maya communities, a researcher should always engage first with the Alcalde, rather than going directly to individual villagers, and trust that he/she will represent them to the village.[10] The relative power and position of the Alcalde and Chairperson differed in each village. These leaders were also re-elected between my second and third trips to Belize, which meant that I had to build new relationships and negotiate access for a second time. In both 2016 and 2017 when I spent time conducting research in the villages, I initially met with the leaders in each village and asked them to find me a host family and translators (and therefore hoped that there would be general satisfaction in the village). By my

[9] See Toomey (2016) on the influence of the people with whom we choose to make contact for access for research.
[10] Toledo Alcaldes Association & Maya Leaders Alliance (2014).

second visit to Belize I had made connections, via the Darwin Project, with certain individuals in the villages, who I hoped might act as research assistants, and suggested these individuals to the village leaders myself.

I designed my household survey in the three villages with two purposes in mind. Firstly, I aimed to collect basic demographic information, and to quantify the numbers of households using fire for farming and hunting (as described in Section 3.2). Secondly, I used the survey data to choose a representative sample of farmers (aiming for a variety of ages and nationalities) to interview in more detail about their fire use.[11] In Bladen and San Isidro I surveyed all households where adult family members were at home at the time of my visit. In Trio, a larger village, I conducted the survey with two out of every three households. The household survey was structured, with eleven standard questions that generally took less than five minutes to administer (see questions in Figure 3.7). My more detailed interviews with farmers took between fifteen and thirty minutes. These were semi-structured: I aimed to keep the interview as close to a natural conversation as possible but included some standard questions that I asked in each interview, though not always in the same order (see questions in Figure 3.8).

In the villages I sometimes encountered difficulty in ensuring prior informed consent for interviews. When conducting sound-recorded interviews, I followed the University of Edinburgh's guidelines, and used consent forms, translated into Spanish or Q'eqchi by my research assistants. I sometimes found that this raised, rather than lowered, social barriers, particularly with interviewees in the villages, some of whom could not read and write, and for whom signing paper was a rare occurrence and aroused suspicion.[12] Several people in the villages said they were

[11] As is discussed in Chapter six, Section 6.1, being largely settlements of immigrants, the villages are very culturally diverse.
[12] See Ntseane (2009) for a discussion of how consent forms may be unsuitable in certain contexts.

Figure 3.7 Household survey

If talking to the head of the household:

1. Record gender of respondent (Male/Female)
2. Record primary language spoken by household (Spanish, Q'eqchi, Mopan, Creole)
3. Leave this blank
4. ***How old are you?***
5. ***In which country and which village were you born?***
6. ***How long have you been living in this village?***
7. ***Does your household do farming?*** (Yes/No) Record anything else interesting they tell you
8. (If yes to 7) ***Do you or members of your household use fire in farming?*** (Yes/No) Record anything else interesting they tell you
9. (If yes to 7) ***Have you or members of your household had any training about fire?*** (Yes/No) Record anything else interesting they tell you
10. (If yes to 8) ***Could I come back in the next weeks and interview you about how you use fire for farming?*** (Explain that this would be for a 20 minute interview and that I would come later and arrange a time that worked with the family)

If talking to another family member:

1. Record gender of respondent (Male/Female)
2. Record primary language spoken by household (Spanish, Q'eqchi, Mopan, Creole)
3. ***What is the gender of the head of the household?*** (Male/Female)
4. ***How old is the head of the household?***
5. ***In which country and which village was the head of household born?***
6. ***How long has the head of household been living in this village?***
7. ***Does your household do farming?*** (Yes/No) Record anything else interesting they tell you
8. (If yes to 7) ***Do you or members of your household use fire in farming?*** (Yes/No) Record anything else interesting they tell you
9. (If yes to 7) ***Have you or members of your household had any training about fire?*** (Yes/No) Record anything else interesting that they tell you
10. (If yes to 8) ***Could I come back in the next weeks and interview you about how you use fire for farming?*** (Explain that this would be for a 20 minute interview and that I would come later and arrange a time that worked with the family)

There are some pairs of pictures and statements on this sheet. I would like you to tell me how many of these pairs apply to your household over the past year. I don't want you to tell me which ones apply, just the number of pairs. So I won't know which particular ones apply to your household, but this will help me to know things about the village in general.

EXAMPLE LIST
We have raised chickens
At least one member of the household was attending high school
We own a truck

Here is an example. My mother raises chickens, my sister is at high school, and my household does not own a truck. I would keep this information to myself, and my answer to this question would be 2.

LIST 1
The head of household worked at the banana farm
We have eaten corn that we have grown ourselves more often than corn that we have bought
We don't have a stove, we have cooked only on a fire-hearth
We own a chainsaw

LIST 2
We have bought our firewood more often than we have collected it ourselves
We have eaten fish that we have caught ourselves at least once a month
At least one member of the household has helped with roofing a thatch house
We have grown pineapples to sell

SENSITIVE ITEM
At least one member of the household has burned the pine savanna for hunting

Figure 3.8 Standard questions used in interviews with farmers in Trio, San Isidro and Bladen

1. Did you have pine savanna like this in the area where you came from, or where you lived before?
2. What do you use the savanna for? Can you use it as agricultural land?
3. What size is your milpa and what crops do you grow?
4. What size of area do you burn for agriculture each year?
5. Why do you use fire for agriculture?
6. At what time of year do you burn your milpa?
7. How do you prepare in advance of a milpa burn?
8. At what time of day do you conduct a milpa burn?
9. What weather conditions do you like to conduct a milpa burn in?
10. Who conducts the burn with you?
11. What do you do on the day when you conduct a milpa burn?
12. Do you like to light the fire so that it moves across your milpa with or against the wind?
13. Where did you learn how to conduct milpa burns? Is it different or similar in that place to here?
14. Have you ever been given any training in fire management? By whom? Did it change how you use fire?
15. Is the way in which you use fire similar to the way in which other people in the village use fire?
16. Have you ever lost your crops to escaped fire?
17. Have you ever had a fire escape from your milpa? Did it reach the savanna?
18. What else do you use fire for besides agriculture?
19. What else do other people in the community use fire for?
20. Have you ever fought fires near your house?
21. Do you know of any laws about fire? Have you ever applied for a permit before conducting a milpa burn?
22. Do you remember any assistance from the government to help with fire management?
23. Are you aware of any fire management by organisations like TIDE or by local logging concessionaires?
24. How could the community be supported better to manage fires?

happy to participate but not to sign anything, which placed me in a dilemma (I chose not to interview them).

My interactions with my respondents were influenced by our relative positionalities. This made every research encounter different. In some situations, I felt myself to be in a position of power (particularly when interviewing rural villagers) which perhaps forced my participants to accede to being interviewed. Such interviews often elicited very short answers; attempts to discuss fire use for hunting or arson were futile. In others, particularly where I was interviewing officials, the conversation was often easier, and felt more 'natural'.[13] Though English/Creole is the official first language in Belize, many of my research participants in the villages, particularly recent immigrants, spoke Spanish, Q'eqchi or Mopan as a native language. I do not speak any of these languages, and so relied both upon translation of surveys in which I asked standardised questions (and which I did not always administer), and of interviews in which I asked more open-ended questions. I worked with research assistants to translate and trial my standardised questions before conducting the surveys.

The presence of research assistants and translators introduced a 'triple-subjectivity' to my surveys and interviews in the villages.[14] I chose in each village to work with research assistants from that village, which meant that I had to spend more time preparing them for what we were going to do, but which provided me with a wealth of specific social information as a result.[15] In informal conversations with my research assistants I learned general contextual information about the villages, how they had interpreted research interviews, or had felt participants to be lying, and

[13] Oglesby (2010), Gent (2014) and Perera-Mubarek (2014) describe how they experienced different relative positionalities with different research participants.
[14] Temple & Edwards (2002).
[15] See Turner (2010) and Leck (2014) for examples of papers in which research assistants are given recognition.

how they felt that other villagers were viewing me (drawing my attention to the ways in which my positionality connected me with money). These discussions also helped me to understand the ways in which their connection with me and my research challenged my research assistants.[16] I was particularly aware of this after a research assistant expressed her discomfort to me about visiting certain houses in the village.

Translation is, of course, on a basic level, about the words chosen. With one translator, in some of my interviews, where my limited Spanish meant that I was understanding some of what was said, I had a sense that I was getting shortened translations and losing some content. I asked my translator in the next village to listen to my recordings and to provide her translation. The differences between the translations were clear evidence of the role of the individual translator. I was, however, unable to have multiple translations of most of my interviews. Translation is more than a simple exchange of words, but it also alters the social and discursive positioning of what is said.[17] It is important to remember Gayatri Spivak's argument that discourse can silence those who are represented.[18] I came to understand this through conversations with certain research assistants, who, despite being native speakers of the indigenous languages they were translating for me and who were able to communicate with me in English, expressed their frustration in communicating the *meaning* of what I was trying to ask. Most of my research assistants were able to act as 'knowledge brokers' because they, unlike other villagers, had had extensive experience outside their villages, and of interacting with foreign researchers or NGO staff. Those research assistants that expressed their difficulties in conveying my meaning did not have such prior experience.

[16] Mistry *et al* (2015) and Turner (2010) discuss the challenging ethical positions in which research assistants are placed as knowledge brokers.
[17] Temple & Edwards (2002); Temple (2005); Leck (2014); Drozdzewski (2018).
[18] Spivak (1988).

I sound-recorded all interviews and then fully transcribed them. As with my transcriptions from archival records, I entered my interview transcripts into *Nvivo 11* as a platform for analysis. Many of my research participants and translators used elements of grammar from Creole when speaking in English with me. When quoting these participants in this thesis, I use [*sic*] once only, to signal that the entire quote is presented verbatim.

3.5 Using ethnography

I observed and gained insight of four things through ethnography: the general social and political context of Southern Belize; practices of contemporary fire use and management; the social processes through which the Darwin Project was carried out; those contexts in which and processes by which I accessed archival material and interviews. It was always important to be mindful of the ways in which my presence and participation shaped these contexts.

In 2016, during my first visit to Belize, I spent a week in each of the five villages targeted by the Darwin Project, with the sole aim of gaining socio-cultural contextual understanding.[19] As mentioned, I found and contacted my host families via the village leaders in each village. I spoke with a diversity of people in each village, spent time observing farmers on their milpas and spent two days of participant observation on two of the commercial banana farms that provide employment for many people in these villages.[20] In 2017 I returned to three of the villages, (Trio, Bladen and San Isidro), where I spent a further total of six weeks, during which I conducted the surveys and interviews described above. During these stays I continued to gain social and cultural insights. I was also able to observe several farmers conducting burns to clear their milpas for planting. I was unable to

[19] As is further elaborated in Chapter six, each village possesses its own social and political dynamics.
[20] A milpa is a small corn and bean farm.

gain access and directly observe fire use for hunting. Throughout these periods of observation my inability to understand Spanish, Q'eqchi or Mopan sometimes limited my insights. In some of my host families the heads of household did not speak English, although, having learned it at school, their children were confident English speakers and able to aid me in communication.

Through my work as Project Officer for the Darwin Project I gained a tacit understanding of social relations in a development context. As described in Chapter one, Section 1.2, throughout each of my visits to Belize I was actively involved with organising and facilitating, and thus able to observe, most of the meetings and activities associated with the Darwin Project. This included participation in six prescribed burns with TIDE's rangers in the Payne's Creek National Park and Deep River Forest Reserve. It also included participation in activities, such as community business development, which are not discussed in depth in this thesis, but which helped me to develop a tacit understanding of social relations in a development context.

Most people with whom I interacted during my research were aware that I was a PhD researcher: I made an effort to explain this, and my research topic, when I was introduced to somebody. However, I could not always obtain prior informed consent for ethnographic research.[21] For example, it was easiest for me to observe if I did not emphasise my identity as a researcher during every Darwin Project activity or meeting. My decision to focus on the workings of the Darwin Project, and interactions between NGO staff and villagers emerged during the research, and during work for the Darwin Project. Thus, the observations I am calling 'ethnographic evidence' were sometimes transcribed to memory and not inscribed in the moment,

[21] See Bryant (2014) for a discussion of the complications of ensuring prior informed consent in ethnography.

but, later, in some different site and time. I was certainly not always attentive to the boundary between 'doing ethnography' and 'not doing ethnography'.

When conducting what was for me consciously 'dedicated' ethnographic work (during stays in the villages in 2016 and during Darwin project meetings and activities), I followed the approach outlined by Emerson *et al*.[22] I took quick jottings of single words or phrases to trigger my memory later, during conversations or observations (when I deemed that writing something down was appropriate in the context, or as soon as possible afterwards). I would then spend time later that day writing up my notes, in journal form, using quotation marks only for direct quotations, and brackets to mark my thoughts or interpretation of events. As with my transcriptions from documentary records and interviews, I entered my ethnographic notes into *Nvivo 11* as a platform for analysis. In Chapter six, I use pseudonyms when writing about individuals from my ethnographic experience.

3.6 Interpreting and interweaving multiple lines of evidence

It was from these diverse sources of evidence that I was able, in their analysis and in their combination, to write a narrative and present an analysis. I also referenced other published histories, themselves interpretations, to inform my reading of the primary material.[23] The evidence I drew together was time-limited in different ways. This means that I used different combinations of material for the different chapters of my thesis, which are ordered chronologically. Chapter four uses archival and textual traces only, Chapter five primarily uses archival and textual traces, but draws also, for its more recent history, upon interviews with current and

[22] Emerson, Fretz & Shaw (1996).
[23] I used, for example, published histories of Belize (e.g. Bolland (1977, 2003); Bulmer-Thomas & Bulmer-Thomas (2012); Shoman (2012)); more thematic writing and memoirs of Belize (e.g. Wilk (1991); Moberg (1997); Wainwright (2008); Godden (2009)); histories of colonial forestry and environmentalism (e.g. Drayton (2000); Barton (2002); Bennett (2015)); development policy (e.g. Furse (1962); Constantine (1984); Adams (2008)); fire management (e.g. Pyne (1997)).

former Belize Forest Department officials and on my own ethnographic observations, Chapter six uses some textual traces but predominantly my surveys, interviews and ethnographic observations. Being interested in the relationship between the two, my challenge was to afford *both* texts/plans about fire management and actual practices of fire management their due weight throughout my analysis, despite my differential access to textual and oral or ethnographic evidence for different parts of the narrative.

Nightingale distinguishes three forms of triangulation, all of which applied as I combined different lines of evidence.[24] In some cases, I employed a realist stance to my data, and looked for *convergences* between sources to verify certain findings. This was the case, for example, when I wanted to confirm who held the logging permit for a certain forest reserve in year X, or what years had particularly frequent fires. From a constructivist position I would not expect certain elements of different sources to converge. Instead of convergence I sometimes looked for *complementarity* between sources to enrich my analysis. This was, for example, the case when I combined archival traces to lend context to one another, or when I used the results of a structured survey to select participants for more open-ended interview. In this research I was precisely interested in the implications of differences in perspective for the production of fire management practices. I thus frequently attended to the *divergences* between sources, sometimes using oral histories precisely because I hoped that they could present a different understanding from the colonial or government record.[25]

I drew in my interpretation of texts on Derrida's 'deconstruction': 'an approach to reading that constantly and rigorously challenges the possibility of

[24] Nightingale (2009).
[25] See Riley & Harvey (2007) on the combination of oral and archival histories.

achieving closure of meaning, since there is no centre or core from which meaning radiates'.[26] The historical texts I could access give voice strongly to the Colonial Office in London and Colonial Administration in Belize, to foreign ecologists, foresters and conservationists. They were rarely produced by less powerful actors. Yet, following Derrida, I could search for the presence of these other actors in the text, within what was hidden, marginalised or conspicuously invoked as pure or ideal. Here it was important to try to distinguish, as Stoler writes, between 'what was "unwritten" because it could go without saying and "everyone knew it," what was unwritten because it could not yet be articulated, and what was unwritten because it could not be said'.[27] For example, sections covering fire suppression in the annual reports of the Forest Department from the 1950s and 1960s, speak, in terms of numbers of fires fought, miles of fire breaks constructed and so on, a rhetoric and discourse of apparently intense control, in keeping with legislation that sought to eliminate fire from certain areas. Yet, the staff lists for the Forest Department, and maps of the coverage of Forest Reserves they managed reveal that they cannot have had much control in most of the forested areas in the country or reached most of its people. Into the way in which these Forest Department reports quantify the technical measures taken without contextualising what they meant in terms of reducing the occurrence of fire in Belizean forests, I read a need to mask the inadequacy of the Department's methods in practice.

I became more and more interested in this distinction between detailed plans of *proposed* fire management, reports of fire management and material practices of fire management. In archived evidence I was presented with plans and reports but had no direct access to the fire management practices themselves. My ethnographic experiences and interviews in contemporary Belize shaped my ability to read this

[26] Braun & Wainwright (2001), p. 48.
[27] Stoler (2010), p. 3.

unbalanced historical material in ways that did not attribute undue power to the ideas inscribed in fire management plans. Here, I present two examples to illustrate.

In the first example it was ethnographic attention to the sites in which I accessed documents and conversations with their curators that provided important insights. The Mountain Pine Ridge Forest Station in the Cayo District was at one time a small settlement housing staff of the Belize Forest Department and their families. Today, several of the buildings still function as an office for the Forest Department, but most of the site lies derelict. In 2017, I sieved through some of the paperwork that is strewn in abandoned offices and in unsorted piles at the back of the Forest Station (see Figures 3.3 - 3.6). Among the records were jumbled maps, aerial photography and pages and pages of handwritten numbers; data divorced from explanation of a collection methodology or purpose.[28]

As it was the weekend, there were only two members of staff keeping watch of the site. One, young and recently employed with the Department, let me into the buildings to look at the records. He said that they were never used for anything and that he had no idea what they contained but he would sometimes leaf through some of them when there was nothing else to do on a boring shift. The other employee, one of the longest-serving at the Department, told me that he had been involved in data collection with a British team on monitoring plots established in the 1990s. From my reading of the project's documentation and a later interview with the (British) leader of the project, I know this to have been the Forest Planning and Management Project funded by the British Overseas Development Administration, which aimed to develop the capacity of the Forest Department to conduct research, among other things. Yet my conversation at the Mountain Pine Ridge made it clear that this staff member at least had seen the data collection as a task carried out for

[28] I found records to be in a similar state at the other Forest Offices I visited, in Belmopan and at Machaca.

a British project. The monitoring plots were not maintained after the project ended. Some eighty years earlier than my visit to the Mountain Pine Ridge, but speaking to similar dynamics, a circular letter was sent from the Belize Forest Department's (British) Conservator of Forests to all Forest Officers on the subject 'preservation of records':

> The use of books or old records for scrap paper has recently resulted in the destruction of some valuable increment records and observation for a period of seven years. All records of work done have a very definite value and they must be carefully preserved.[29]

In 2018, I met with the leader of the 1990s Forest Planning and Management Project in Oxford. In the library at his home he kindly allowed me to look through a collection of boxes of records from his six years in Belize. Looking at these carefully preserved reports, data, newspaper articles and photocopies of historical documents felt like a parallel experience to an earlier visit to Oxford, when I had examined Neil Stevenson's (Conservator of Forests in Belize in the 1930s and 1940s) personal records in the Weston Library's Special Collections. These collections, curated by British foresters, and removed from Belize, stood in stark contrast to those in decay in Belize.

These experiences and textual fragments together led me to understand that the collection and preservation of data about the Belizean environment has been an enterprise largely driven by foreign scientists and administrators.[30] While Belizeans have been involved, they have not always owned the 'vision' or purpose behind data collection. There has often been a form of institutional 'memory loss' as records of research have been destroyed or forgotten. These were conclusions I reached by taking an ethnographic approach to the archives and record collections I visited.

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[29] Circular despatch from Neil Stevenson to all Forest Officers, 13th February 1941, [Machaca Forest Station, Toledo District, Belize, uncatalogued in storage].

[30] Note that this is changing, with the work of Belize's Environmental Research Institute (ERI), established at the University of Belize in 2010. The ERI is curating a digital archive of historical data and reports about the Belizean environment, available at http://eprints.uberibz.org/.

Examining the maps and data that have been created about the Belizean environment in isolation might have led to false assumptions about their relevance and use in Belize.

In a second example, it was my own experiences working in the Darwin Project that shaped my reading of the experiences of Martin Johnson (now deceased), a British forester who was, in the 1970s, seconded from the British Overseas Development Ministry (ODM) to the Belize Forest Department. In 2017, I found a copy of Johnson's Southern Coastal Plain Fire Protection Scheme among the jumbled 'archive' of material at the Belize Forest Department headquarters in Belmopan.[31] This publication by ODM's Land Resources Division was the output of Johnson's second assignment in Belize; a single month's consultancy in 1973. Johnson had earlier spent three years, 1968 to 1971, working on forest inventories in Belize, including of the Southern Coastal Plain savanna.[32] He had gone to considerable lengths to research the history of the Department and its work on the Southern Coastal Plain. Both of his publications are rich in detail. I felt a sense of affinity with Johnson; he had read many of the reports and documents that I have read in conducting my research. He had felt that an understanding of the history of the Department was essential if he was to write useful policy.

A few months later, among the decaying records at the Mountain Pine Ridge Forest Station, I stumbled across several letters written by Johnson. These dated from several years after his consultancy for the writing of the Southern Coastal Plain Fire Protection Scheme, when Johnson returned to Belize for several years' secondment as a member of staff with the Forest Department. He was tasked with writing working plans for several areas, including the Southern Coastal Plain.

[31] Johnson (1974).
[32] Johnson & Chaffey (1974).

Johnson clearly believed that these plans would be of importance to the Forest Department: in a letter to the Chief Forest Officer he wrote

> I hope that the plans I produce will function as policy documents for the next 10 years or so for the areas involved. I think that they should be approved by and signed by the highest possible authority. There was a time when working plans in the French Forest Service were signed by the President of the Republic himself. I am not suggesting that they should go as far as the Hon. Premier here, but I think they should go as far as the Hon. Minister of Trade and Industry.[33]

Johnson's secondment to Belize ended before the draft working plans could be finalised or, indeed, adopted. Back at ODM in 1977, he wrote to Nick Woods, another British member of staff in Belize with the Forest Department, to enquire as to what progress had been made with the working plans:

> Nearly seven months have passed since I left Belize…. My main reason for writing is to enquire what has happened to the draft management plans for Chiquibul, Mountain Pine Ridge and the Southern Coastal Plain. They were in manuscript only when I left Belize. When I visited Henry Flowers the day before I left, I understood him to have agreed to send a copy of the typescript of each one to me for corrections and additions. I have so far received nothing. On two occasions when I was at Oxford, I wrote to Henry Flowers sending details of nursing career opportunities in the UK for his daughter and asking about the management plans. I also, when sending Eustace Bradley details of a BBC broadcast about match manufacture in Pakistan he had requested, asked him about the management plans. I have not received an answer to any of the three letters.[34]

In 1978, Nick Woods and others finalised the Southern Coastal Plain Working Plan. Neither the Working Plan, nor Johnson's 1974 Fire Protection Scheme, were put into practice by the Forest Department.[35] A former staff member with the Forest Department who I interviewed recalled the fate of the various studies, including Johnson's, published by ODM/ ODA's Land Resources Division: 'when those reports were published, they made, of course, hundreds of copies….

[33] Letter from Martin Johnson to Chief Forest Officer, 25th November 1976, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[34] Letter from Martin Johnson to Nick Woods, 30th December 1977, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[35] Letter from Nick Woods to the Chief Forest Officer on subject 'Southern Coastal Plain Working Plan', 9th February 1978, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage]; Zisman (1996); Interview 3.

these are things that you are supposed to distribute to every office and everybody who is interested. And here they were stored away and stacked away in that old storage shed somewhere'.[36] I saw parallels with my own experience working in Belize. During and after my time as Project Officer for the Darwin Project I sent many unanswered emails requesting updates from Belizean project partners.

I encountered and understood Martin Johnson's relationship to the Belize Forest Department, not only in his words, but also through my own experience of researching the history of the Forest Department and working for an international development project in Belize. The emotional and intellectual connection I felt with Johnson helped me understand those between my own position and that of former British development workers in Belize. As Sarah de Leeuw argues, looking at colonial settlers in Canada, such emotional connections are important: we are not distant observers but deeply implicated in the histories that we research and write.[37]

3.7 Conclusions on writing the thesis

'Writing up' is difficult when one has been an 'insider' in ethnographic research. This proved true in my case, of working within the Darwin Project while also attempting to research *how* the project worked (and not always *whether* it worked). As David Mosse recounts, from such a position, exiting the 'field' for the 'desk' is challenging, not only because written accounts continually seem incomplete but also

> because ethnographic writing begins to have significant social effects of its own. The detachment of writing is now socially experienced by others. Of course, those reading about themselves may be intrigued, amused, or pleased; but turning relationships into data, and placing interpretations in public, can also disturb and break relationships of fieldwork. It may be "anti-social". Those interlocutors - neighbours, friends, colleagues, or co-professionals - who directly experience

[36] Interview 3.
[37] De Leeuw (2012).

> ethnographic objectifications now surround the anthropologist at her or his desk; they raise objections, make new demands to negotiate public and published interpretations.[38]

Writing and editing could thus be conceived of as part of a research methodology. Just as they were challenged constantly in the 'field', so too were my interpretations shaped and refined in sharing my text with my colleagues.

In choosing what to take 'as read' in analysis, and thus what to present as 'historical fact' in writing, I faced '*the* meaningful tension disclosed in the archive', of choosing 'how to deal with subjectivity — whether kept at arm's length or allowed just that little bit closer'.[39] Ultimately, in thematic analysis and in constructing a narrative, I gave my own structure to a messy reality.[40] It is my hope that the reflexive elements in this chapter will enable the reader to 'work along the grain' of my own text as presented elsewhere in the thesis.[41]

[38] Mosse (2006), p. 937.
[39] Lorimer (2009), p. 258. Emphasis original.
[40] Cronon (1992); Baker (1997).
[41] To reference Stoler's (2010) approach to archival traces, which aims to treat them as subjects and not as sources.

4

Fire protection: ‘British Empire forestry’ in the Belizean savanna, 1920-1941

> *By the nineteenth century British fire history had largely moved to the empire’s overseas dominions. Britain's own containment and occasional expulsion of fire perhaps made all the more intense the shock of rediscovering free-burning fire as an endemic and elemental phenomenon elsewhere. To travel to India, Africa, America, Canada, New Zealand, or Australia was to step back into British history to the early centuries of landnam and to engage environments where, unlike sodden Britain, nature could escalate bonfires into holocausts (*Pyne, 1997, 360).

> *Colonial governors and missionaries, settlers and technocrats, cast their gaze across the globe, but the question remains: to what extent were their visions clear or powerful enough to remake it?* (Cooper & Stoler, 1989, 620).

This chapter explores the origins of the Belizean state Forest Department and of its attempts to manage savanna fires. Sections 4.1 and 4.2 provide context, introducing Belize’s lowland savannas and sketching some of Belize’s historical political economy. While my focus is on the period after 1920, because this was when state fire management was instituted, developments in the eighteenth and nineteenth centuries set the stage for patterns of land distribution and management that persisted into the first decades of the twentieth century.[42] I address, particularly, how development of the colonial state affected human activity in the lowland savannas before 1920. In Section 4.3 I interrogate the ‘problem’ of savanna wildfires in Belize, and its proposed solutions, as they were articulated in an influential report of 1921, by the Department’s first Conservator of Forests, Cornelius Hummel. In Section 4.4, to understand the report’s influence, I examine the discourses and

[42] Bolland & Shoman (1977); Wainwright (2008, 2015, 2018).

practices that lent Hummel authority with the British Colonial Office. The final sections examine how, in the decades following 1921, fire management was not 'implemented' by the Forest Department as it had been envisaged in Hummel's report. In practice, fire management was frustrated by a poorly-understood ecology, hurricanes, different fire users and schismatic politics. The evidence presented speaks of a messy and emergent reality in dialogue with – but often divergent from – official colonial texts and ideals.

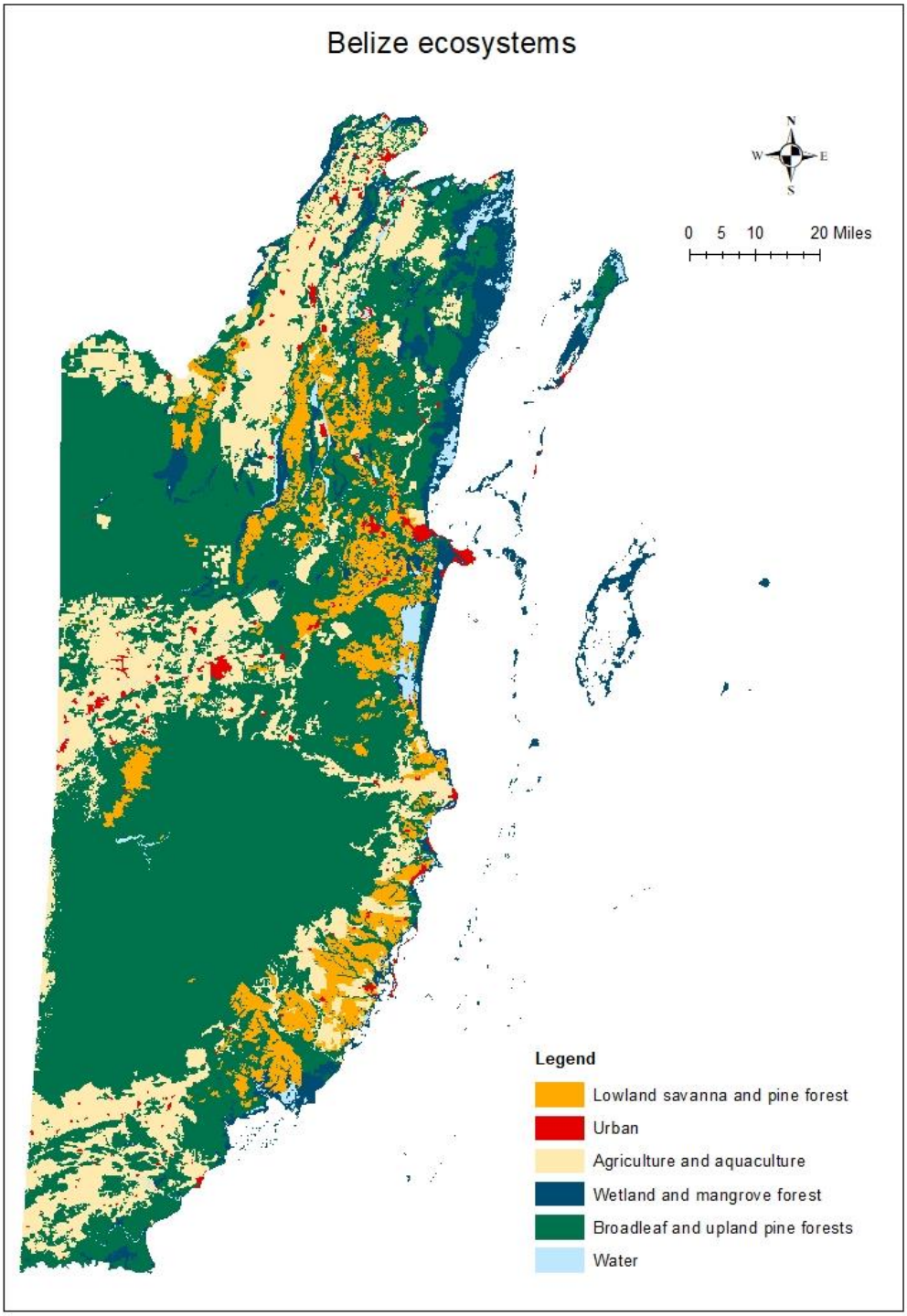
4.1 Belize's lowland savannas

Belize's subtropical to tropical climate has a mean monthly minimum/maximum temperature of 16/28 °C (winter) and 24/33 °C (summer).[43] Lowland savannas extend along the Belizean coast and further to the north and south on the Central American isthmus, bordered by mangrove swamps to the sea, and dense broadleaf rainforest inland (see map Figure 4.1).[44] These savannas have a patchwork mosaic of habitats: grassland with pine, oak or no trees, and pockets of broadleaf forest (see views of the savanna, Figures 4.2 – 4.5).[45] Wildfires are common in the savanna in the dry season, from February to May. In Chapters five and six, the emphasis is on the savannas of the southern coastal plain in the Stann Creek and Toledo Districts.

Climatic and edaphic factors broadly control the vegetation distribution in Belize. The savanna is underlain by an Eocene-Cretaceous limestone platform, overlain by clay and topped with silty and sandy Pliocene deposits derived from the older rocks of the Maya Mountains inland, or, in some places, with Quaternary

[43] Stuart, Barratt & Place (2006).
[44] Cameron, Stuart & Goodwin (2011). Though not the subject of this thesis, it is important to note that there is also a small area of upland savanna in Belize. This are further inland and is named the Mountain Pine Ridge area. The upland savanna has a different ecology to the lowland savanna. It is, however, similarly subject to frequent fires and fire management has been carried out there by the Forest Department.
[45] Wright *et al* (1959); Stuart, Barratt & Place (2006); Goodwin *et al* (2013); Furley (2016).

Figure 4.1



Source: Map created in Arc GIS by author, using Belize Ecosystems 2015 version shapefile (Meerman, 2015), available at http://www.biodiversity.bz/, [accessed 11/02/2019].

Figure 4.2

Savanna in Deep River Forest Reserve near Payne's Creek National Park, showing the patchwork mosaic of vegetation types in the savanna: open grassland with some shrubs (to front); grassland with pine (circled in red); broadleaf (circled in purple); a dense 'island' of palmetto (circled in yellow).
Source: Author, 2018.

Figure 4.3

View over the savanna to the north of the Deep River Forest Reserve from the abandoned Las Lomitas fire lookout tower. The image shows the patchwork mosaic of vegetation in the savanna: grassland with and without pine interspersed with inclusions of broadleaf.
Source: Author, 2016.

Figure 4.4

Smoke from an ongoing savanna wildfire at the north of the Placencia peninsula.
Source: Author, 2018.

Figure 4.5

Savanna to the north of the Placencia peninsula following a wildfire
Source: Author, 2018.

coastal deposits.[46] These are, for the most part, heavily weathered acidic and nutrient poor soils. Together with the clay layer, which determines poor drainage and seasonal inundation (given the marked seasonality in rainfall), these factors, broadly, explain the occurrence of savanna. By contrast, the richer soils inland, calcareous outcrops and alluvial deposits along rivers that cut down from the Maya Mountains support dense broadleaf rainforest (patches of broadleaf also occur within the savanna mosaic). At a local level, differences in slope, drainage and soil underly the mosaic of vegetation types within the savanna. For example, the gently undulating topography of the coastal plain leaves drier ridges and wetter depressions, and the higher and drier ridges generally support more pine and oak.[47] At a finer scale, it is feedbacks with disturbances that control the shifting vegetation boundaries. In Central American pine savannas, fire and hurricanes are the main disturbance agents given the lack of large, grazing herbivores.[48] Today, human agency is the cause of most fires in the coastal savannas (although the presence of grassland, pine and fires pre-date human presence in Belize).[49] Since their arrival in Central America, approximately 10,000 years ago, human use of fire may have aided the expansion of grasslands, and, coupled with erosion, have allowed pine to expand its distribution.[50]

Many plant species of the Belizean coastal savannas are adapted to some level of frequent fire. Burning triggers flowering for a rich ground flora of grasses and

[46] Wright *et al* (1959); Donoghue *et al* (2019).
[47] Wright *et al* (1959); Stuart, Barratt & Place (2006).
[48] Myers & Morrison (2006); Myers (2009).
[49] The first known record of fire in Belize is from a charcoal fragment in the Mountain Pine Ridge, dated by Kellman (1975) to 11210 ±330 BC. Most writers have believed that the majority of fires are human in origin, with only occasional fires resulting from lightning strikes (Hunt, 1962; Wolffsohn, 1967; Johnson & Chaffey, 1974; Arnold & Armitage, 1989). There is no existing data regarding the number of lightning fires in the coastal savannas. The only evidence I found in this regard was in the Forest Department's annual report for 1963 (Forest Department, 1964), which notes that of the fires fought that year on the coastal plain, 19% were due to lightning strikes and 81% were human in origin. This is surprising given that three years later, Wolffsohn wrote that 'in the coastal pine forests lightning fires are unknown' (Wolffsohn, 1967, p. 233).
[50] Myers & Rodríguez-Trejo (2009).

herbs. *Pinus caribaea*, the dominant pine species, has shade intolerant seedlings and requires post-fire sunlit conditions for regeneration. Fires kill the oldest individuals, bringing light and space to new seedlings. Pine seedlings with less than one year's growth will often be killed by fire, although the likelihood of mortality is also highly dependent on site-specific variables. Once pines reach maturity they will generally survive low-intensity fire, having a thick protective bark and a 'self-pruning' capacity to shed and quickly regrow crown needles and re-sprout from stems (see Figure 4.6).[51] Dense 'islands' and scattered individuals of the palmetto *Acoelorrhaphe wrightii* are also found throughout the savanna. This species, like other palmetto palms, is adapted to fire, with fire-induced flowering and large underground organs from which it sprouts clonally, as well as the ability rapidly to refoliate post-fire. Its leaves contain a volatile wax which burns intensely, propagating fire and killing neighbouring competing species (Figure 4.7 shows palmetto burning).[52]

Myers and Morrison loosely characterise an 'ecologically appropriate' fire regime for the pine savannas of Honduras, which are very similar to those in Belize, as one of low intensity surface fire with a return interval of one to ten years.[53] Recent analysis of satellite imagery suggests that the present fire return interval in the coastal savanna of southern Belize is under three years.[54] The ecological role of fire in the Belizean coastal savanna has, however, received very little empirical research, especially in so far as it may guide management.[55]

[51] Myers & Morrison (2006); Myers (2009); Rick Anderson (pers. comm. 16th December 2018).
[52] Milne (1997); Furley (2008).
[53] Myers & Morrison (2006).
[54] Roper (2016).
[55] The feedbacks between fire, soil nutrients and vegetation in the upland savannas of the Mountain Pine Ridge were subject to extensive experimental study by Martin Kellman and students from the 1970s to 1990s (see in particular Kellman (1984); Kellman & Sanmugadas (1985); Kellman, Miyanishi & Hiebert (1987); Kellman & Maeve (1997)) but no similar work has been carried out on the coastal plain.

Figure 4.6

Pinus caribaea re-sprouting from a stem after fire.
Source: Author, 2017.

Figure 4.7

A highly flammable palmetto palm (*Acoelorrhaphe wrightii*) burning during a prescribed burn in the Deep River Forest Reserve.
Source: Author, 2018.

Various writers describing the Belizean savannas earlier in the twentieth century tried to fit the vegetation boundaries they saw into the framework of the theory of ecological succession and equilibrium ecology (as described in Chapter two). Stevenson (1927), saw an ecological succession from treeless savanna to pine forest to climax broadleaf forest; Bartlett (1935) saw pine forest and broadleaf as separate climaxes.[56] Conversely, Charter (1941) and Beard (1953) believed there to be a succession from broadleaf forest to pine to treeless savanna, and thought it to be controlled by the gradual weathering of alluvial soils, and impedance of drainage, not fire.[57] Wright *et al* (1959) upheld the importance of soil drainage on surface vegetation, but also understood fire to play a role.[58] So too, Lamb (1950) and Hunt (1962), pointed to edaphic factors and to the importance of fire.[59] Munro (1966) and Budowski (1966) understood fire as the most important factor controlling the occurrence of savanna, and believed human agricultural fire use in broadleaf forests to have been a major driver of 'savannisation' of formerly forested areas.[60] While these writers emphasised different factors, each failed to theorise the feedbacks between different factors and to explain the inherent disequilibrium of the system. In searching for a theory to account for all Belizean savannas, these writers did not appreciate that, given the ecological variety that exists in savannas in Belize, different factors might be important in different areas. In this, and the next chapter, I will show how this limited understanding of the complex ecology of the savannas influenced their management by the Forest Department from 1920 to 1986.

[56] Stevenson (1927); Bartlett (1935).
[57] Charter (1941); Beard (1953).
[58] Wright *et al* (1959).
[59] Lamb (1950); Hunt (1962).
[60] Budowski (1966); Munro (1966).

4.2 Belize's political economy: A brief history to 1920

Though it is thought that humans had reached Central America by 10,000 BCE, the first evidence of settlement in Belize is at 2600 BCE at Cuello.[61] What is now Belize was within the area occupied by the Mayan civilisation, and contained various major population centres, many of which reached their peak populations in the Early Classic (AD 250-600). Many sites declined into the Post-Classic (from AD 1000).[62] In 1504, Columbus encountered the Gulf of Honduras on his fourth voyage, initiating the Spanish conquest of the Central American mainland. The Spanish did not establish a permanent presence in what is now Belize but raided, enslaved and attempted to 'pacify' the indigenous Maya of three linguistic groups occupying the area. The British entered the Caribbean in 1560, condoned by the British Crown's attempt to break Spain's embargo on foreign trade: British buccaneers used the Cayes on Belize's coast as a base to pillage Spanish vessels.[63] When buccaneering was outlawed by the Treaty of Madrid in 1667, some former British buccaneers founded logwood cutting settlements on the mainland in what is now Mexico's Yucatan at Campeche, and also in 'the Bay' (modern-day Belize City). Logwood was certainly being exported from the Bay, via Jamaica, by 1670, and it is likely that the British were importing African slaves to the settlement.[64] By 1735 the Bay settlement grew in importance after the Spanish cleared the British logging camps in the Yucatan. The Spanish first granted the British limited rights to occupation, and for logwood cutting only, in the Treaty of Paris of 1763. By then mahogany was already

[61] Hammond *et al* (1976).
[62] Coe & Houston (2015).
[63] The Cayes are the islands that run the length of Belize's coast along its barrier reef.
[64] Though the first written evidence of African slaves in the Belize settlement dates to 1724. See Bulmer-Thomas & Bulmer-Thomas (2012), pp. 47-9. The British also attempted to make slaves of the Maya.

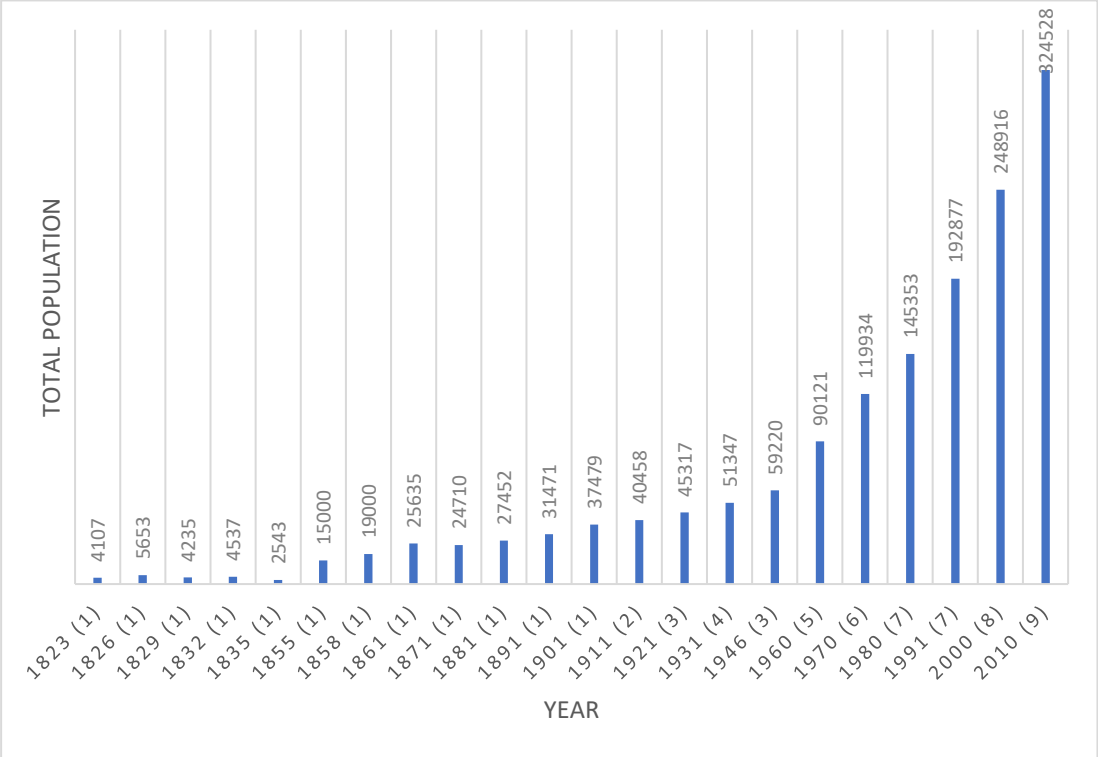
superseding logwood cutting and export, but this was not legally sanctioned by the Spanish until the 1786 Convention of London.[65]

Before 1763 the British settlers had no formal system of land ownership, but, following official recognition of the settlement by the Spanish, the British Government sent a Vice-Admiral to encourage the settlers to develop a basic set of laws for the settlement, which were known as 'Burnaby's Code'. This included the first 'location law', which established the principle that occupation of a logwood 'work' equated to ownership of it. The law specified that no man should occupy more than two works, but the settlers did not adhere to this. The same principles soon applied to mahogany works. Mahogany cutting demanded more land and labour than logwood and thus land was rapidly concentrated in the hands of a dozen powerful settlers. They owned the largest number of slaves, controlled the 'public meeting', the settlement's only legislative body, and having established connections with London merchants for their timber export, controlled the imports upon which the settlement depended.[66]

When the Spanish empire was dismantled after 1821, Britain negotiated its rights to the settlement with newly-independent Guatemala and Mexico. The treaties with Spain had only allowed British timber extraction as far south as the Sibun, but the settlers had ignored this, and mahogany operations reached the Sarstoon River (at what is now the southern border of Belize) by 1825. This uncertainty as to the nature of the British right to the territory (which, as Figure 4.8 shows, had a small population) made the British Government reluctant to openly assert a claim to sovereignty throughout the first half of the nineteenth century. Britain's interest in the settlement was largely economic: besides the logwood and mahogany trades, Belize

[65] Bolland (1977), chs. 3 and 4; Thomson (2004), chs. 2 and 3; Bulmer-Thomas & Bulmer-Thomas (2012), ch. 2; Shoman (2012), ch. 2.
[66] Bolland & Shoman (1977); Bulmer-Thomas & Bulmer-Thomas (2012), ch. 3.

Figure 4.8 Total population of Belize by year



Data sources*

(1) Belize Census of 1901**, [BARS Census-11].
(2) Belize Census of 1911, [BARS Census-12].
(3) Belize Census of 1946, (BARS Census- 16].
(4) Belize Census of 1931, [BARS Census-14].
(5) Belize Census of 1960, [BARS Census-16 and Census-17].
(6) Belize abstract of statistics 1973-4, [BARS AR117].
(7) Belize abstract of statistics 1991, [shared by the Belize Government's Statistics Institute].
(8) Belize Census of 2000, [raw data shared by the Belize Government's Statistics Institute].
(9) Belize Census of 2010, [raw data shared by the Belize Government's Statistics Institute].

* These sources did not follow consistent census methodologies.
** Data prior to 1901 was compiled by the authors of the 1901 census from estimates in a variety of sources.

was the base for a flourishing entrepôt trade with the Central American mainland. From 1786 the British government had installed superintendents in the Bay, but they had little power over the local elite. One, Superintendent George Arthur, attempted and failed in 1817 to end the 'location' system and break the land monopoly. He succeeded only in passing several new resolutions, one of which named all unclaimed land as 'Crown Land', disposable by grant. In practice, over the following decades the location system remained in force. The Crown made few land grants and no attempt to regulate the use of Crown Lands. In the early nineteenth century, some of the dominant settlers went bankrupt and their lands secured by 'location' were bought out by several British metropolitan companies who came to own most of the private land. By 1882, the Belize Estate and Produce Company (BEC), owned over half of the private land in Belize, with secure title under the Land Titles Act. BEC's lawyers had strong influence with both the British Government and Belizean legislative assembly and were thus able to bias the Belizean legislation in their favour.[67]

When the settlement became an official colony in 1862, and a crown colony in 1871, the British Government and its Governors appointed to Belize took a stronger ruling stance.[68] By then, the Caribbean colonies were declining in importance within Britain's Empire, and Britain preferred to encourage capitalist investment rather than create a strong local administration.[69] There was minimal public spending and little attempt to regulate private actors. For example, despite the publication of a report on the Forests of Belize in 1887 in a series commissioned

[67] BEC had immense political influence in Belize until after WW2. BEC's largest shareholders, the Hoare family, included a Director of the Bank of England, and two members of parliament, one of whom served as British Foreign Secretary in 1935. Bolland & Shoman (1977); Bulmer-Thomas & Bulmer-Thomas (2012), ch. 3 and appendix 2; Shoman (2012), ch. 5.
[68] Crown Colony status was sought by the settlers in the hope that Britain would then lend greater support to the settlement in the Caste War with Mexico. Despite Crown Colony status, British assistance was not as forthcoming as had been hoped.
[69] Bolland (1977), chs. 9 and 11; Bulmer-Thomas & Bulmer-Thomas (2012), ch. 4.

by Kew Gardens for the West Indian colonies, which noted the unregulated and over-extractive nature of the mahogany industry, the suggestion to establish a Forestry Department to regulate forest use and extraction was not taken up.[70]

Despite constitutional changes throughout the twentieth century, the influence of the Governor and his officials to direct affairs in the Colony remained constrained by the power of the metropolitan companies. These major landowners had their headquarters in Britain, but their interests were protected locally by representatives or partners who often held positions in the legislature and doubled as merchants in Belize City. Between 1890 and 1892, this group succeeded in campaigning for an unofficial majority in government. As Governor Swayne lamented in 1910, 'no other British Colony has a constitution like that of British Honduras, where we have a nominated unofficial majority practically appointed for life and considering themselves responsible neither to the people of the Colony nor to the Crown'.[71]

In the later nineteenth century, the government made increasing efforts to encourage foreign capitalists to establish commercial plantation agriculture, for which labour was imported from the Caribbean and China. Slavery had been abolished in Belize in 1834 and the government had introduced a price for small land grants and a contract labour system. Many former slaves were thus inhibited from developing their own smallholder agriculture and remained bound into a system of debt servitude in the mahogany industry, which remained the economic backbone of the settlement.[72] The Mayan population grew in Belize in the second half of the nineteenth century, in the north as a result of the Caste War, and in the south as Q'eqchi immigrants fled conditions of coercive labour on coffee plantations

[70] Hooper (1887). See also Richardson (2004), ch. 4; Wainwright & Zempel (2018).
[71] Governor Swayne to Crewe, 18th July 1910, [TNA CO, 123/265], in Ashdown (1981), p. 128.
[72] Bolland (1977), chs. 7, 8 and 9; Bolland (2003), ch. 6; Bulmer-Thomas & Bulmer-Thomas (2012), ch. 4.

in Guatemala. Many lived largely 'unseen' by the state, but there were increasingly efforts to govern and gather revenue from the Maya. In 1872, the Crown Lands Ordinance provided for the creation of 'Indian Reservations', in which the Maya paid occupancy fees for usufruct rights to occupy Crown Land. The government sought to organise settled communities of agriculturalists, in which the state-formalised Alcalde leadership system gave them a means of indirect rule.[73]

Bolland and Shoman summarise Belize's political economy in the nineteenth and twentieth centuries as follows:

> This then is the circle of factors concerning land in Belize: the demands of the metropolitan market create the raison d'être for colonial occupation and settlement; the system of land tenure and the pattern of land use develop in relation to the changing demands of the market and the development of the Settlement's constitutional position; the growing colonial economy makes greater demands for labour, resulting in immigration, dispossession, and a variety of coercive measures to keep the labour force dependent; the monopolization of land and the dispossession of the people ensures the dependence of the labourers upon their employers for their subsistence; the underutilization of land resulting from its monopolization maintains the dependence of the entire country upon the metropolis. In this fashion the demands of Western European, and now North Atlantic, capitalism have created and perpetuated dependent satellite economies.[74]

Thus, entering the period of focus of this thesis, Belize was ruled from Belize City; 'to all intents and purposes the capital was the colony'.[75] In southern Belize, capitalist commodity production, labour markets and direct rule by state representatives or institutions was minimal.[76] Most land was 'undeveloped' and possessed by a handful of companies based in London, or, as was the case for most of the savanna, held by the British Crown. These colonial legacies set the stage for persistent inequality: In 1971, three per cent of the freeholders still owned

[73] Wilk (1991), chs. 3 and 11; Moberg (1992); Bolland (2003), ch. 5; Wainwright (2008), ch. 1; Grandia (2012), chs. 1 and 3; Shoman (2012), ch. 6; Wainwright (2015). It is unlikely that the Maya chose to live in such 'communities' before Spanish and British colonial rule. The Alcaldes were indigenous leaders, whose positions of jurisdiction over village affairs were legally formalised by the colonial state. Indigenous villages in southern Belize still maintain biannually-appointed Alcaldes.
[74] Bolland & Shoman (1977), p. 8.
[75] Ashdown (1981), p. 16.
[76] Wainwright (2015).

95% of the private land in Belize.[77] Land distribution has since remained highly inequitable.[78]

4.3 The Belizean coastal savannas and human fire use before the twentieth century

Little is known empirically about human fire use in Belize prior to European contact and in the early colonial period. Palaeoecological studies of charcoal and pollen records from lake sediment cores can provide evidence of human land and fire use, although these signals are not easily isolated from climate signals. There are only three charcoal records for Belize.[79] None isolates a local charcoal record from savanna. These studies associate increased charcoal frequency, as a proxy for fire use, with times of population increase and higher farming intensity in broadleaf forest.

Palaeoecological and archaeological studies give some limited insights into the use of the savanna prior to European contact. In some areas in northern Belize, the wettest savanna was used for 'chinampa' (raised field agriculture).[80] There are archaeological remains of Maya hunting sites in the southern coastal plain savannas.[81] In the Classical Period, the Maya operated an extensive salt industry in the coastal lagoons of Southern Belize, close to the lowland savannas (Figure 4.9 shows a Maya site in the savanna associated with the nearby salt works).[82] Nevertheless, as today, the limitations of the soils for agriculture probably led to little inhabitation of the savanna, settlement instead

[77] Bolland & Shoman (1977), p. 104.
[78] Wainwright (2008, 2015, 2018); Shoman (2012), ch. 12 and 13.
[79] These are at different resolutions and timespans: Pohl *et al* (1996) cover dates from 6000 BCE to present; Rushton *et al* (2013) from 1500 BCE to 1500 AD; Walsh *et al* (2014) from 800 BCE to present.
[80] Siemens (1982); Baker (2003).
[81] Heather Mckillop, pers. comm. 21st March 2018.
[82] Mckillop (2002); Robinson & Mckillop (2013); Mckillop & Robinson (2014); Mckillop & Sills (2017).

Figure 4.9

Maya site in the southern part of the Deep River Forest Reserve (circled in yellow). This earthen mound is likely associated with the salt works, and one of several remnant sites where brine was leached to enrich the salt content before it was boiled to make salt (Heather McKillop pers. comm.). Source: Author, 2018.

favouring fertile river valleys and broadleaf forest further inland.[83] Pine from savanna areas was traded and of importance in settlements located some distance from savannas, being used in construction, for fuelwood, and as wood ash from household refuse, to fertilise agricultural land.[84] Pine was also of ritual and political importance. Pine torches feature in Classical Period Mayan iconography and it is found in ceremonial cave deposits throughout what is now Belize.[85]

Palaeoecological records across the neotropics generally show a decrease in charcoal frequency associated with European contact, attributed to population decrease among indigenous populations encountering European disease and

[83] Thompson (1973); Dunham & Wanyerka (1994).
[84] Wyatt (2008); Rushton, Metcalfe & Whitney (2013); Rushton (2014).
[85] Lentz *et al* (2005); Morehart, Lentz & Prufer (2005).

violence.[86] The charcoal records from Belize each show different patterns and are too limited in number and location to make generalisations about the impact of European contact on fire use.[87] European settlers and their African slaves certainly brought their own fire use practices to Central America, which subsequently both influenced and were influenced by indigenous practices. William Dampier's account of the logwood settlements to the north of Belize at Campeche demonstrates settlers' use of fire in savannas in their use as rangelands for cattle: 'The Mould of the Savannahs is generally black and deep, producing a course sort of sedgy Grass. In the latter end of the dry time, we set fire to it, which runs like Wild-fire, and keeps burning as long as there is any Fewel'.[88] Sluyter and Duvall suggest that this late dry season timing of fire use as described by Dampier shows the influence of African burning practices on the logwood cutters.[89] Such early descriptions of fire use in savannas in Belize are few, but nineteenth-century sources suggest that fire use for hunting was commonplace, and associated with indigenous practices. The colonial forester Hooper noted in 1887 'I would add on the subject of the Pine ridges that those in the interior are burnt over yearly by Indian hunters'.[90] The Maya, African slaves and European settlers used fire to clear land for agriculture in the broadleaf forest, but this, generally occurring at some distance from the savanna, is unlikely to have been a major cause of savanna wildfires.[91]

While laws to control fires within Belize City to protect its mostly thatch buildings were passed as early as 1806, the Belizean legislation did not refer to fires outside urban areas until much later.[92] In 1894, an Ordinance was passed to 'render

[86] Nevle *et al* (2011).
[87] Walsh *et al* (2014).
[88] Dampier (1697), p. 58.
[89] Sluyter & Duvall (2015).
[90] Hooper (1887), p. 10.
[91] See description for example in Duval (1878), p. 67.
[92] Cambridge University Library special collections, GBR/0115/RCMS 270, item 56.

more effectual the provisions for the protection of property from destruction or injury by fire', which was aimed at controlling fire that might damage any 'house, building or other property'.[93] Under this definition, privately-owned land could be included. The Fire (negligent use of) Ordinance, passed in 1912 (see Table 4.1), made the first explicit reference to fires outside property boundaries:

> Every occupier or person who shall set, or who shall negligently, carelessly or improperly use or manage, or who shall permit or allow the careless or improper use or management of, any fire in or upon any land or place whatsoever, and every person who shall use or carry any lighted pipe cigar or cigarette or any lighted torch or other matter or thing in a state of ignition not sufficiently guarded or enclosed so as to prevent danger from fire, where by danger may or shall result to any building, land, forest, wood, cultivated or uncultivated tree, plant, or other produce whatsoever of the soil, engine, carriage, train, railway-line, fence or any property of whatsoever nature or kind.[94]

Table 4.1 Legislation regarding fires in Belize (excluding legislation regarding urban fires)

Year	Legislation	Effect
1912	Fire (Negligent Use of) Ordinance	Makes careless or 'improper' use of fire on any land or property illegal.
1926	Ordinance for the Protection and Control of Forests and Forest Produce	Enables the Governor to make rules regarding fire use in forest areas.
1927	Forest Rules (Under 1926 Forest Ordinance)	Rule 12 makes it illegal to set fires or leave fires burning in the Crown forests.
1945	New Rules under Fire (Negligent Use of) Ordinance	Fire traces must be created around vegetation before burning for agriculture.
1958	Agricultural Fires Act	Those wishing to burn to clear land for agriculture must apply for a license to the agriculture department first. All agricultural fires must take place within a fire trace (fire break) of at least 6 ft in width.
1962	Forest Fires Act	The Governor (later the Minister overseeing the Forest Department) can declare any area of Belize a fire control area, for which the Chief Forest Officer will write a fire protection plan. This must be followed through by the landowner or management agency at their expense.

[93] Ordinance 11 of 1894, [TNA CO 125/6].
[94] Ordinance 12 of 1912, [TNA CO 125/10].

My analysis of surviving travel accounts and archival records gives some insight into the use of the savanna in Belize after European contact. Most of this activity initially took place in the northern savannas near Belize City. If the settlers or their slaves used the southern coastal plain savannas they did so after 1800, once mahogany cutting reached the area. Hunting and consuming a diversity of wild meats, including from savannas, was both a means of subsistence for the lower classes but also valued for sport and gastronomy by the white upper classes.[95] The settlers used some savanna areas to graze cattle, but with limited success, owing to the lack of water in the dry season.[96] The savanna also housed other resources, most still used today. Yellow-headed parrots, prized as pets, were 'in large numbers … annually taken from their nests in the standing trees which are very often cut down for that purpose'.[97] Palmetto stems and leaves were used in thatching and walling by settlers and indigenous people.[98] The British and their slaves also used pine wood in construction, though lumber imported from the US was commonly in use by the nineteenth century.[99] The logwood and mahogany cutters used pine shards as torches, without which 'the hauling of mahogany, which, on account of the heat and the flies (mosquitoes), takes place chiefly at night, could not be carried on'.[100]

Rights of access to savanna areas began to change in the nineteenth century. The British had privatised much of the broadleaf forest for its logwood and

[95] Uring (1726), p. 356; Wilk (2005, 2006).
[96] As described by Henderson (1811), p. 120; Swett (1868), p. 28.
[97] Memorandum of Surveyor General Usher, of 24th November 1903, enclosed in letter of 26th November 1903 from Colonial Secretary Cork to Colonial Office [TNA, CO 123/245], p. 4. See also Henderson (1811).
[98] Dampier (1697), p. 79; Henderson (1811), p. 17; Swett (1868), p. 31; Morris (1883), p. 56.
[99] Henderson (1811), p. 109; Morris (1883), p. 57-8; Memorandum of Surveyor General Usher, of 24th November 1903, enclosed in letter of 26th November 1903 from Colonial Secretary Cork to Colonial Office [TNA, CO 123/245], p. 4; Memorandum of Surveyor General Usher, of 1st February 1904, enclosed in letter of 4th February 1904 from Colonial Secretary Cork to Colonial Office [TNA, CO 123/246], p. 1.
[100] Morris (1883), p. 57. This use of pine is also described in 'Letter to the editor', *The Clarion*, 29th September 1904.

mahogany resources, but most savanna areas had remained common access areas. In 1936, the Forest Trust noted how 'an interesting entry appears in the Archives of the Colony dated 7th December 1793, when the Quarterly Court decided that the "Pine ridge aback of Poor Man's Rest" was "a Common free for any of the inhabitants using and cutting pine in"'.[101] Thus, when Superintendent Arthur, in 1919, proclaimed all unclaimed land to be Crown Land, he included most of the coastal savanna. In practice the government made few land grants and did not limit access to the savanna until the twentieth century. Government officials made few excursions out of Belize City, and the savanna was still un-mapped in 1903, the Surveyor General noting:

> When I say that about one-third of the bulk of Crown lands (estimated at 1956600 acres) is pine ridge I am only speaking roughly – the same manner as the area of all other lands in the Colony has been arrived at- from personal knowledge of portions actually travelled over, of other parts seen at distance and from the tops of hills, also from what other travellers in remote and at present almost inaccessible places have recorded.[102]

The reason for the change was a growing desire by the government to obtain revenue and encourage capitalist investment in commercial pine extraction (there had been awareness of the commercial potential of Belizean pine for timber, resin and turpentine in the nineteenth century[103]). After 1860, pine sawmilling was started on two private estates (at All Pines and Regalia near the Sittee River), but this failed, 'possibly from want of judgment and capital as much as from the unsuitability of the country at the time for any undertaking requiring skilled manipulation and management'.[104] In 1886, an amendment to the Crown Lands Ordinance introduced

[101] Forest Department (1936), p. 10.
[102] Memorandum of Surveyor General Usher, of 24th November 1903, enclosed in letter of 26th November 1903 from Colonial Secretary Cork to Colonial Office [TNA, CO 123/245]. 'Pine ridge' denoted pine savanna.
[103] Henderson (1811), p. 109; Gibbs (1867), p. 125; Hooper (1887), p. 5.
[104] Swett (1868), p. 27-8; Morris (1883), p. 27;

licensing to cut pine on Crown Lands, at a rate of 25 cents per tree.[105] By the end of the nineteenth century the government began to consider how to encourage capital investment to 'make something' of this resource on a larger scale.[106] In 1904, the Government, backed by the Colonial Office, granted to a US firm, the Consolidated Naval Stores of Florida, a 30-year concession to harvest all pine on Crown Lands ('the Chipley concession').[107] The firm also obtained the rights to harvest pine on the private lands of BEC, who owned the majority of the non-Crown savanna land.[108] From this point, access to the savanna was constrained, though the concessions remained unworked for another thirty years.[109]

4.4 The formal beginnings of state fire management in Belize

In 1922, a state forestry department was established in Belize, with fire 'protection' of the pine savannas a part of its remit.[110] This followed the publication of a 'Report on the forests of British Honduras with suggestions for a far reaching forest policy' by a German forester, Cornelius Hummel, by commission of the newly established British Colonial Research Committee.[111] Hummel was appointed to head the new Forest Department as Conservator of Forests: 'The Forest Dept. in British

[105] Rules made on 19th July 1886, enclosed in letter from Governor Goldsworthy to Colonial Office, [TNA CO 123/179].
[106] Governor Maloney, for example, addressing the issue in his opening speech to the legislative council in 1892, [Kew Gardens Archive MR/641], f. 12.
[107] Correspondence between Colonial Secretary Cork and the Colonial Office in 1903 and 1904, [TNA CO 123/246 and CO 123/247]; 'Our pine woods', *The Clarion*, 4th August 1904; 'The pine concession', *The Clarion*, 8th September 1904; 'The pine concession', *The Clarion*, 22nd September 1904; 'Editorial', *The Colonial Guardian*, 1st October 1904.
[108] Board meeting minutes, 3rd May 1905, [uncatalogued archives of the Belize Estate and Produce Company, Ladyville, Belize].
[109] As noted in the press: 'Letter to the editor', *The Clarion*, 29th September 1904, and evident in requests for permission to cut pine in the Chipley concession area received by the Colonial Secretary in the following decades: Letter from Surveyor General to Colonial Secretary, 7th August 1916, [BARS MP2496/1916]; Letter from Acting Town Superintendent to Colonial Secretary, 8th June 1917, [BARS MP1948/1917].
[110] 'Protection' denoted fire prevention and suppression.
[111] Hummel (1921).

Honduras started in 1922 with C. Hummel in charge and alone'.[112] This section examines the content of Hummel's text: the means by which it rendered fire a problem, the solutions it identified, and what this reveals of the governmental rationality for state fire management in Belize. Section 4.5 explores why Hummel and his report held authority with the British Colonial Office, such that his recommendations for state forestry were heeded. This entailed examining the evidence upon which his report rested and its discursive and socio-economic context.

Hummel held that treeless savannas were aberrant, and fire an exogenous destructive force:

> The stock of the pine forests of this country, with only a few and very small exceptions, is in a sub-normal and unsatisfactory state; they are subject at present to a process of slow, but sure, destruction by fire…. On several places the pine forest has actually been destroyed so entirely that not a single living tree is left, and on large areas the destruction is so far advanced that *the former forest can no longer be classed as a 'forest'; it is now poor grass savannah with some pine trees on it* and with numerous half-burnt trees lying on the ground, thus showing that there was a forest before.[113]

This understanding of savannas was in line with succession theory from equilibrium ecology and parallels the perceptions of many of Hummel's contemporaries in other European colonies, such as Madagascar and South Africa.[114]

Hummel asserted that pine had potential as a valuable commodity and fire thus rendered the savannas 'wasteland from an economic point of view'.[115] In that savannas covered a large part of the Crown Land, he deemed fire an obstacle to the Colony's development: 'It is the large area of the British Honduras pine forests which

[112] Letter from Neil Stevenson to Peter Ashdown, 1st April 1980, [OWL MSS.W.Ind.s.56], f. 18. Hummel is similarly credited with the establishment of the Forest Department in other accounts. See for example Oliphant (1925); Duff C.E., 'History of Forestry in British Honduras', [unpublished, 1960s, OWL MSS.Brit.Emp.s.466].
[113] Hummel (1921), p. 48, emphasis added. Note that, Hummel, like other writers (see discussion earlier in this chapter), reserved the term 'savanna' for only treeless areas, which were presumed to have resulted from destruction of pine forests.
[114] Kepe & Scoones (1999); Pyne (1999); Kull (2004); Kepe (2005); Pooley (2014).
[115] Ibid. p. 54.

makes it so important that they should be utilised and developed. A weighty additional reason for doing this is that the soil on that extensive area is so inferior that besides some poor grass, pine wood is almost the only one, and certainly the most valuable commodity, that can be grown there'.[116]

Besides cattle pasture, which he acknowledged could be combined with pine forestry if properly managed, Hummel's report mentioned no other 'services', species or resources of the savanna ecosystem. He attributed all potential value of the land to pine either as timber or resin. 'Development' of the savanna, with large-scale capitalist investment in the establishment of a sustained pine industry, was presented to be in interests of the Colony at large.[117] Only through fire suppression to conserve pine could 'proper' development of the savanna proceed: 'If measures were taken for raising the stock of the British Honduras pine forests gradually to normal, there should be no difficulty in getting the whole pine area opened by simple railways at the expense of concessionaires'.[118] Additionally, 'the pine forests of this country should become valuable in about ten years hence, as it is well enough known that the present stock of pines in the United States is decreasing so rapidly that in about ten years an import to the United States instead of the present export must be anticipated'.[119]

Hummel attributed savanna fire to human fire users, whom he portrayed as irrational, motivated only by their own desires and blind to the wider implications of their actions:

> I have been assured repeatedly that the majority of the people who set the grass in the pine forests on fire every year hardly realise that they do any damage. It is done practically by everybody and sometimes for very trivial reasons. There is some excuse in certain cases for burning the grass on limited areas for cattle grazing, but it is done too freely for hunting purposes, and even for pleasure.... grazing is only possible during a few months every year after burning the old grass. This burning is

[116] Ibid. p. 54.
[117] Ibid. p. 50.
[118] Hummel (1921), p. 49.
[119] Hummel (1921), p. 81.

> done at present with no regard whatever to the pine trees, and in such cases, for instance, where a burning over 10,000 acres would be sufficient for the cattle, the fire is allowed to spread over 100,000 acres or so. It is this unlimited and wasteful annual burning that is objectionable and does so much unnecessary harm to the pine forest.[120]

James Ferguson and Tania Li have suggested that development interventions must render the problems they would solve in technical and apolitical terms, to make their proposed 'solutions' appear necessary.[121] In this way, Hummel's framing of the fire problem led him to suggest certain solutions: 'A proper system of protection from fire, *as in other countries*, is necessary, with systematically laid out fire lines *under the control of a qualified forester*, and with a special staff for patrolling during the dry season. A Forest Ordinance will also be required for this purpose'.[122] For Hummel, Belize's fires were materially no different to fires faced by foresters elsewhere and so could be managed by applying universal methods. Fire suppression was a technical problem that could be solved by forestry professionals with the correct training and expertise. Fire prevention required regulations, information and persuasion to convince fire's human point-sources to stop the burning. His proposed solutions were presented apolitically; the expertise and qualifications of foresters would legitimise fire protection in Belize. Guidance from forestry experts was as necessary for the Colonial Administration, who were to be forgiven for past errors and could not 'be expected to have professional knowledge of forestry', as it was for the enlightenment of the general public: 'It is easy for anyone to see this effect of the destruction by fire, and everyone who has been with me in the pine forests (educated people and uneducated labourers) saw and realised the above facts quickly when their attention

[120] Hummel (1921), p. 48-50.
[121] Ferguson (1990); Li (2007a).
[122] Hummel (1921), p. 49, emphases added.

was drawn to it. The only thing they wondered at afterwards was that they themselves had not noticed that before'.[123]

In Hummel's framing of the fire issue, the rational solution involved alignment between forestry officials, capitalist investors and state administrators. His text established Hummel's authority based on scientific rationality, presenting his analysis as 'the facts'.[124] To understand why this rationality had such salience at the time, we must examine the context and practices upon which it rested: British concerns for colonial development, pre-existing proprietorial concerns in the Colony, and, not least, Hummel's background and his fieldwork in Belize.

4.5 The evidence, expertise and authority behind Hummel's call for fire management in Belize

In part, Hummel's text held sway with the Colonial Office and Governor of Belize because it spoke to existing developmental concerns within the Colony.[125] They sought to reduce Belize's dependence upon mahogany exports, for which the market had, for decades, been unstable.[126] Unlike the broadleaf forests, which were largely in private hands, a large proportion of the pine savanna was Crown Land, but these areas generated no revenue. Since the negotiation of the 30-year Chipley concession in 1904, the Government had waited, in vain, for capitalist investment in a pine industry. Moreover, in 1920, a representative of the concessionaires, named Kluge, made a proposal to the Government to reduce the area in question and

[123] Hummel (1921), p. 95 and p. 48.
[124] Hummel (1921), p. 48, 95.
[125] It is important to note that besides his recommendations for the pine industry, Hummel proposed the establishment of a Forest Department to impose regulatory measures on existing over-exploitative industries in the Colony, in particular mahogany. As Bulmer-Thomas & Bulmer-Thomas (2012, ch. 4) argue, the overexploitation of mahogany could no longer be ignored, with the Colony still economically dependent upon it.
[126] Bulmer-Thomas & Bulmer-Thomas (2012).

establish new terms for the concession.[127] At the time of Hummel's visit to Belize, the Governor was keen that the proposed area be specially examined. Before Hummel's arrival in 1920 he requested of the Secretary of State that Hummel devote his attention to particular 'economic question[s] of great importance', among which he included 'the Pine Wood Forests of the Colony, the value of which has recently increased'.[128]

Over only one day of fieldwork in Belize, Hummel collected a small dataset of pine tree measurements from a single location in the savanna.[129] From these data, Hummel extrapolated estimates of pine stocks on all Crown Land. Whether or not they were reliable, these estimates (and predictions of future yields) were powerful in making the case for fire management. Once the savanna could be expressed in the volumes of a potential commodity, it became a 'field' for capitalist and state intervention. The words of a staff member of the Colonial Office, speak to a specifically economic interest in Hummel's work, and particularly in his data:

> This strikes me as an extremely valuable report, and it shows that the pine forests in British Honduras are of an actual and prospective value much greater than we would have anticipated…. Mr Hummel considers that the production of timber could be trebled merely by the adoption of well understood and routine methods of protection against fire. Under proper management the pine forests between Monkey River and Sittee River alone, which cover an area of about 200,000 square miles, could be made to yield at least 50,000 tons a year, and perhaps twice that amount.[130]

Hummel was the first to publish a call for fire management, but not the first to problematise fire in relation to a potential pine industry. The issue of fire in the savanna had already been raised in 1904, as objections heard during the initial

[127] Letter from Governor Hutson to Colonial Office, 15th March 1920, [TNA CO 123/299], f. 440; Correspondence between Kluge and Colonial Secretary, May to June 1920 [BARS MP1697/1920]; Correspondence between Governor Hutson and Colonial Office, June to July 1920, [TNA CO 123/301]; 'Our pine woods and the Chipley contract', *The Clarion*, 17th June 1920; 'The Chipley contract', *The Clarion*, 8th July 1920; Correspondence between Governor Hutson and Colonial Office, November to December 1920, [TNA CO 123/303].
[128] Letter from Governor Hutson to Colonial Office, 5th July 1920, [TNA, CO 123/301], f. 452-3.
[129] Report detailing the savanna reconnaissance of 16th December 1920, [TNA, CO 123/303].
[130] Colonial Office minute of 27th January 1921 on Hummel's Report detailing the savanna reconnaissance of 16th December 1920, [TNA, CO 123/303], f. 155.

negotiation of the Chipley concession. Usher, the Surveyor General, had then cautioned that

> The pine land of this colony does not maintain itself in the same manner as the Mahogany forests in the propagation of plants by seed cast abroad from the tree, for the following reasons: when the seeds fall if they do not rot they are nearly all burnt up by the recurring annual fires – this may account for the isolated growth of the pines in the open pine ridges which to all appearances are very old- the majority being 8 inches and above that size. If the old trees are all cut down there seems no prospects of ever replacing them.[131]

Eugene Campbell, Director of Belize's Botanic Station, had warned that

> Considerable damage is done to these pine forests every year by the indiscriminate use of fire; hundreds of thousands of seeds and seedlings of pine are annually killed. If this goes on unchecked, I am afraid our pine ridges will in the course of time become a barren treeless waste.… it would be advisable to consider some measure by which these pine tracts would have some kind of protection; notice boards might even be placed about warning travellers against the careless use of fire especially in the dry season of the year. Forests like nations endure only at the expense of a constant succession of births and deaths. It is not an easy matter to regulate or control forest fires: but an effort might be made to mitigate this disastrous annual destruction of valuable pine forests.[132]

Neither of these earlier calls was heeded by the Colonial Office or local government; they added no special measures for fire protection to the Chipley concession agreement. Yet fire remained a consideration in connection with the potential pine industry. In correspondence with the Colonial Office before Hummel's arrival, the Governor noted with his request that Hummel report on the pine forests, that 'Except in certain limited areas there is apparently every reason to believe that there is little or no natural reproduction of pine trees; the cause is alleged to be frequent fires in the pine ridges during the dry season of the year'.[133] Fire was already a 'problem' in Belize before Hummel's work. Yet, by the Colonial Office and Colonial Administration, Hummel's perspective on savanna fires was deemed different – and

[131] Memorandum of Surveyor General Usher of 26th January 1904, enclosed in letter from Colonial Secretary Cork to Colonial Office, 28th January 1904, [TNA CO 123/246].
[132] Memorandum of Campbell of 1st February 1904, enclosed in letter from Cork to Colonial Office of 4th February 1904, [TNA CO 123/246]. Campbell was at the time one of the only scientifically trained officials stationed in the Colony. The Belize Botanic Station had been established in 1892 under direction from Kew Gardens (see Bulmer-Thomas & Bulmer-Thomas (2012), ch. 5).
[133] Letter from Governor Hutson to Colonial Office, 5th July 1920, [TNA, CO 123/301], f. 452-3.

superior – to local knowledge: 'The frequent occurrence of fires is a matter of common knowledge in the Colony, but it has been left to the eye of *the expert* to appreciate the extent to which those fires have resulted in the destruction of seedlings, in damage to adult trees, and in the reversion of whole areas to savannah'.[134] From this, it is appropriate to examine how Hummel's perspective gained authority as 'expertise'. As discussed in Chapter two, Section 2.7, expertise can be both real and socially constructed. Let me examine, first the forms of expert knowledge that informed Hummel's report, before turning to the social construction of Hummel as *the* expert.

Behind Hummel's recommendations for fire management lay ten days of field inspection of the savanna between the Sittee and Deep Rivers, in southern Belize, remote from Belize City. This was the area proposed by Kluge for a renegotiated pine concession. Hummel's recommendations were not made by scientific induction from quantification of savanna fires and their effects on the growth of pine growth. The only measurements Hummel made were those mentioned above, that were taken on one day (and from which he estimated the pine stocks). Sullivan and Forsyth assert that knowledge can derive authority from its discursive presentation as science, even if not derived from empirical scientific research.[135] So too, the 'science' contained within Hummel's report was limited to deductions using theory that he had learned during his training in forestry. We might therefore consider this, after Fleischmann and Briske, 'professional ecological knowledge'.[136]

[134] Colonial Office minute of 27th January 1921 on Hummel's Report detailing the savanna reconnaissance of 16th December 1920, [TNA, CO 123/303], f. 155.
[135] Sullivan (2000); Forsyth (2011).
[136] Fleischmann & Briske (2016).

Hummel asserted that before his inspection '*very little was known* with regard to the available quantity of wood; the pine forest in question was generally supposed to be the best of the Colony and to be well stocked with good trees'.[137] Yet his field report from 1920 makes clear that many local informants played a role in its construction:

> Before starting I collected information from various sources about the forest, the land, landing places, river, swamps etc. I was able to check afterwards the reliability of the greater part of such information by visiting several of the described localities and forests myself, and I found that most of that information was good; it could therefore be taken as valuable also for those localities which I could not see myself.[138]

Hummel gathered local knowledge about the pine's quality in different areas, and about the frequency of fire in the savanna: 'an old man, who has known this part of the pine forest for 56 years, told me that as far as he remembers, it has been burnt over every year during that long period'.[139] 'On the strong advice of reliable men who had been there', Hummel also changed his original plan to cross the savanna on horseback in the wet season.[140] Hummel navigated and was shown the field by local people, including the owner of a mahogany camp in the area, who:

> seemed to know the country all round very well and has been over larger areas of the pine forest for shooting deer.… he drew my attention to another smaller good forest belt in the Southern part of Mr. Kluge's proposed concession land, near the Ycacos lagoon. I decided at once to go there, as this appeared to be rather important, and Mr Winzerling was kind enough to offer me his services for showing me that forest belt and various other good patches.[141]

Hummel's fieldwork was also facilitated by field assistants who carried his equipment and conducted data collection. These field assistants feature in

[137] Report detailing the savanna reconnaissance of 16th December 1920, [TNA, CO 123/303], f. 160, emphasis added.
[138] Ibid. f. 162.
[139] Ibid. f. 165.
[140] Ibid. f. 162.
[141] Ibid. f. 170.

Hummel's fieldwork account only in a comment that one day he 'did partly labourers' work [himself] in order to get that timber survey completed'.[142]

Hummel's local informants possessed tacit knowledge of the savanna's geography gained through extensive experience conducting their livelihoods in these areas. After Collins and Evans, we can consider this a form of expertise, even if it was not considered such at the time.[143] Hummel could not have produced his report without drawing upon this local expertise. The contributions of local tacit knowledge and labour to assembling Hummel's case for fire management, while hinted at in the fieldwork report from 1920, are not acknowledged in his 1921 publication, nor were they considered 'expert' by the Colonial Office. This is often the case with 'lay participation' in scientific fieldwork.[144] To understand why, let me now examine the social construction of Hummel as *the* expert on savanna fires in Belize in 1920.

It is striking that those local informants that are directly referenced by name in Hummel's report (such as Mr Winzerling) were male members of the colonial elite. Hummel, too, could speak with authority to the colonial administration in Belize and to the Colonial Office, in part, because of his position as a white male in a colonial context. Beyond this, his authority as an 'expert' was derived from his professional training in forestry. To understand why, let me examine the growing authority of forestry as a discipline and its relationship with colonial development at this time.

In the early twentieth century, colonial 'development' meant 'complementary development': stimulating colonial economies by increasing revenue from private enterprise in the exploitation of raw materials or agriculture and thereby creating a greater demand for the export of manufactured goods from Britain.[145] In the

[142] Ibid. f. 167.
[143] Collins & Evans (2008).
[144] See Latour (1987); Ogden (2008); Vetter (2011).
[145] Worboys (1996).

nineteenth century, Britain's Colonial Office had generally taken a passive approach to this, responding to proposals or queries from Colonial Governors, but deeming private enterprise largely responsible for bringing about colonial development. After 1895, the Colonial Office began to see itself as responsible for facilitating an empire-wide strategy of colonial development.[146] Within the ideology that Scott terms 'high modernism', science was viewed as a tool by which the state would enable colonial development, initially through exploration and problem-solving and, latterly, through provision of technical services.[147] Science's universalism aligned politically with the notion of a unified empire.[148] Between the wars, the Colonial Office reorganised, moving from departments oriented to particular geographical regions, towards specialist technical departments with an empire-wide focus. Training of officials for the Colonial Services was also unified.[149] After the 1929 Colonial Development Act, an annual budget was put forward for colonial development by the Treasury, and after the 1940 Colonial Development and Welfare Act, the amount was greatly increased (further detail follows in Chapter five). Nonetheless, Worboys asserts that the alignment between science and development was largely rhetorical: 'What impact the work of colonial scientific and technical services had on the economic and material development of the Colonial Empire is impossible to say.... What is evident, however, is the importance of science in colonial development thinking and policy between the wars'.[150] In this context, the Colonial Research Committee was established in 1919 'for the assistance of the poorer colonies and protectorates in conducting necessary researches', and it was this Committee which commissioned and co-financed Hummel's report.[151] Hummel was directed to write 'in the interest of

[146] Overseas Development Institute (1964); Constantine (1984); Havinden & Meredith (1993).
[147] Scott (1998), p. 4.; Worboys (1991, 1996); Harrison (2005); Bennett (2011b).
[148] Worboys (1991).
[149] Furse (1962).
[150] Worboys (1996), p. 108.
[151] Foreign and Commonwealth Office (1971), p. 28.

the local Government, but also in the interest of the Imperial Government' and to focus principally on 'economic questions of forest development'.[152]

Forestry was one of the 'sciences' to have allied with colonial development, promising 'progress' by enabling capitalised resource extraction and state revenue collection, sustained by measures of conservation such as fire protection.[153] Although it lagged behind countries like France and Germany in instituting forestry, Britain had previously employed foresters trained in continental Europe to serve in colonial forest departments (like Hummel, who trained at Aschaffen in Germany and, prior to his position in Belize, had served in the British Federated Malay States).[154] In the late nineteenth and early twentieth centuries, first in India and then in Edinburgh, Britain established its own schools of forestry. By 1920, aligning with the notion of universal scientific approaches for an economically unified Empire, the ideal of a unified British 'Empire forestry' had emerged (as I described in Chapter two).[155] In this context, the Colonial Office called upon the testimony of experts such as Robert Scott Troup, who headed the Oxford Imperial Forestry Institute, and David Prain, the Director of Kew Gardens, in making Hummel's appointment, and in the appointment of his successors as Conservator of Forests in Belize.[156] Hummel's qualifications and professional background in forestry, and his ability to frame Belize's fire 'problem' in the language of forestry, played in part in his social construction as the 'expert' and lent him authority with the Colonial Office.[157]

Hummel's recommendations held enough authority with the Colonial Office that a Forest Department was established in Belize. Yet, as I demonstrate in examining the first decades of work by the Forest Department, forestry's experts

[152] Hummel (1921), p.7.
[153] Bryant (1996).
[154] Correspondence between Darnley and Prain, April 1920, [KEW, MR/641], f. 80-2.
[155] Furse (1962); Bryant (1996); Barton (2002); Rajan (2006); Powell (2007); Bennett (2011b, 2015).
[156] Correspondence between Darnley and Prain, April 1920, [KEW, MR/641], f. 80-2; Draft letter from Colonial Office to Governor Hutson, 3rd December 1923, [CO 123/315].
[157] On the social construction of scientific expertise see Wynne (1992) and Shapin (1994).

and their methods, held less authority with powerful elites and fire users in Belize, and were not always suited to this ecological context.

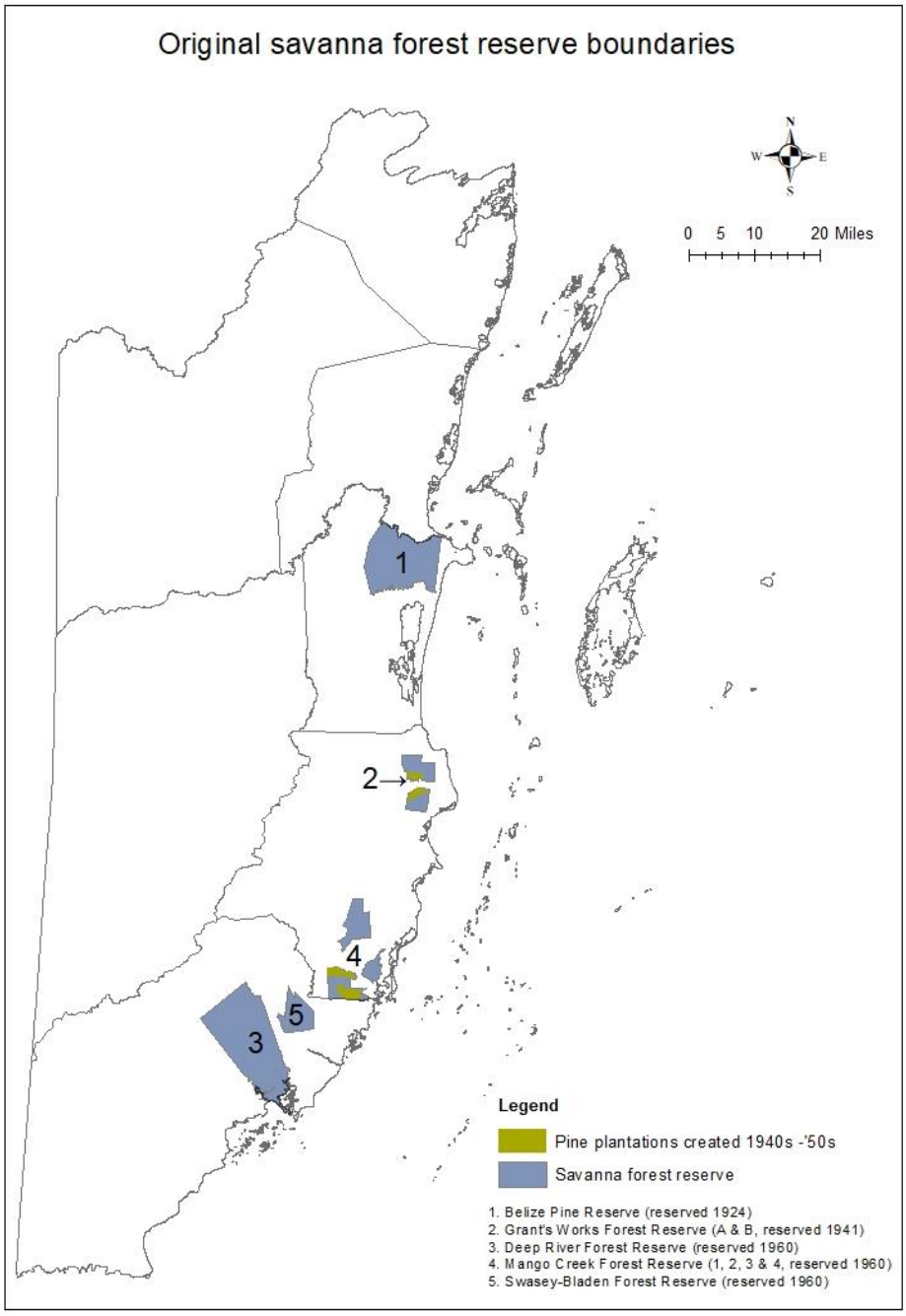
4.5 Fire management methods of the Forest Department, 1921-1941

The Forest Department's methods of fire management involved attempts to directly suppress fires and to prevent fires by modifying the landscape and by changing the behaviour of local fire users. Following the recommendations made in Hummel's report in 1921, notices were published in the government gazette warning that the use of fire in the pine ridges was punishable by law (under the existing Negligent Use of Fire Ordinance), with rewards for information leading to the conviction of anyone found guilty of this offence on Crown Land.[158] In 1926 and 1927 the Forest Act and Forest Rules were passed (see Table 4.1), recapitulating that 'Setting fire to any grass of undergrowth or leaving any fire burning in such a manner as to endanger tree or forest produce in any part of the Crown forests is prohibited', and authorising the Governor to make additional rules regarding fire for any forest area.[159]

Several forest reserves were established in 1923, the Crown Lands Ordinance of 1872 having already included provision for reservation of Crown Land. One of these, the Belize Pine Reserve, was an area of 64,000 acres of pine savanna between the Belize and Sibun Rivers (see map Figure 4.10 and Table 4.2).[160] Here the Forest Department made its first attempts to suppress fires. Annually in the dry season starting in 1923, they patrolled a small portion of the

[158] Notice published in the Government Gazette, May 21st 1921, [BARS MP602/1921], f. 10.
[159] Ordinance for the control and protection of forests and forest products, 14th October 1926, [TNA CO 125/12]; 1927 Forest Rules, [OWL MSS.W.Ind.s.28(4)].
[160] Forest Department (1925).

Figure 4.10



Source: Map created in Arc GIS by author, using Belize Basemap shapefile (Meerman & unknown sources, 2013), available at http://www.biodiversity.bz/ , [accessed 11/02/2019], and various historical maps. No historical map showing the boundaries of the Belize Pine Reserve was available. I thus estimated the possible boundary of the Belize Pine Reserve based on its description in several sources, which gave its size, place names within it, and described it as located between the Belize and Sibun Rivers (Forest Department, 2015); Field diary of Duncan Stevenson, [OWL MSS.W.Ind.s.28(1)]). I based the pine plantation boundaries and the Mango Creek reserve boundaries on the Land Resource Assessment of Stann Creek District map (King, 1987). I based the Grant's Works boundary on a 1944 map of existing and proposed forest reserves [TNA CO 122/385/9]. This map is intended to show the boundaries of each reserve at the time of reservation. I was, however, not always able to find maps with the relevant dates of origin, some may be later, altered, boundaries.

Table 4.2

Forest Reserve	Year reserved	Year de-reserved	Year re-reserved
Belize Pine Reserve	1923	1933	
Grant's Work A	1941		
Grant's Work B	1941		
Deep River	1941		
Mango Creek	1960	1968	1977
Swasey-Bladen	1960		

reserve and attempted to fight fires that threatened the area.[161] A new telephone line and roads were constructed to improve access and fire warning communications.[162] From 1924 the Forest Department cleared vegetation to construct fire lines to protect part of the Belize Pine Reserve.[163] For several years after 1924, the Forest Department also assisted a private company operating in the Corozal District by patrolling and constructing fire lines on their land.[164] After 1929, as is explained in Section 4.5, the Department underwent retrenchment and was unable to expand fire protection further, although maintenance and patrolling of existing fire lines continued.

The Forest Department also attempted to change local fire use behaviour. Notices in the Government Gazette and signage in the Belize Pine Reserve warned of the illegality of setting fires.[165] The Postal Authorities issued a special fire-related

[161] Memorandum by Hummel 4th May 1923, [BARS MP149/1923], f. 12; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925]; see also annual reports of the Forest Department for following years.
[162] Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925]; Forest Department (1926, 1929).
[163] Field diary of Duncan Stevenson, entries for 12th February 1924 and 30th January 1925, [OWL MSS.W.Ind.s.28(1)]; Forest Department (1925); see also annual reports of the Forest Department for following years.
[164] Forest Department (1925), appendix b; Forest Department (1926), appendix b.
[165] Notice published in the Government Gazette, May 21st 1921, [BARS MP602/1921], f. 10; Memorandum by Hummel 4th May 1923, [BARS MP149/1923], f. 12; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925]; Notice published repeatedly in Government Gazette, for example on 23rd June 1928, [TNA CO 127/24].

postage stamp for the fire season of 1927.[166] On patrols of the Belize Pine Reserve everyone met with was warned 'of the danger of setting fires and the consequences attached to it if they were caught so doing'.[167] In 1923, Hummel envisioned introducing a licensing system for hunters. He imagined police constables, alcaldes and schoolmasters registering the names of all hunters and issuing licenses. This would offer an opportunity 'to get into direct touch with them', as all licenses would have printed on them a warning about fire use and thus 'to make them feel that in future they will be under control to some extent and that the Government does not consider the extensive Forest Fires as harmless and negligible as they do'.[168] Following the Colonial Secretary's advice, he soon realised that this would not be a simple matter, and his, and future suggestions, to introduce licensing for hunters in 1927 and 1930, were not followed through.[169]

Although the Forest Department only attempted to protect a small part of the Belize Pine Reserve from fire, they repeatedly failed to do so. Fires, reportedly originating on nearby agricultural land, entered the protected area in 1924, 1927 and 1933.[170] The reserve was therefore closed in 1934.[171] To understand why, we must consider the limitations of the Forest Department's methods of fire protection as envisaged by Hummel and outlined above. Hummel's assumptions that forestry's fire management methods could be directly transferred from Europe to Belize and were the only necessary measure for pine regeneration, were undermined, in practice, by an unappreciated Belizean ecology and politics.

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[166] Forest Department (1927).
[167] Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925], p. 5.
[168] Letter from Hummel to Colonial Secretary, 9th January 1923, [BARS MP149/1923], f. 1.
[169] 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[170] Forest Department (1925, 1927, 1933).
[171] Forest Department (1935).

The ecology and working conditions of the Belizean savanna frustrated the Department's fire management. The explosive combustion of palmetto palms threw burning debris over fire lines (Figure 4.7 shows palmetto burning).[172] Thick, tufty grass grew as a result of fire suppression and slowed pine regeneration.[173] It became apparent that drainage or soil nutrients might also limit pine regeneration, even in the absence of fire.[174] A bark beetle outbreak in 1939 caused pine mortality over large areas, increasing the amount of combustible matter on the landscape.[175] Most devastatingly, in Belize, hurricanes interacted with fire in the disturbance of the savanna; following a large hurricane in 1931, the blown-over dead timber fuelled widespread fire. This was partly responsible for the destruction of the protected part of the Belize Pine Reserve in 1933.[176] Moreover, as Hummel's fieldwork in 1920 had demonstrated, the savanna generally lacked infrastructure and working conditions were difficult.[177] Swampy conditions early each year made it hard to construct fire lines before the dry season.[178] In the 1920s the Forest Department thus devoted time to building roads in the Belize Pine Reserve, making it 'possible to travel from the Belize River to Sibun River through these Pine Ridges at any time of the year'.[179] This had unforeseen consequences. By building roads, the Forest Department facilitated access to the area by local fire users. Roads also made the area more valuable for agricultural leases, which, when granted by government officials despite

[172] Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925]; Forest Department (1939).
[173] Forest Department (1937).
[174] Forest Department (1935, 1939); 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[175] Johnson (1974).
[176] Forest Department (1933). See Wolffsohn (1967) for discussion of the interaction between hurricanes and fire in Belize.
[177] Report detailing the savanna reconnaissance of 16th December 1920, [TNA, CO 123/303], f. 160.
[178] Field diary of Duncan Stevenson, entry for 15th February 1924, [OWL MSS.W.Ind.s.28(1)]; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925].
[179] Ibid p7; Forest Department (1926).

protests by the Forest Department, was another contributory factor to the 1933 fires and closure of the Belize Pine Reserve.[180]

The Department's attempts to reach fire users had little effect. In the 1920s and 1930s, the Forest Department perpetuated a racially-oriented discourse around the 'problem' of indigenous shifting agriculture and made efforts to settle the indigenous population.[181] No similar racially-oriented discourse could be created for savanna fires. There was no class or 'race' to whom corrective measures could be targeted: fire was used for hunting, land clearance and cattle grazing by diverse sectors of the population, including some government officials.[182] Fires were mobile in the landscape; attributing individual fire events to certain individuals and enforcing the fire legislation was difficult. Most importantly, the foresters and their legislation did not command the same authority with the Belizean public as they did with the Colonial Office. The reasons for this are explored in detail in Section 4.6.

For the Forest Department, fire management was part of a wider remit of work that took place with a limited budget and staff. The Department was thus more generally limited in capacity to undertake extensive fire management by economic and political factors that lead to its repeated retrenchment after 1929. The remainder of the chapter explores these factors.

4.6 Economic and political challenges to the Forest Department, 1921-1941

If the purpose of conservation was to enable exploitation, a paradox lay at the heart of the Forest Department's mandate to conserve pine and other timber

[180] Forest Department (1935); Comments of Neil Stevenson on the resolutions of the fourth British Empire Forestry Conference, enclosed in a letter from Governor Burns to Colonial Office, 1st October 1936, [TNA, CO 123/360/19].
[181] See for example Forest Department (1933); Wainwright (2008).
[182] See for example accusations by Assistant Conservator of Forests Duncan Stevenson against Mr Eyles, an official of the Survey Department, February 1927, [BARS MP 460/1927].

species in Belize.[183] To justify and finance its work, the Department was dependent upon (and thus to some extent needed to appease) capitalist interests. Simultaneously, it needed to be able to regulate and speak authoritatively to these interests. Furthermore, these interests were strongly represented within the Legislative Council, upon which the Department relied to pass legislation and approve budgets. This section examines how the Forest Department was undermined by this tension in the 1920s and 1930s.

Hummel's justification for fire management relied on the prospect of a Belizean pine industry. After collapse of the market for mahogany in the late nineteenth century and early twentieth century, the Colony was, by the late 1920s, again heavily dependent on a booming mahogany industry. This was a dangerous dependency, and the Government placed hope on the development of a pine industry as part of a programme to diversify the Colony's economy.[184] In 1926, the Consolidated Naval Stores transferred the 'Chipley pine concession' to another US firm, the Tidewater Lumber Company, who did not work it.[185] In 1930 the concession period was extended, but the concession lapsed in 1932 after the Company failed to pay occupancy fees.[186] There was further interest in 1934, but no further pine concessions were granted until 1943.[187] A small-scale pine industry developed on several private estates in the Stann Creek district in the 1920s (Figure 4.11 gives log

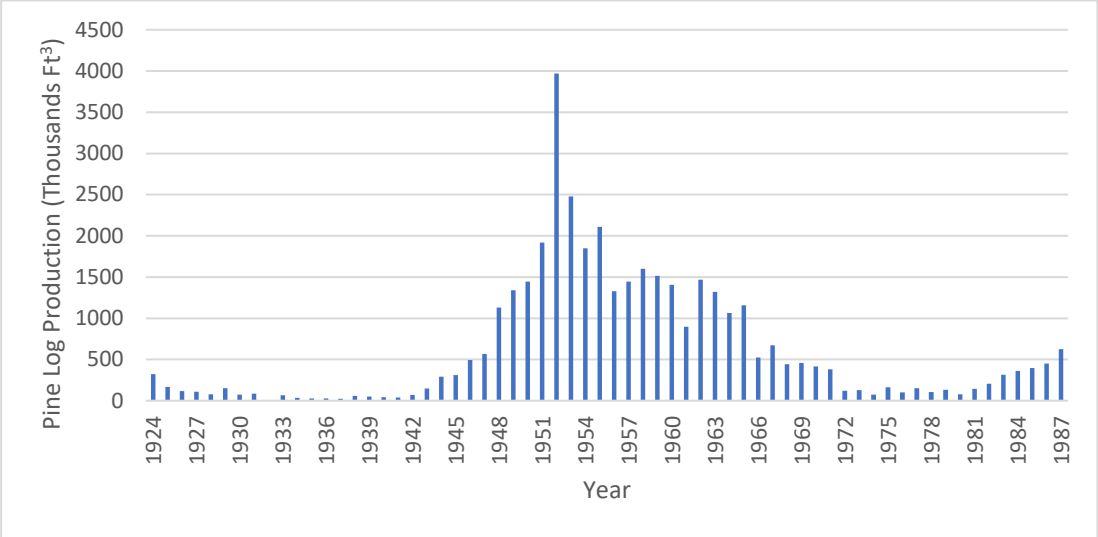
[183] Forestry science generally did see other reasons for conservation, besides exploitation, but these were not deemed necessary in Belize: 'The so-called indirect utility of forests, i.e. their influence upon the feeding of springs and rivers, the preservation of soil in sloping ground, etc., which is sometimes very important in more open countries, hardly calls for special measures in British Honduras in its present wild and wooded state.' [Hummel (1921), p. 90.
[184] Bulmer-Thomas & Bulmer Thomas (2012), ch. 4.
[185] Concession agreement of 24th April 1926 forwarded in letter from Governor Burdon to Colonial Office, 9th December 1926, [TNA CO 123/324].
[186] Forest Department (1931, 1933).
[187] Correspondence between Governor, Colonial Office and Troup of Imperial Forestry Institute, November 1934, [TNA CO 123/349/14].

production data).[188] A small amount of timber was exported in 1925, 1926, 1928, 1930 and 1932, but most fed the local market (Figure 4.12 shows export data). Since this was far from enough to meet local demand, the Colony also continued to import (and re-export) pine from the USA.[189] There are several reasons why the pine industry did not develop in Belize in the 1920s and 1930s on the scale hoped for by Government. There was no shortage of US pine on the market; the US pine industry overproduced in the late 1920s.[190] For capitalists, development of this industry in Belize came with that high risk and initially high capital investment associated with working in a place lacking maps and infrastructure and without information regarding the properties and exchange value of this particular species of pine.[191] The Great Depression in the 1930s also impeded investment.

Aware of these barriers to the development of a pine industry, the Forest Department and Colonial Office made efforts to improve the information available to potential investors. In 1929, the Forest Department was awarded a Colonial Development Grant to enable it to conduct research 'into the exploitation and marketing of secondary timbers with the view to taking prompt advantage of the recovery of world trade when the present depression lifts'.[192] In 1932, samples of pine from Belize were shipped to the British Government's Forest Products Research Laboratory at Princes Risborough for tests, which 'proved' in 1937 that it was 'well suited to the usual uses of pitch pine'.[193] The grant also covered the Department conducting ground and aerial surveys allowing topographic and

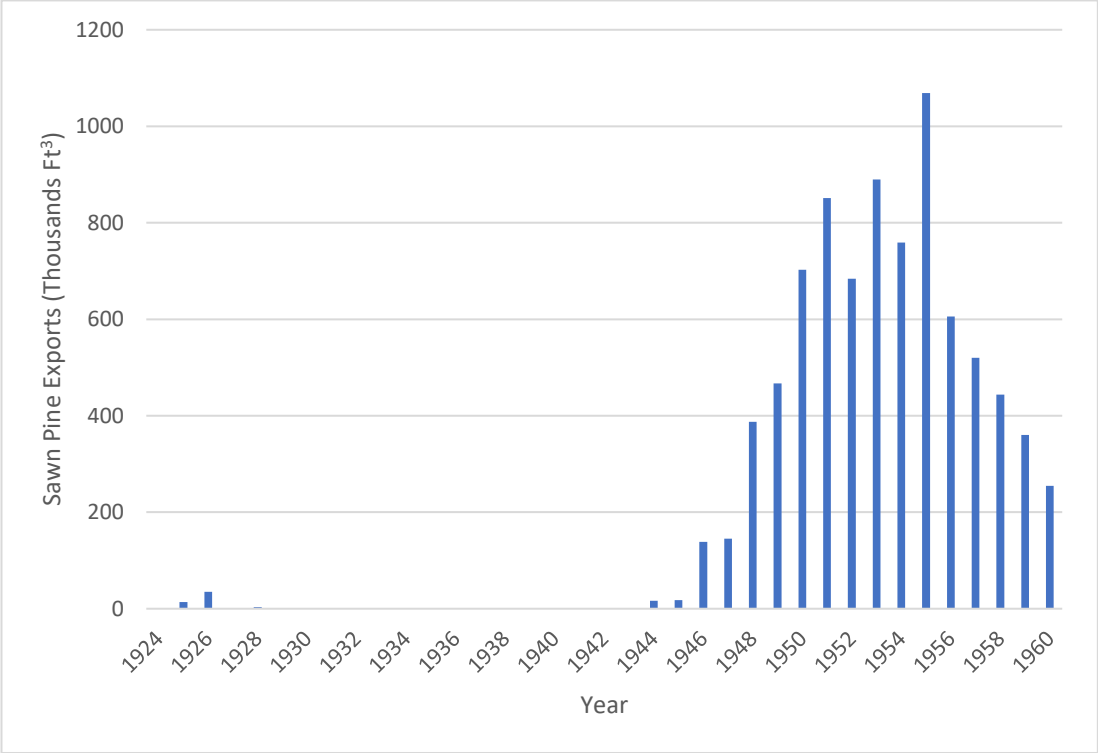
[188] The annual reports of the Forest Department describe sawmills processing pine at All Pines from 1924-6 and in 1928 (operated by the Tidewater Lumber Company), at Regalia from 1926 through the 1930s and at the Sapodilla Lagoon, from 1929 through the 1930s.
[189] See statistics in annual reports of the Forest Department.
[190] Forest Department (1928).
[191] Report by G. H. Barnett of BEC on a visit to Belize in 1935, [Uncatalogued BEC Archive, Ladyville, Belize]; Report by Hoare of BEC on visit to Belize in 1937, [Uncatalogued BEC Archive, Ladyville, Belize].
[192] Forest Department (1933).
[193] Forest Department (1938), p16. Also Forest Department (1935); Letter from Princes Ridsburgh to Colonial Office, 2nd November 1932 and draft letter from Colonial Office to Governor of Belize, 21st November 1932, [TNA CO 123/339/9, items 14 and 17].

Figure 4.11 Pine log production from private and Crown Land in Belize



Data sources
For 1924-1945 I have drawn data from the annual reports of the Forest Department. From 1946 onwards, the data is from the Belize Tropical Forestry Action Plan (TFAP) (Arnold and Armitage, 1989, 202-3), which was also compiled from the annual reports of the Forest Department. As the TFAP notes, the format in which the Forest Department presented annual data for pine production varied (sometimes reporting round timber production and sometimes sawn lumber production). They did not always make clear in which format and in which unit the figures were given. It is also likely that the production reported was incomplete for most years—the Forest Department is unlikely to have recorded all pine extracted on private and Crown Land. The TFAP team (as I have done for the earlier years) therefore attempted to convert this 'messy data' (converting between units and using conversion estimates between sawn lumber and round timber), into a standard format. The data is nonetheless sufficient to demonstrate that pine extraction reached its highest rate between 1948 and 1965, peaking in 1952.

Figure 4.12 Sawn pine exports from Belize



Data source
Data compiled by Bulmer-Thomas (2012) from the Colonial records. I have converted the data from board feet to thousands of cubic feet. Note that pine was exported in 1928, 1930 and 1932, but the figures are so relatively small that they are not visible on the graph.

vegetation maps of the Colony to be produced. As part of this work, detailed pine enumerations were carried out on Crown Lands, including in the Toledo district.[194] Several companies interested in the pine also carried out their own surveys, some sharing their data with the Department.[195] This work helped render the savanna visible and legible to administrators and potential investors, but was insufficient to kick-start a larger-scale pine industry in the 1930s.

Despite the lack of revenue from a pine industry, the Colony might have been able to sustain fire management and other forestry work on a greater scale, had other forest industries generated ample revenue and had there been political support for the Department in Belize. This was not the case. The Belizean economy, which had struggled since 1900, was hit particularly badly by the Great Depression, which coincided with widespread devastation from the 1931 hurricane.[196] The Forest Department also found itself compromised as it became embroiled in a political conflict of interests in Government.

By the 1920s there was a change to the make-up of the unofficial majority in Belize's legislative council. Before, the majority had represented expatriate landowners like BEC, but a new group of Belize Creole merchants and professionals had come to take most of the unofficial seats. These were aligned with American interests, following the Colony's strengthening import-export links with the USA. In the 1920s, this element of the unofficial majority began to push for a blanket land tax, which would greatly compromise British landed interests, in particular BEC, then in financial difficulty and considering sale of land to US interests. With BEC still well connected in the British Government however, the Colonial Office continued to

[194] Handwritten report by Phillips entitled 'Short note on the pine cruising in the Deep River Area', December 1935 and data in handwritten tables, [Machaca Forest Station, Toledo District, Belize, uncatalogued in storage].
[195] 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[196] Grant (1976), ch. 2; Ashdown (1981), ch. 7; Bulmer-Thomas & Bulmer-Thomas (2012), ch. 4.

defend it. This placed the Forest Department, with its mandate to encourage forest development and regulate exploitative forest industries, in a predicament. BEC held large tracts of land in speculation and was largely responsible for the Colony's past and current overexploitation of mahogany, yet there was the risk that a US successor to BEC would be more exploitative.[197]

The Department failed to take a strong regulatory approach, adopting instead a policy of 'encouraging' private landowners 'to practise conservative management of their forests': 'the emphasis in dealing with landowners was always example and precept and the fostering of cooperation, not legal sanctions'.[198] In the 1920s, operating on this principle that expert example would change behaviour, the Department seconded most of its few staff to work with landowners including BEC. In 1924 Hummel left the Forest Department to become the local manager of BEC. This limited the capacity of the Department to work on Crown Land (for example to conduct fire management).[199] It also immediately and publicly aligned the Department with BEC and the Colonial Office. Hummel, as BEC's manager, argued against raising land taxes that would affect the Company.[200]

Introducing a land tax did, however, align with the Forest Policy to curtail overexploitation and to encourage development of land held in speculation. While Hummel defended BEC, his successor as Conservator of Forests, John Oliphant, took a different position. He, with the Governor, was convinced that a land tax was necessary, though Oliphant did not support the blanket tax proposed by the unofficial majority. Oliphant called for a discriminatory system of land taxation, with some tax relief to compensate landowners that made efforts to introduce measures of conservation:

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[197] Ashdown (1981), ch. 6.
[198] Letter from Neil Stevenson to Peter Ashdown, 1st April 1980, [OWL MSS.W.Ind.s.56], f. 19.
[199] Oliphant (1925).
[200] Ashdown (1981), ch. 6.

> unless there is a reasonably near prospect of the Government being enabled to carry legislation for a scheme of discriminatory taxation of land…. without inclusion of the vitiating feature of the flat increase in the land tax demanded by the exploitative and mercantile interests in the legislature, it will be useless to retain the forest organisation in any form…. surrender to the Unofficial demand for the flat increase would be decisive against a policy of forest conservation, as the real motive underlying that demand, though possibly not definite in the minds of the rank and file of its supporters, is antagonism to the conservative treatment of the private forests.[201]

Oliphant saw that, as things stood, in stalemate against the unofficial majority, there was little that he or the Governor could pass through the Legislative Council. He repeatedly called on the Colonial Office to change the constitution. The Colonial Office, fearing the unrest this might cause, felt it more sensible to 'wait until an incident occurs'.[202] Caught in this conflict, the Forest Department was unable to adopt a strong regulatory position against major landholders. They faced active public opposition, engendered by their political position against the unofficial majority, but also because of how they were financed and conducted their work.

Aware of the financial restraints in Belize and of the likelihood of political opposition to the Forest Department from the unofficial majority in the legislative council, the Governor and Colonial Office had initially set up the Forest Department with a fixed annual budget of 60 percent of general forest revenue supplemented by a loan from the Colonial Office, devolved to a separate 'Forest Trust' chaired by the Governor.[203] Its budgets were approved by the Colonial Office, which effectively 'shielded' the Department's finances from 'political pressure' by the unofficial majority in the legislative council, and the loan acted as a 'stabiliser', reducing the Department's dependence on forest revenue.[204] From its inception the Department

[201] Memorandum of Oliphant, 5nd February 1929, enclosed in letter of 25th February 1929 from Governor Burdon to the Colonial Office, [TNA CO 123/330/8].
[202] Ashdown (1981), p. 193.
[203] Forest Department (1924).
[204] Letter from Neil Stevenson to Peter Ashdown, 1st April 1980, [OWL MSS.W.Ind.s.56], f. 19.

was touted as an 'expert-led' and technically-motivated body. This exacerbated the problems caused by the Department's position in the dispute over land taxes.

The unofficial members of the Legislative Council resented that they had no control over the Department's finances and used this as public evidence that the Department was 'imposed on the Colony by the British Government in its own interests'.[205] They also nurtured a growing public resentment of the Department because its staff presented themselves as technical experts superior to other Officials in the Colony. To get 'staff of the best quality' to serve in Belize, forest officers were on salaries comparable with those in other British Colonies, and thus far higher than those of the other Government Departments in Belize.[206] In the press, the Forest Department attributed lack of support for its Forest Policy to a lack of public understanding of forestry.[207] It is clear that the officials of the Department conducted themselves with some arrogance. The Governor noted that 'intellectual pride' was one of the 'causes for the public dislike of the Forestry Department'.[208] For example, Oliphant raised opposition to the suggestion in 1926 that the Colonial Secretary should replace the Governor as chairman of the Forest Trust on the grounds that it would be anomalous to subordinate 'a highly qualified technical officer to an administrative officer of – on an average – a relatively low standard of education and judging by salary, of economic value…. The 'average Colonial Secretary' would find difficulty in explaining forest cases in Executive Council and would there cause trouble through misunderstandings'.[209] Brian Wynne argues that institutional science often faces problems of legitimacy, not simply when it does not

[205] Pim (1934), p. 105. See also correspondence between the Governor and Colonial Office over the set-up of the Forest Trust in August and September 1926, [TNA CO 123/324].
[206] Letter from Neil Stevenson to Peter Ashdown, 1st April 1980, [OWL MSS.W.Ind.s.56], f. 18.
[207] 'Mr Hummel's Report', *The Clarion*, 2nd August 1922; 'The Value of Forestry', *The Clarion*, 12th February 1925.
[208] Letter from Governor Burdon to Darnley of the Colonial Office, 11th August 1926, [TNA CO 123/324], p. 6.
[209] Ibid. p. 3.

incorporate local knowledge, but when its social practices alienate the public.[210] So too, when the Forest Department's senior staff enacted their expertise by calling upon their professional training, it did not command authority with the public in Belize in the way it did with the Colonial Office.

Thus, in 1929, the unofficial members of the Legislative Council raised a petition calling for retrenchment of the Forest Department.[211] Aware of economic difficulties in the Colony and fearing unrest being stoked by Oliphant, the Colonial Office, rather than amending the constitution to strengthen the Department's position, reduced the Department's annual budget and arranged for Oliphant's transferral to another Colony:

> The Forest Trust is intensely unpopular, and its activities are thereby seriously hampered. This unpopularity is largely due to the personality of the Conservator … as the Governor indicates, he is by temperament uncompromising, intolerant of opposition, especially when it lacks intelligence, and not the type which succeeds when brought into contact with persons of inferior calibre. Of his personal unpopularity in the Colony, the local press affords abundant evidence. I have seen cuttings about an attempt recently made to burn down his house during his absence on leave.[212]

The retrenchment effectively ended any hope of the Department regulating private interests. With a reduced staff and budget, it could no longer afford to second officers to private companies, and its work was heavily restricted to small areas of Crown Land. In 1929 the Colonial Development Act made provision for direct grants to Colonies for 'aiding and developing agriculture and industry … and thereby promoting commerce with or industry in the United Kingdom'.[213] With the

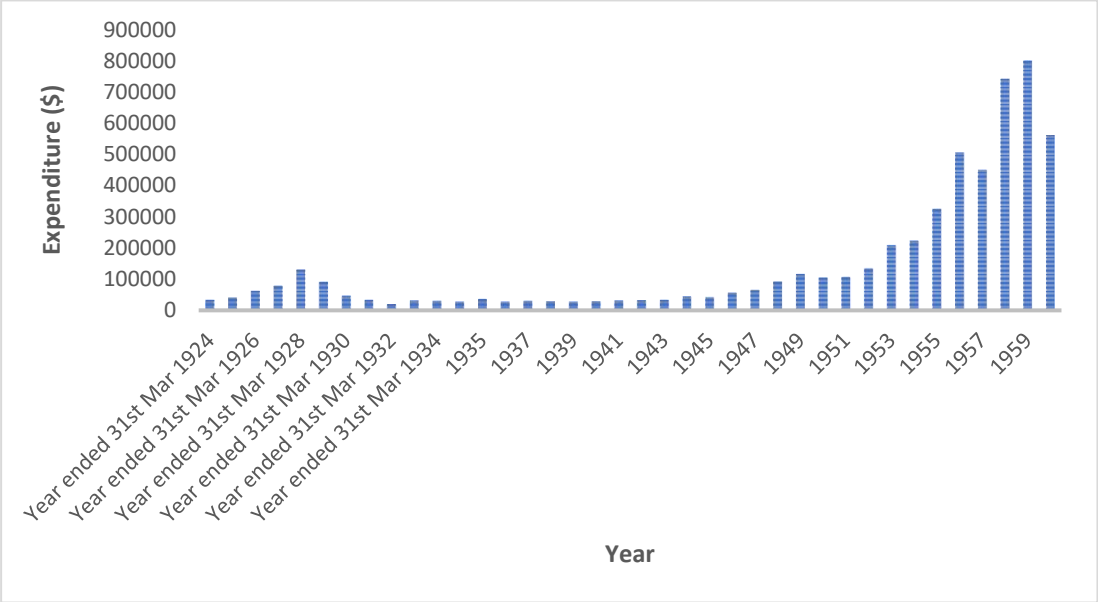
[210] Wynne (1992, 2003).
[211] Petition of 22nd January 1929, enclosed in letter of 25th February 1929 from Governor Burdon to the Colonial Office, [CO 123/330/8]; 'An appeal for retrenchment', *The Clarion*, 24th January 1929.
[212] Note of 15th August 1929 by a Colonial Office staff member on the minute sheet for correspondence between Governor Burdon and the Colonial Office over retrenchment of the Forest Department, [CO 123/330/8]. Oliphant, in his next position with the Forest Department in Malaya and then as director of the Imperial Forestry Institute, continued, in character, to speak out in favour of radical policies. Vandergeest & Peluso (2006a, 2006b) use his views as illustration of the dissent among foresters as to the purpose of forest management.
[213] Foreign and Commonwealth Office (1971), p. 6. See also Overseas Development Institute (1964); Constantine (1984).

award of such colonial development grants to the Belize Forest Department, the Colonial Office protected the Department's existence while keeping its work securely outside of the political domain. This grant, as discussed above, provided for eight years of surveying and mapping of the Colony's resources (as Figure 4.13 shows, even with the grant, Forest Department expenditure was heavily reduced after 1930).

The devastation caused by the hurricane in 1931, coincident with the collapse of Belize's exports during the Great Depression, was the final 'incident' seized upon by the Colonial Office to change the Belizean constitution. As conditions attached to a grant for hurricane reparations, they insisted upon reserve powers to the Governor to pass legislation.[214] Now, so long as the Colonial Office insisted upon its maintenance, the Forest Department could be protected from closure. The Department, however, remained unpopular. In a climate in which the people, in poverty, had begun to organise demonstrations, strikes and petitions, the question of further retrenchment or closure of the Department was raised again by the Legislative Council and successive Governors throughout the 1930s.[215] In 1932, in the Colony's depressed conditions, Governor Kittermaster found it difficult to justify expenditure on forestry: 'Is Reason to be the only guide or is Sentiment also to be allowed to exert an influence? As I sit quietly writing in my office my intelligence tells me that Reason should be the only guide but when I pass out into the street and see the starving children Sentiment will thrust itself in…. when my people come to me clamouring for bread and I am fain to offer them – a tree,

[214] In practice, in the following decades, the Colonial Office was generally unwilling to back those Governors that sought to use these powers to oppose the local elite. See Grant (1976), ch. 2; Ashdown (1981), ch. 7; Bulmer-Thomas & Bulmer-Thomas (2012), ch. 4.
[215] See correspondence between Governor and Colonial Office in 1932 [TNA CO 123/339/9], 1934 [TNA CO 123/349/12], 1936 [TNA CO 123/360/19] and 1938 [TNA CO 123/386/2]; 'Retrenchment', *The Independent*, 16th January 1935; 'The Forest Trust', *The Independent*, 25th September 1935.

Figure 4.13 Forest Department expenditure



Data source
All data is drawn from an unpublished report written in the early 1960s by C. E. Duff entitled 'History of Forestry in British Honduras', [OWL MSS.Brit.Emp.s.466]. The data includes spending from colonial development grants. Duff compiled the data from the Forest Department's records and is unlikely to have accounted for inflation. Nevertheless, the figures are sufficient to demonstrate the fall in spending after retrenchment from 1930 and the increase in spending from the late 1940s.

Sentiment intervenes'.[216] This is a reminder that scientific 'reason' alone did not direct colonial rule.[217] Yet in this case the Colonial Office, had sovereignty to dictate, and, keeping emotional distance from the poverty in Belize, reminded the Governor of the Colonial Development Grant that Belize had received: 'Large grants have been made by the Imperial Government for research work and it would seem that under the circumstances it is incumbent on the government to keep this department in existence'.[218] It also reminded him of Belize's duty to contribute to trade within the Empire: 'The virtual abolition of the Forestry Department cannot very well be discussed at the moment. Moreover, it ought not to be definitely considered by the local Government until they have had the circular despatch dated 12th July, regarding the advisability of training officers in timber utilisation and the prospects of securing a greater share of the home market'.[219]

In 1934, a report on the Colony's economic position by Sir Alan Pim, an economic advisor to the British Government, strongly re-asserted the position that Belize required its Forest Department: 'Even if the Department is for some time to come not able to show substantial financial results from its work, the Finance Committee of 1932 were clearly right in considering it essential to retain a competent Forest Service'.[220] 'For many years to come … much the greater part of the Colony must remain under forests, and in the main, forest products must continue to form the most important element of its economic resources'.[221] Though the Colonial Office shielded the Department from closure, it was decided in 1935 to close the Forest Trust, and make it a normal government department, as 'the

[216] Letter from Governor Kittermaster to Colonial Office, 25th December 1932, [TNA CO 123/339/9, item 20].
[217] Cooper & Stoler (1989); Stoler (2002); Stoler (2010).
[218] Comments from the Colonial Office finance committee, [TNA CO 123/339/9, item 21].
[219] Comment of Colonial Office staff member on minute sheet of correspondence over possible abolition of the Forest Department, [TNA CO 123/339/9].
[220] Pim (1934), p. 103.
[221] Ibid. p. 164.

present impression that the Forest Department is beyond criticism is not good of the officers of the Department and unnecessarily irritates the public'.[222] Entering the 1940s, the Forest Department lacked finances and political support in Belize and was propped up by the sovereignty of the Colonial Office. In the process of retrenchment and abolition of the Forest Trust, it had lost any position of authority it might have had from which to regulate capitalist interests. Despite its challenges, as Section 4.7 examines, the Department's annual reports throughout the 1920s and 1930s ignored in their language mention of its political struggles, presenting its work in technical terms, while maintaining the ideology and practices of a wider 'Empire Forestry'.

4.7 Maintaining fire management as 'Empire Forestry'

As noted, for the Forest Department, the practice of fire management in Belize entailed confronting a specifically Belizean ecology, economics and politics. These factors had barely featured in Hummel's initial plans; he had assured the Colonial Office and Colonial Administration that technical methods of fire management, developed elsewhere, could be successfully implemented in Belize by qualified foresters. The Department was not unresponsive to the local challenges that it faced in fire management. As we have seen, after an initial engagement, the Department more or less ended its efforts to engage with fire users or with the pine industry, from which it might have demanded assistance with fire management. [223] Limiting fire management to technical work on certain areas of Crown Land cocooned the Department from political resistance.

Unlike with its political struggles, it was possible to confront the challenges of the local ecology by technical means. Evidence shows that the Department

[222] Letter from Governor to Colonial Office, 1935, [TNA CO 123/349/12, item 3].
[223] Stevenson (1944).

experimented, sometimes unsuccessfully, to adapt and adjust its methods to the Belizean savanna. The foresters trialled different methods of clearing and maintaining fire lines, including hand-cutting with machetes, controlled burning and the use of weed-killing chemicals.[224] They experimented with controlled fire to remove the high grass accumulating from lack of fires.[225] Lacking other equipment, palmetto leaves from the savanna were found to be the 'best weapon for fighting a fire' by beating or smothering.[226] Experiments were made with planting cashew trees along fire lines to block flying burning debris from crossing them.[227] The Department also began to try to identify the factors affecting pine growth: in 1938 they established sample plots to examine the influence of different soil types.[228] When the Belize Pine Reserve was abandoned in 1934, the fire protection 'experiments' were immediately moved, away from this populous area and re-located further south, to an area of Crown Land near Melinda, where a small-scale private pine timber operation was underway.[229] In 1941 this area and surroundings became the Grant's Works Forest Reserves (see Table 4.2 and map Figure 4.10). By moving the operations from a place of failure to a fresh locale, fire management could continue.

The Forest Department maintained a particular textual representation of its coherent fire management programme in its annual report sent to the Colonial Office, newspaper articles and other publications. Fire management was presented in technical terms; no political challenges were mentioned. What were small-scale

[224] Field diary of Duncan Stevenson, entry for 12th February 1924, [OWL MSS.W.Ind.s.28(1)]; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925]; 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[225] Field diary of Duncan Stevenson, entry for 22nd May 1925, [OWL MSS.W.Ind.s.28(1)]; Forest Department (1935).
[226] Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925], p. 3.
[227] Forest Department (1939, 1940).
[228] Forest Department (1939).
[229] Forest Department (1933, 1935).

operations were given weight and described in detail for a Belizean and British readership that, for the large part, did not see the work on the ground.[230] The Forest Department thus presented itself and its work within the context of a successful and wider 'Empire Forestry'. The discourse of Empire Forestry implied that each colonial forest department was following standard approaches, developed, taught and monitored centrally in Britain. In 1927 Governor Burdon wrote that 'the management of the forests is being brought into accord with proper silvicultural practice as established by experience in other tropical regions of the Empire'.[231] Staff of the Department attended the Empire Forestry Conferences and published in the Journal *Empire Forestry*.[232] After 1938, the Department's annual reports contained tables of statistics in a standard format used by Forest Departments across the Empire.[233] There was thus a gap between texts and practices of fire management in Belize, not only because the planned methods did not anticipate local conditions, but also because the realities of fire management in practice were not easily reported in the discursive context of Empire Forestry.

4.8 Conclusion

As James Ferguson and Tania Li contend, any programme of government must frame problems such that its interventions appear as solutions to them.[234] Cornelius Hummel's text problematised Belize's savanna fires as an impediment to development, narrowly defined as capitalist investment in, and government revenue

[230] See for example 'Our Forest Wealth', *The Clarion,* 10th August 1922; 'Importance of Forest Conservation', *The Clarion*, 14th December 1922; 'The Value of Forestry', *The Clarion*, 12th February 1925; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925].
[231] Burdon (1927), p18.
[232] See statements prepared for the Empire Forestry Conferences in 1928 and 1935 [Oliphant (1928); Stevenson (1935a, 1935b)] and journal publications by Oliphant (1925), N. Stevenson (1927, 1938) and D. Stevenson (1928).
[233] Forest Department (1939).
[234] Ferguson (1990); Li (2007a).

from, a pine industry. To this problem he proposed a solution: the conservation measure of fire management, to be implemented by qualified foresters following technical methods developed by a universal British Empire Forestry. These proposed methods included constructing fire lines to protect areas of pine, firefighting, and passing legislation to penalise fire use.

Hummel's text had the power to instigate fire management and state forestry in Belize because it framed economic concerns in the colony within a contemporary discourse that linked development with sciences like forestry. Hummel's professional training in forestry granted him authority as an 'expert' with the British Colonial Office. In following decades, Hummel, and the Forest Department's other senior staff, found that such credentials stood for less in Belize. The Forest Department faced opposition from the local elite in Belize, who had the support of the public and the political power to limit its budget. Forestry's aims for state-managed conservation and regulation of the timber industry were in logical and financial competition with other priorities in colonial rule, of courting private enterprise and assuring (limited) social welfare in times of extreme hardship. The limited exports of pine lumber between 1920-1940 made fire management a costly investment, for little gain. The Department had neither the authority to limit fire use in Belize, nor the funding required to carry out fire management on a large scale. The ecological and infrastructural conditions in the Belizean savanna further limited the efficacy of the Department's technical methods of fire management.

Despite these challenges, fire management survived as a small-scale programme because of continuous work to maintain it despite the Belizean realities: methods were altered in response to the savanna ecology; work was re-located in response to failure; an initial social element of the programme attempting to engage directly with fire users or private landowners was abandoned. Through careful political adjustments made in London to protect British interests, the Forest

Department was kept in existence. Yet these adjustments compromised the Department's ability to push for regulation of private industry and relegated it to technical work on Crown Land. As I show in the chapter following, this was a sufficient base from which to build a larger-scale programme of fire management from the 1940s to 1960. Yet, importantly for understanding its efficacy and influence, as I show in Chapter five, the Department remained reliant on impetus and funding external to Belize. Because it spoke to this wider context of Empire Forestry, the Department consistently presented fire management as a coherent and purely technical programme in its annual reports.

The picture disclosed through this archival analysis of the Belize Forest Department in the 1920s and 1930s aligns with accounts of the practices that constituted 'Empire Forestry' in other British colonies, in that it was shaped in a specific context and did not follow a single governmental rationality imposed from Britain.[235] As Tania Li argues, all governmental interventions are insecure. When an intervention is justified by rendering a problem in technical and apolitical terms, continuous work is required to maintain the intervention in the face of ecological and social realities.[236] So too, the Belize Forest Department and Colonial Office worked to maintain a fire management programme in the Belizean savanna in the face of hurricanes, palmetto palms, opposition from the Belizean political elite and other challenges. Fire management in Belize was not translated directly from a plan, pre-conceived by Hummel and following European ideology, into action on the ground, but emerged in the ecological, economic and political context of Belize.

[235] See for example Sivaramakrishnan (1997); Vandergeest & Peluso (2006a, 2006b); Bennett (2011a); Hansen & Lund (2017).
[236] Li (2007a, 2007b).

5

The Belize Forest Department's fire management, 1942 to present: policies, projects and practice

The emphasis on colonial development and welfare was ... essentially a defensive operation, to provide a new justification which would legitimise the perpetuation of colonial rule (Constantine, 1984, 259).

There is no obvious sense of policy or direction, no determination that forestry can and will regain the place that it once had in the national economy, but this time through human effort rather than simply by the exploitation of a wild resource (UN-FAO, 1982, report for project BZE 79/002 [BARS ASR-888], 16).

This chapter examines how, between 1942 and the present, fire management by the Belize Forest Department was shaped by impetus and short-term project funding from abroad. The chapter elucidates the continuities and discontinuities in the relationship between the Belizean Forest Department, the Belizean and British Governments, and other foreign development agencies during the period of transition from a colonial to an independent Belize. Sections 5.1 – 5.3 examine the Department's fire management practices and their funding sources and design across three time-periods.[1] From 1942 to 1966, the Department's work, including its fire management, was written into development schemes funded by UK-Government Colonial Development and Welfare (CDW) grants. These grants enabled fire management to cover a greater area and to become more technical in its use of equipment and methods of spatial planning. After this funding ended, and the Department was retrenched in 1960, it continued to receive short-term assistance from British, Canadian and US development agencies, but fire

[1] Table 5.1 provides a summary of the reports, projects and aid for fire management from 1942 to present that are referenced in this chapter.

Table 5.1 Reports, projects and aid with implications for fire management by the Belize Forest Department, 1943 to present

Report or expert advice

Proposal for development project (not funded)

Development project or aid

Year(s)	Funder(s)	Report, plan or project	Reference(s)
1943-48	Belizean Government	Grant's Works Pine Regeneration Plan	Forest Department, 1942, 1943, 1944
1944		A Forest Regeneration Scheme for British Honduras	Stevenson, 1944, [OWL MSS.Brit.Emp.s.366NeilStevenson(1)]
1946		W. A. Robertson (Forestry Advisor to Secretary of State) visits Belize	Forest Department, 1947; Lamb, 1950
1948		Report of the British Guiana and British Honduras Settlement Commission	Evans *et al,* 1948
1948-52	Belizean Government and CDW grant	Forest Development Plan Part 1- Forest Regeneration at Grant's Works and Machaca	Stevenson & Lamb, 1947, [OWL MSS.Brit.Emp.s.366NeilStevenson(2)]; Forest Department, 1949; Lamb, 1950; Cree, 1957
1952-55	Belizean Government and CDW grant	Forest Development Plan Part 2- Adds extra provision for fire protection in Toledo and for rural fire service	Lamb, 1950; Forest Department, 1953; Cree, 1957
1955		Land in British Honduras (draft to Belizean Government)	Forest Department, 1956; Wright *et al* (1959)
1956		A Pine Regeneration Scheme for British Honduras	Cree 1956, [unpublished, BARS ASR-45-4]
1955-60	Belizean Government and CDW grant	Forest Development Plan Part 3- Adds road building and natural and artificial regeneration at Mango Creek	Forest Department, 1956; Cree, 1956b, [BARS ASR-1505-114]
1959		Development Plan for Forestry 1960-64 (Draft)	Forest Department, 1959, [unpublished, viewed in unofficial archive at Forest Department Office, Belmopan, Belize].
1959		An Economic Policy for British Honduras	Downie, 1959; Forest Department, 1960
1961		Campbell Macleod of Canadian Forest Research Division advises on fire management after Hurricane Hattie	Forest Department, 1962
1971-73	Canadian Technical Assistance Programme	Grant of fire-fighting equipment and training of personnel by Canadian expert Herbert Ball	Forest Department, 1972, 1974; 'Government acquires specialised equipment for fighting forest fires', *British Honduras Newsletters*, 25th June 1973
1974		Inventory of the Southern Coastal Plain Pine Forests (ODM)	Johnson & Chaffey, 1974
1974		Southern Coastal Plain Fire Protection Scheme (ODM)	Johnson, 1974
1976		Southern Coastal Plain Working Plan (Draft)	Johnson [unpublished, 1976]
1976	UK Ministry of Overseas Development	Grant of fire-fighting equipment	Fellows, 1976, [unpublished report for CIDA, BARS ASR-955-74]

1989		Belize Tropical Forestry Action Plan (collaboration with team from UK ODA, CIDA, USAID and UN-FAO)	Arnold and Armitage, 1989
1991	UN-FAO	Forest Conservation and Management Project (FO-DP/BZE/87/009)	Belize Tropical Forestry Action Plan First Quingennial Report, 1994, [unpublished report viewed in unofficial archive of Neil Bird, Oxford]
1992-97	UK ODA	Forest Planning and Management Project	Forest Planning and Management Project Technical Proposal, 1991 [unpublished report, viewed in unofficial archive at Belize Forest Department Belmopan Office]; Joseph, Faizool & Underwood, 1998
1990s (date)	Montana Forest Service	Montana Forest Service fire training and equipment	Interviews 51, 55, 56, 66
2001-09	The Nature Conservancy	Training under the Global Fire Initiative	Interviews 55, 59, 60
2009		Wildland Fire Management Policy and Strategy for Belize (funded by TNC & Friends for Conservation and Development)	Sabido & Green, 2009
2014-19	The World Bank and GEF	Management and Protection of Key Biodiversity Areas in Belize project	World Bank, 2014
2017		Forest Fires Communication Strategy 2018-22 (funded by the World Bank & GEF)	Yorke, 2017

management on the southern coastal plain gradually came to an end. After 1960, fire management as envisioned in various plans was not implemented. Since 1986 the Department has had no active programme of fire management in the coastal savannas but has continued to receive fire management equipment and training under foreign aid projects.

The final sections draw conclusions about the implications of foreign aid, reviewing the Department's history in its entirety. Section 5.4 explores the 'expertise' that informed plans and policies for fire management. I argue that an authority afforded to foreign, and increasingly technical, 'experts' to devise fire management plans and policies inhibited the development of a long-term vision or capacity for fire management locally by Belizeans and limited the realisation of these policies. In Section 5.5, I examine how foreign funding limited the continuity, autonomy and efficacy of the Department's work. The short-term nature of aid limited the development of a consistent programme of fire management. The technical

approaches to fire management that this funding supported limited the extent to which the Department attempted to regulate, or work with, the pine industry, other government departments, and importantly, fire users in rural locations. With foreign assistance, the Department avoided the need to have political support for its work within Belize. Foreign aid projects became a means by which local political elites could continue to derive benefits from savanna land and resources, while retaining an apparent commitment to conservation agendas. Unlike the previous chapter, the archival texts upon which this chapter draws are largely limited to official plans and reports. These sources provide far less evidence of the politics and practice of Belizean forestry. I draw what insight I can from a deconstructive reading of this evidence, from newspapers, and, for the later decades, from oral histories and ethnography.

5.1 Technical expansion of the Forest Department's fire management from 1942-1959

Entering the 1940s, the Belize Forest Department had few staff and little funding.[2] Its active fire management was limited to a part of what, in 1941 became the Grant's Works Forest Reserve in the Stann Creek District (see map Figure 4.10). In response to its earlier precarious funding, a more directed ten-year plan was written in 1941, to commence in 1942, for 'the regeneration of pine (*Pinus caribaea*) on 2000 acres of Grant's Work Reserve by artificial and natural measures'.[3] The plan involved the 'artificial' regeneration of 1000 acres of 'pine-hardwood transition forest' by clearing and planting with 'pure pine'. In 1942, the first 15 acres of pine plantation were created, and until 1959, new areas of plantation

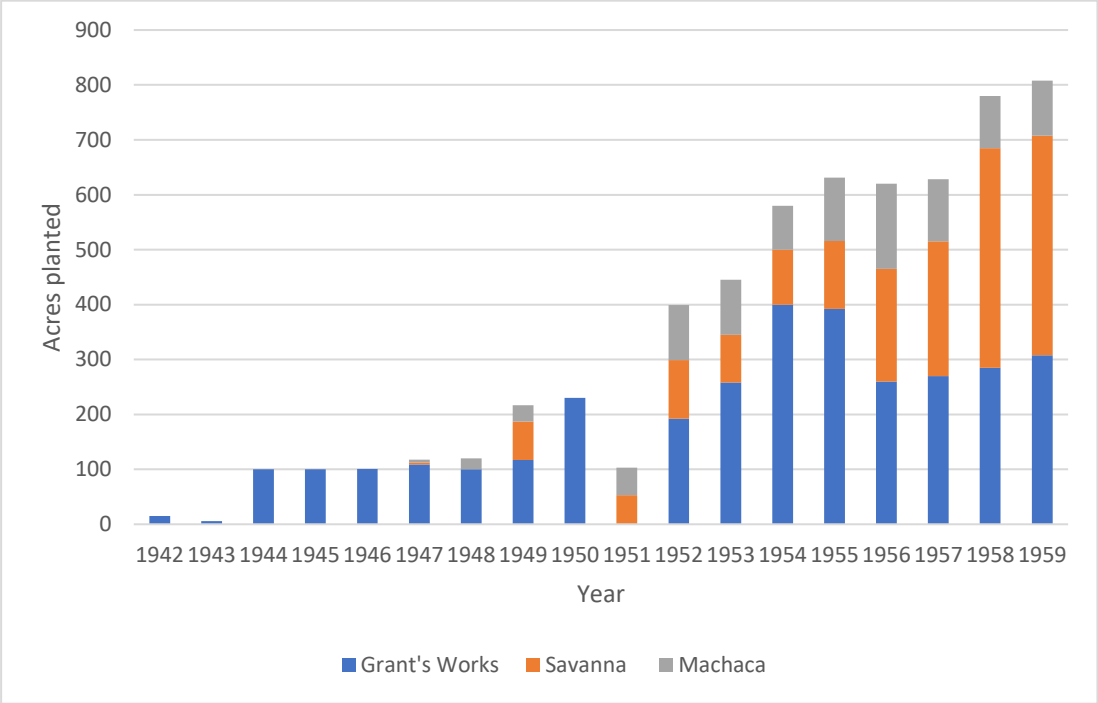
[2] It also lost labour to the British war effort. Between 1941 and 1944, over 800 Belizean forestry workers were sent to Scotland to work for the British Forest Commission (Ford, 1985). Many remained in Scotland after the second world war ended.
[3] Forest Department (1942), p. 1.

were created annually, eventually at three different locations on the southern coastal plain (see Figure 5.1 for the annual area planted with pine by the Forest Department in this period and Figures 5.2 – 5.4 for images of the pine plantations). As part of their artificial regeneration, these plantation areas were to be fully protected from fire. A further 1000 acres of existing pine savanna were to be protected from fire and to undergo what was termed 'natural regeneration'.

It took a year for the Grant's Works plan to pass the Legislative Council, as some members were averse to funding it from the territorial budget.[4] The Forest Department was, however, aware of new opportunities for funding by Colonial Development and Welfare (CDW) grants. In 1940, a decade after the 1929 Colonial Development Act, the British Government had passed the Colonial Development and Welfare Act. The 1929 Act had made only £1 million in grants available across all the British colonies annually: the 1940 Act increased this to £5 million.[5] The 1940 Act was in large part a response to political unrest in the Colonies in the 1930s, where poverty in the depression years exacerbated the growth of social movements calling for independence. Political organisation for riots and strikes in the West Indies from 1934-8 prompted the British Government to send a special commission to investigate conditions in the West Indian colonies, including Belize. Among the recommendations of the West India Royal Commission was a greater focus on colonial development.[6] Many have argued that the 1940 Act and its successors were intended as means to subdue political unrest and perpetuate British colonial rule through 'constructive trusteeship'.[7] This colonial rationale for funding development was certainly applicable to Belize. Already in the late 1930s, Governor

[4] Forest Department (1943, 1944).
[5] ODI (1964); Foreign and Commonwealth Office (1971).
[6] Moyne *et al* (1945).
[7] Constantine (1984), p. 304, also Lee & Petter (1982); Havinden & Meredith (1993); Cooper (1996); Clarke (2007); Hodge (2016).

Figure 5.1 Area of pine plantation established by year



Data source
The data is drawn from the annual report of the Forest Department for the relevant year.

Figure 5.2

Pine nursery beds at the Grant's Works in the Stann Creek District in 1947.
Source: Loock, 1950, 63.

Figure 5.3

‘Broken pine ridge’ clear-cut and burned prior to planting with pine at the Grant’s Works in the Stann Creek District in 1947.
Source: Loock, 1950, 65.

Figure 5.4

Three-year old pine plantation, with cover-crop of cassava at the Grant’s Works in the Stann Creek District in 1947.
Source: Loock, 1950, 65.

Alan Burns had made application for colonial development grants as a direct response to political riots in Belize.[8] Chapter four showed that a colonial development grant to the Belize Forest Department under the 1929 Colonial Development Act was a mechanism by which the Colonial Office enabled the continued existence of the Department in the face of political opposition within the country. In this chapter I show how CDW Grants to Belize after 1949 performed a similar role in defending the work of the Forest Department from a need for political support in Belize.

In 1943, by recommendation of the Governor, Conservator of Forests Neil Stevenson prepared a ten-year scheme of forest regeneration work, with a specific focus on mahogany and pine, aimed at attracting CDW funding.[9] The pine regeneration element of the scheme drew on the existing plan for the Grant's Works, envisaging expansion of the work across the southern coastal plain. The Grant's Work plan was for the creation of 100 acres of new plantation annually, but Stevenson's plan increased that target to 1000 acres. He envisioned scaling-up the existing 1000 acres under 'natural regeneration', to the protection from fire of tens of thousands of acres of the southern coastal plain into the southern Stann Creek and Toledo Districts. The plan called for a more than tenfold increase on the expenditure of the previous decade (see Figure 4.13).[10]

In 1944, Stevenson's plan was sent to the Colonial Office, with a detailed report on the 1944 work at the Grant's Works, followed by another progress report in 1945.[11] Stevenson's scheme was deemed too costly to fund. In 1945, the new CDW

[8] Ashdown (1981), ch. 7.
[9] Forest Department (1944); 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[10] 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)].
[11] 1944 and 1945 reports on the Grant's Works pine regeneration scheme, and Colonial Office minutes on the file, [TNA CO 123/388/1, items 2 and 22 and minute sheet].

Act raised the annual budget available and called for a change in the submission format for development schemes. Colonies were now to integrate multiple individual schemes into single ten-year plans for the development of the whole colony.[12] The Forest Department, under a new Conservator of Forests, Alan Lamb, submitted a new ten-year development plan for consideration by a development planning committee that had been established in Belize.[13] Lamb scaled back his predecessor's intentions, but took most of his text from Stevenson's plan.[14] After 1940, the Secretary of State for the Colonies had dedicated technical advisors, including for forestry, who were involved in reviewing colonial development plans. Forestry Advisor Wheatley Robinson visited Belize in 1946, and commented of the plans for pine plantation and protection that he would not be surprised if they 'when established, prove to pay the Colony better in the long run than the mahogany'.[15] The British Guiana and British Honduras Settlement Commission, visiting in 1948, was also supportive of 'vigorous development' of the country's 'latent resources, including through forestry'.[16] These endorsements by the Colonial Office's official experts aided the passage of Lamb's scheme by the CDW committee in 1949.

In the funding of the scheme, it was also undoubtedly important that there was, by 1948, a rapidly growing pine industry in Belize and thus a new substance behind the Department's rationale for fire management as a conservation measure to enable sustained pine exploitation. For reasons explored in Chapter four, US concession-holders and BEC, the London-based company that owned a large proportion of the private land in Belize, had made no attempt to establish a large-

[12] ODI (1964); Lee & Petter (1982).
[13] Correspondence between Governor of Belize and Colonial Office over development plans, 1946, [TNA CO 123/388/8]; Forest Department (1946).
[14] 'A ten-year forest regeneration plan for British Honduras', draft by Alan Lamb and Neil Stevenson, 1947, [OWL MSS.Brit.Emp.s.366(2)].
[15] In Lamb (1950), p. 219.
[16] Evans *et al* (1948), p. 1.; Forest Department (1949).

scale pine industry in the 1930s. After WWII, the export timber harvest from the colonies rose dramatically in response to demands for reconstruction.[17] In anticipation of this, the Colonial Office informed the Governor of Belize in 1942 that

> there should be good prospects for the development of a pinewood industry in British Honduras, since the tree apparently grows well and there is likely to be a large market for this type of timber in the West Indies for building purposes after the war. It would appear that British Honduras is the only potential source of local supply for export in that area, while there is the additional advantage that forest development is also in accord with the aptitude and inclination of a large section of the Colony's population.[18]

With prospects of a favourable market, BEC began pine extraction from its private lands and in 1943 negotiated a concession to harvest pine on Crown Lands in the southern part of Stann Creek, which was extended in 1949 for a further ten years.[19] Other companies and individuals also began small-scale pine operations, many of them becoming contractors to BEC, which handled most of the export.[20] In 1948, BEC opened a sawmill at Mango Creek to process pine from the southern coastal plain (Figure 5.5 shows the sawmill's stacking yard). The period between 1941 and 1949 saw a thirty-fold increase in pine log production in Belize (data in Figure 4.11). By 1949, a good proportion of this pine was being exported (data in Figure 4.12). There was a strong market for Belizean pine in the other British West Indian Colonies, as the 'dollar scarcity' following WWII made it preferable for those colonies importing pine to buy within the sterling area.[21]

[17] Arnold & Armitage (1989); Hansen & Lund (2018).
[18] Letter from Secretary of State to Governor Hunter, 19th February 1942, [TNA CO 123/380/7].
[19] Letter from Martin Johnson to Nick Woods on subject 'working plan prescriptions', 25th November 1976, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage]; Forest Department (1950).
[20] 'Forestry', *The British Honduras Government Gazette*, 28th December 1950; Forest Department (1959); BEC board meeting minutes of 24th May 1953, 5th January 1955, 12th May 1955, 24th November 1955, 7th December 1955, 12th April 1956, [Uncatalogued BEC Archive, Ladyville, Belize]; 'Pommells and Pilgrim to operate in Swasey', *The Billboard*, 19th March 1959.
[21] Barbara Bulmer-Thomas (pers. comm. 12th December 2018).

Figure 5.5

The stacking yard of the BEC sawmill at Mango Creek in 1956.
Source: Belize Archives and Records Service [B7E173P3].

After the 1949 grant, the Belize Forest Department continued to receive CDW funding, including specifically to finance fire management.[22] Further CDW Acts in 1950, 1955, 1959 and 1963 progressively increased the annual grant amount available across the Colonies for development schemes, until by 1963 the annual allocation was £30 million. The last expenditure under the Colonial Development and Welfare Acts was in 1967.[23] Belize was among colonies classed as 'small territories which could make little or no contribution from local resources and could "afford to raise loans only for directly revenue-earning projects"'.[24] It thus received a large allocation of CDW money with little need to demonstrate co-financing of its

[22] Note that fire management was funded both in the coastal plain savannas (my focus here) but also in the upland savannas of the Mountain Pine Ridge.
[23] ODI (1964); Foreign and Commonwealth Office (1971).
[24] ODI (1964), p. 58.

development schemes from territorial budgets. Despite its relatively small size as a country, Belize's Forest Department received £1,001,000 in CDW grants in the period 1948-66; 17% of the total granted for forestry schemes in that period across all British colonies.[25] These grants, as well as increased allocation from the territorial budget, enabled a large increase in the annual spending of the Forest Department (Figure 4.13).[26] In the decades that followed retrenchment in 1929, the Department had only three senior staff (having been cut from seven), but by 1959 the Department had a senior staff of eight, and had substantially increased numbers of junior and labouring staff.[27]

The pine industry continued to grow, with extraction and exports peaking in the 1950s (Figures 4.11 and 4.12).[28] In 1958, after four years of negotiation, BEC's monopoly over the pine industry was re-affirmed as it was granted concessions to move its operations further south to the Swasey-Bladen and the Deep River areas.[29] As I will show, the Forest Department made little attempt to directly regulate the pine industry in order to control or manage the effects of exploitation, despite repeatedly noting the 'serious overcutting' taking place in the 1940s and 1950s.[30] Rather than regulating the pine industry, with the assistance of CDW funding, the Forest Department expanded its parallel and compensatory programme of pine plantations and fire management.

From 1949 to 1952, the first CDW grant to the Belize Forest Department enabled the plantation of approximately 150 acres with pine annually, including

[25] Foreign and Commonwealth Office (1971), Table 1.
[26] Though this was also accompanied by an increased territorial allocation to forestry in this period.
[27] Colin Eric Duff, unpublished report entitled 'History of Forestry in British Honduras', early 1960s, [OWL MSS.Brit.Emp.s.466].
[28] Forest Department (1967).
[29] Forest Department (1959); 'Letter to the editor', *The Billboard*, 20th June 1959; 'Sawmilling begins in Swasey-Bladen area', *The Billboard*, 21st June 1959; 'Monopoly is the destruction of the economy of a country', *The Times*, 22nd June 1959.
[30] Cree (1957), p. 5. Also Lamb (1950); Forest Department (1953).

experimentation with plantations at sites near Mango Creek and Machaca in the Toledo District.[31] The area under fire protection using fire lines was expanded to include new areas at Mango Creek.[32] From 1952 to 1955, further expansion took place, with an enlarged CDW allocation, again supported by the Secretary of State's Forestry Advisor, who visited Belize in 1952 noting that 'there is only some ten to fifteen years supply of British Honduras pitch pine in sight and the current planting and fire protection of pine are inadequate', 'there is a very strong case indeed for speeding up the current planting and fire protection. This is a matter of staff and funds'.[33] Five hundred acres of pine plantation were now created annually at Grant's Works, at Mango Creek and at Machaca, and the area covered by fire lines and under fire protection was increased to 3000 acres.[34] The 1955 – 1960 development plan saw a final enlargement of the CDW grant allocated to forestry. Again, the findings of visiting experts, namely the British Honduras Land Survey team led by Charles Wright, lent support to the Forest Department's programme; based on soil type, forestry was deemed the optimal form of land use for development of the pine savannas.[35] The Forest Department increased pine plantation rates to 600 then to 800 acres annually. Fire lines and logging roads were extended to the Swasey-Bladen area.[36]

Sabine Clarke has identified a 'decidedly technocratic turn' in the last decades of British colonial policy following the CDW Act in 1940.[37] After 1940 more substantial funding was available for expert-led, technical, development schemes. The Colonial Office took a new interest in understanding the specificities of colonial

[31] At that time the Mango Creek plantations were on national land. The area became a forest reserve in 1960.
[32] Lamb (1950).
[33] Scott, Richardson & Lamb, (1953), p. 4 & p. 15.
[34] Forest Department (1953).
[35] Forest Department (1956); Wright *et al* (1959).
[36] Forest Department (1956); Colin Eric Duff, unpublished report entitled 'History of Forestry in British Honduras', early 1960s, [OWL MSS.Brit.Emp.s.466].
[37] Clarke (2007), p. 453.

environments as the basis for ‘rational’ land planning and development. This research upon colonial environments did not explicitly make use of local knowledge but was directed by scientists using Anglo-American methods. These patterns are, I show, visible in the Forest Department’s increasingly technical fire management programme from 1942 to 1959: in the reams of paper dedicated to planning and describing the employment of new equipment, infrastructure and organisation; in debate and experimentation over technique; in the use of classification of the savanna landscape to plan and spatially segregate the Department’s work.

From the 1940s the Forest Department increasingly made use of aerial photography and land classification schemes to plan its work on the southern coastal plain. By 1955, distinct methodologies of pine regeneration had been developed for different types of savanna. The ‘artificial regeneration’ at the Grant’s Works took place in ‘broken pine ridge’ (hardwood and pine scrub) by clearing and planting. Once hardwood competitors had been removed, this was deemed a suitable place for pine plantations, because the soil was generally better than that of the open savanna. By contrast, the ‘artificial regeneration’ at Mango Creek took place in sparse pine or open grassland areas, requiring furrowing and fertiliser use. Dense or medium-dense pine was preferred for ‘natural regeneration’ enabled by fire protection alone. In 1956, new aerial photography was used to delimit areas of savanna suitable for each of these three types of treatment, which took place under three separate schemes under the CDW funding after 1955.[38] The Department repeatedly asserted that it could not be expected to manage fires outside of these delimited fire protection areas. For example in 1953, its annual report noted that ‘although bush fires throughout the country cause great damage and are to be

[38] Cree (1956), ‘A pine regeneration scheme for the Southern Coastal Forests of British Honduras’, [unpublished, BARS ASR-1505-114].

deplored, the Forest Department's responsibility must be confined to its own areas, if these are to be effectively fire protected with the resources available'.[39] During the 1940s and 1950s the areas in which the Department conducted fire management included Forest Reserves such as the Grant's Works, but also other areas of Crown Land. From the late 1950s, on the advice of the forestry advisor to the Colonial Office, new forest reserves were established, including the Mango Creek and Swasey-Bladen Forest Reserves (see Table 4.2 and map Figure 4.10).[40] Reservation gave the Department 'security of tenure' in these areas.[41] From then onwards, fire management was confined to forest reserves (which now covered most of the savanna land on the southern coastal plain). This kept the work technical and amenable to development funding, but, as is explored in Section 5.5, it limited strategic engagement with the Agriculture Department, logging companies and rural fire users.

The areas under fire protection were increasingly compartmentalised into ranges under control from different forest stations and visible from fire lookout towers manned during the dry season. These ranges were divided into 'fire management units' separated by fire lines. The Department's ambitions for such a network of fire lines, controlling stations and fire lookout towers far exceeded their realisation on the ground. By 1956, a network of 255 miles of major and minor roads and 1358 miles of major and minor fire lines was envisaged on maps covering the whole southern coastal plain.[42] On paper, the southern coastal plain was divided into eight ranges, to be under the control of three forest stations and with 17 fire

[39] Forest Department 1954, p. 7.
[40] Cree (1956), 'The present forestry programme. A reassessment', [unpublished, BARS ASR-45-4].
[41] Cree (1956), 'The present forestry programme. A reassessment', [unpublished, BARS ASR-45-4], p. 3.
[42] Cree (1956), 'A pine regeneration scheme for the Southern Coastal Forests of British Honduras', [unpublished, BARS ASR-1505-114].

lookout towers.[43] By 1960, however, only two of the forest stations and six fire lookout towers had been built.[44]

In the early days of fire management by the Forest Department fire lines were constructed largely by hand, using machetes and controlled burns. Fires were attacked using palmetto leaves from the savanna.[45] External funding for fire management enabled the Department to employ ever more sophisticated equipment. After 1942, the Department came to see mechanical equipment as a prerequisite for fire management. The Department's annual report for 1948, for example, remarked that 'proper control of fires awaits improvement of communication and the arrival of a Fordson tractor with rotary cultivator'.[46]

The ten-year forest development plans written in the 1940s to attract CDW funding called for the purchase of new equipment, both to aid the construction of fire lines and direct attack on fires.[47] The Department first used a tractor pulling a harrow to cut fire lines in 1945.[48] In the years following, a variety of different jeeps and tractors, harrows and graders was put to work in the savanna.[49] By 1950, the Department had acquired trailers to use as fire tenders, equipped with knapsack fire pumps for attacking fires, and drip torches for back firing.[50] The Department was influenced in the choice of equipment by 'the experience gained in Florida by the U.S Forest Service'.[51] Equipment unavailable in Belize was ordered specially from companies based in the US: catalogues of fire equipment from the 1940s to 1960s

[43] Ibid.
[44] Colin Eric Duff, unpublished report entitled 'History of Forestry in British Honduras', early 1960s, [OWL MSS.Brit.Emp.s.466].
[45] Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925], p. 3.
[46] Forest Department (1949), p. 5.
[47] Forest Department (1944); 'A forest regeneration scheme for British Honduras', draft by Neil Stevenson, 1944, [OWL MSS.Brit.Emp.s.366(1)]; 'A ten-year forest regeneration plan for British Honduras', draft by Alan Lamb and Neil Stevenson, 1947, [OWL MSS.Brit.Emp.s.366(2)].
[48] Forest Department (1946); Lamb (1950).
[49] Lamb (1950).
[50] Ibid.
[51] Forest Department (1948), p. 1.

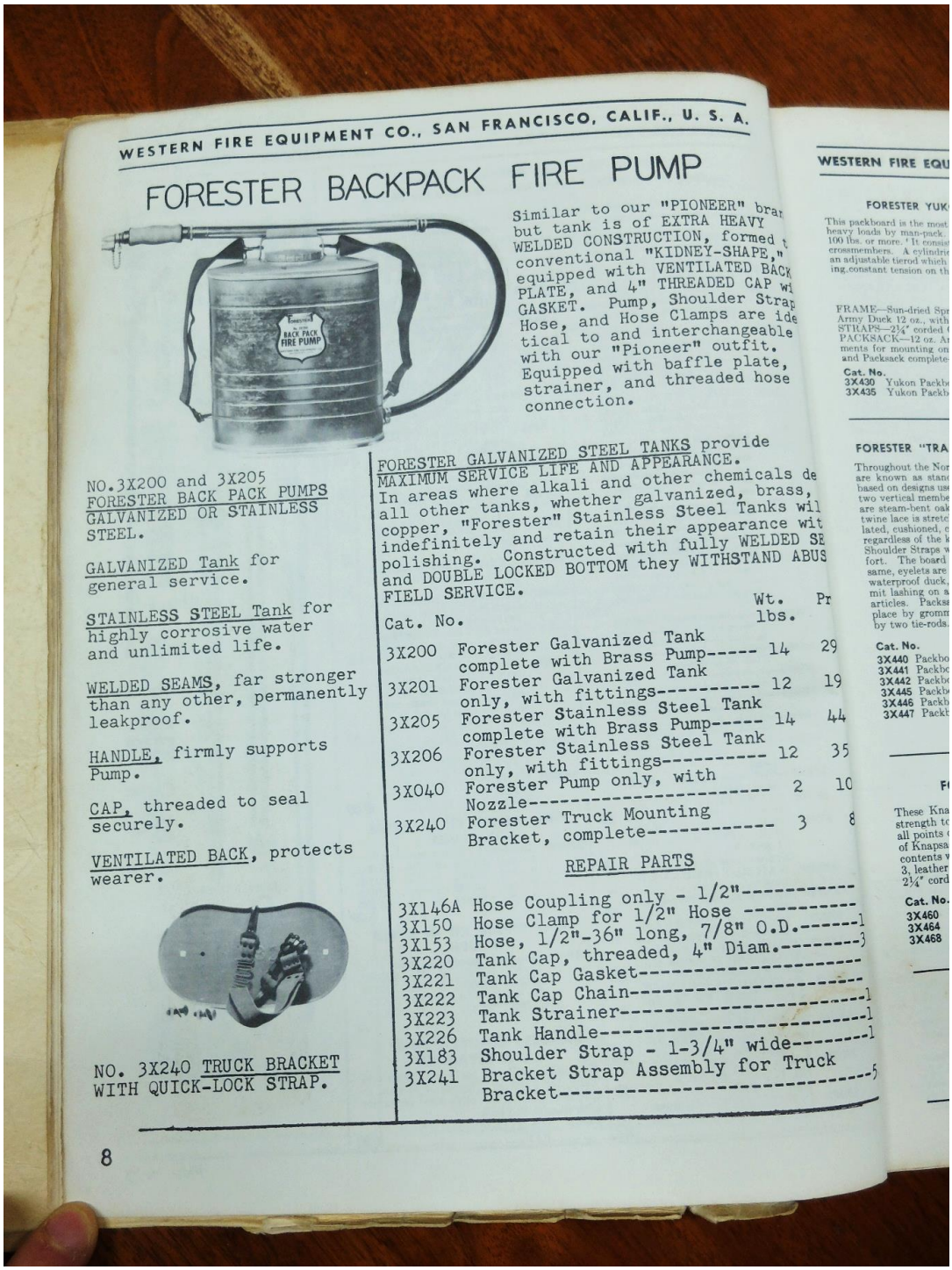
still remain among piles of old records at the Department's main office in Belmopan (Figures 5.6 and 5.7 show examples). The equipment did not either always perform as hoped or increase firefighting efficiency. Fire lines cut by a disc harrow or a double-breasted disc plough tended to become flooded with water, making it difficult for firefighters and vehicles to move down them. Polydisc ploughs were more suitable, but heavier, and so needed to be pulled by larger tractors, which were cumbersome to manoeuvre on the waterlogged savanna landscape. In these conditions the vehicles used as fire tenders and bulldozers, were too slow to be useful during a direct attack on fires.[52]

In the mid-1950s the Forest Department's policy towards savanna fires changed. From its earliest days the Forest Department experimented with applying fire to help clear fire lines.[53] Fire protection areas were not, however, subject to prescribed burning; the policy, following Hummel's report, remained one of complete fire suppression.[54] As noted in Chapter two, during the first half of the twentieth century, fire suppression was also the dominant policy in US forestry. From the 1930s, however, some ecologists and land managers noted that fire suppression was causing fuel levels to build to dangerous levels and that fire played a necessary ecological role in certain ecosystems. With the Florida Forest Service at the helm, prescribed burning gradually made mainstream and became general US Forest Service policy by the 1970s.[55]

The Belize Forest Department took note of the Florida Forest Service's use of prescribed burning. In 1950, Conservator of Forests Alan Lamb suggested that

[52] Lamb (1950); Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74].
[53] Field diary of Duncan Stevenson, entry for 12th February 1924, [OWL MSS.W.Ind.s.28(1)]; Draft newspaper article enclosed in letter from Conservator of Forests to Colonial Secretary, 2nd July 1925, [BARS MP1894/1925].
[54] Hummel (1921).
[55] Pyne (2015, 2016b).

Figure 5.6



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Cat. No.		Wt. lbs.	Pr
3X200	Forester Galvanized Tank complete with Brass Pump-----	14	29
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3X150	Hose Clamp for 1/2" Hose ----------	
3X153	Hose, 1/2"-36" long, 7/8" O.D.------	1
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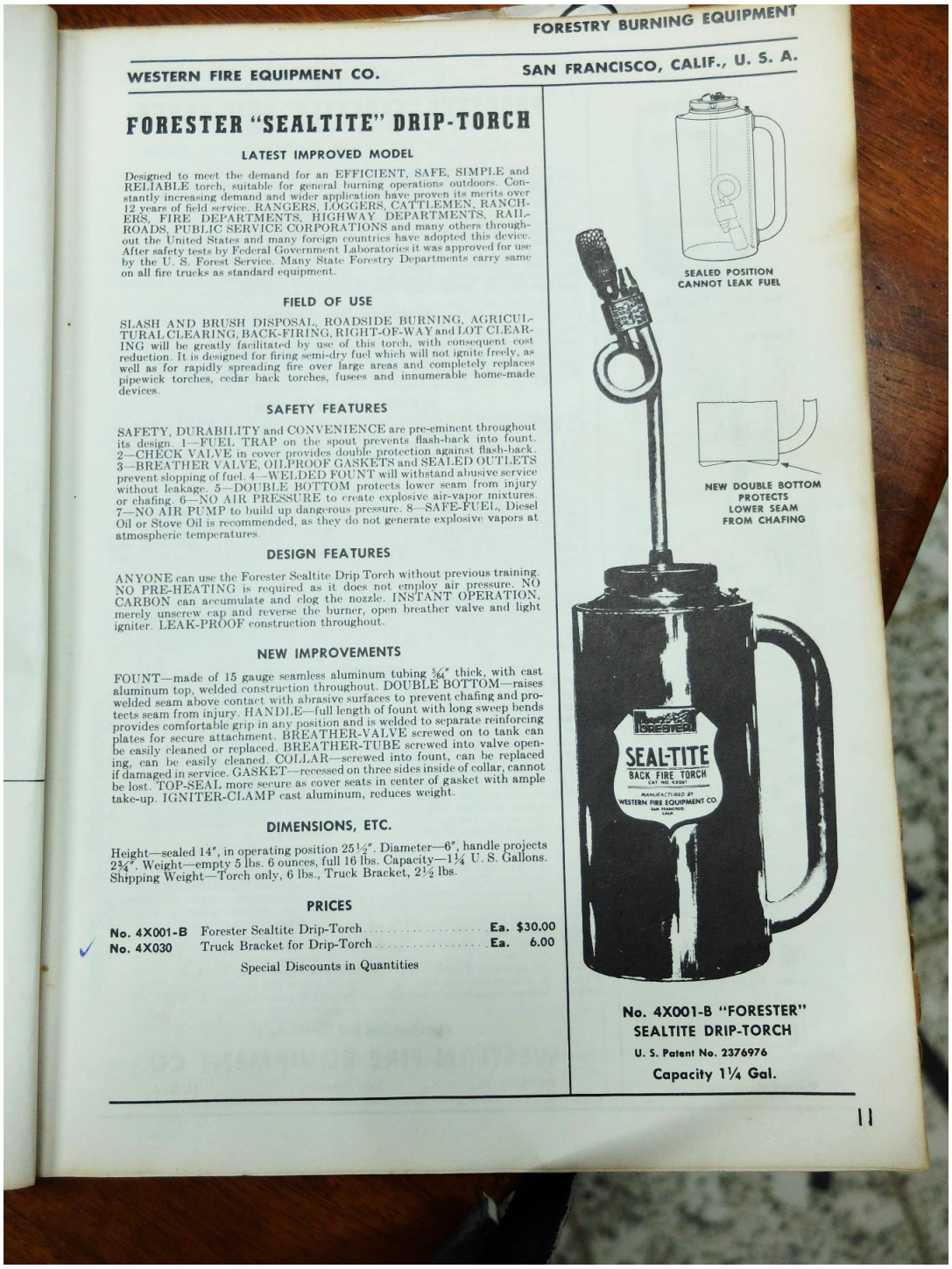
3X221	Tank Cap Gasket----------	
3X222	Tank Cap Chain----------	1
3X223	Tank Strainer----------	1
3X226	Tank Handle----------	1
3X183	Shoulder Strap - 1-3/4" wide--------	1
3X241	Bracket Strap Assembly for Truck Bracket----------	5

8

‘Forester’ fire-fighting equipment brochure from 1946 amongst unsorted records at the Belmopan office of the Forest Department, Cayo District, Belize.
Source: Author, 2017.

Figure 5.7



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FIELD OF USE

SLASH AND BRUSH DISPOSAL, ROADSIDE BURNING, AGRICULTURAL CLEARING, BACK-FIRING, RIGHT-OF-WAY and LOT CLEARING will be greatly facilitated by use of this torch, with consequent cost reduction. It is designed for firing semi-dry fuel which will not ignite freely, as well as for rapidly spreading fire over large areas and completely replaces pipewick torches, cedar back torches, fusees and innumerable home-made devices.

SAFETY FEATURES

SAFETY, DURABILITY and CONVENIENCE are pre-eminent throughout its design. 1—FUEL TRAP on the spout prevents flash-back into fount. 2—CHECK VALVE in cover provides double protection against flash-back. 3—BREATHER VALVE, OILPROOF GASKETS and SEALED OUTLETS prevent slopping of fuel. 4—WELDED FOUNT will withstand abusive service without leakage. 5—DOUBLE BOTTOM protects lower seam from injury or chafing. 6—NO AIR PRESSURE to create explosive air-vapor mixtures. 7—NO AIR PUMP to build up dangerous pressure. 8—SAFE-FUEL, Diesel Oil or Stove Oil is recommended, as they do not generate explosive vapors at atmospheric temperatures.

DESIGN FEATURES

ANYONE can use the Forester Sealtite Drip Torch without previous training. NO PRE-HEATING is required as it does not employ air pressure. NO CARBON can accumulate and clog the nozzle. INSTANT OPERATION, merely unscrew cap and reverse the burner, open breather valve and light igniter. LEAK-PROOF construction throughout.

NEW IMPROVEMENTS

FOUNT—made of 15 gauge seamless aluminum tubing 5/64" thick, with cast aluminum top, welded construction throughout. DOUBLE BOTTOM—raises welded seam above contact with abrasive surfaces to prevent chafing and protects seam from injury. HANDLE—full length of fount with long sweep bends provides comfortable grip in any position and is welded to separate reinforcing plates for secure attachment. BREATHER-VALVE screwed on to tank can be easily cleaned or replaced. BREATHER-TUBE screwed into valve opening, can be easily cleaned. COLLAR—screwed into fount, can be replaced if damaged in service. GASKET—recessed on three sides inside of collar, cannot be lost. TOP-SEAL more secure as cover seats in center of gasket with ample take-up. IGNITER-CLAMP cast aluminum, reduces weight.

DIMENSIONS, ETC.

Height—sealed 14", in operating position 25½". Diameter—6", handle projects 2¾". Weight—empty 5 lbs. 6 ounces, full 16 lbs. Capacity—1¼ U. S. Gallons. Shipping Weight—Torch only, 6 lbs., Truck Bracket, 2½ lbs.

PRICES

No. 4X001-B	Forester Sealtite Drip-Torch	Ea. $30.00
No. 4X030	Truck Bracket for Drip-Torch	Ea. 6.00

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No. 4X001-B "FORESTER" SEALTITE DRIP-TORCH

U. S. Patent No. 2376976

Capacity 1¼ Gal.

11

'Forester' fire-fighting equipment brochure from 1946 amongst unsorted records at the Belmopan office of the Forest Department, Cayo District, Belize.
Source: Author, 2017.

'early burning' of mature stands should be a future policy, after five to ten years of complete fire protection.[56] In the field, Department staff began to take note of the build-up of fuel that followed fire protection: 'Each year that protection is successful, the young pines grow well, but so does the stock of highly inflammable grass and weeds'.[57] Then in 1955, following a year of severe fires, exacerbated by the excess fuel available because of fire suppression, Conservator of Forests at the time, Charles Cree, argued that the Department should adopt a policy of controlled burning:

> pine fire protection work was carried out in the last decade on the supposition that it would be possible and was desirable completely to exclude fire from regeneration areas…. In February 1955 a small plot of very well stocked pine 3-5 feet high in the Mountain Pine Ridge was early burnt. It was burnt again by the wild fires in May, but as the early burning had previously removed most of the inflammable grass, it showed nearly 95% survival, whereas adjoining areas of small trees which were not early burnt showed nearly 90% mortality after the May fires. These expensive lessons have been quite enough for us to reverse the previous policy of extensive complete fire protection and to early burn all our pine lands, except those actually under regeneration where there are young seedlings which any fire would kill…. The same error was made in the Southern States by the U.S. Forest Service, whose first policy of complete fire protection ended in disastrous fires. They now also ''winter-burn'' all their pine forests except for limited regeneration areas.[58]

From then onwards, the Department's policy was to give 'protection areas' (that is, new plantations or cut-over areas) five years of complete fire suppression followed by prescribed burning on a three-year cycle. Surrounding areas were also to be subjected to periodic prescribed burning.[59] This change in policy did not represent a full recognition of the ecological role of fire in savannas. Like elsewhere in the British Empire where prescribed burning was being considered at this time, it was viewed as a 'necessary evil'.[60] Prescribed burning was an insurance against

[56] Lamb (1950), p. 220.
[57] Forest Department (1952), p. 6.
[58] Cree (1956), 'The present forestry programme. A reassessment', [unpublished, BARS ASR-45-4], p. 9.
[59] Cree (1956), 'A pine regeneration scheme for the Southern Coastal Forests of British Honduras', [unpublished, BARS ASR-1505-114].
[60] Van Wilgen et al (2004); Laris & Wardell (2006); Pooley (2014).

uncontrollable fires caused by fuel build-up. Fire was still deemed to slow pine growth and regeneration (which remained the purpose of fire management).[61]

In this section we have seen how between 1942 and 1959 sustained finance from CDW grants enabled the fire management programme of the Belize Forest Department to expand, across a greater area and in technical scope, to involve new mechanical equipment and spatial planning. The methods of fire management in this period included infrastructure to prevent fire from spreading across the landscape and to enable fire suppression, and, from the 1950s, prescribed fire use. These were technical approaches involving minimal engagement with fire users and limited to certain 'protection areas' only.

5.2 The decline of fire management in practice from 1960 to 1986

After the 1960s, for several reasons, fire management on the southern coastal plain gradually slowed down. New plans and policies were written, and equipment granted for fire management under various short-term foreign aid projects, but the area covered by active fire management became ever smaller. This section begins by exploring the factors that contributed to the general decline in funding for the Forest Department's work in this period, and by which fire management became less of a priority. It then examines the work carried out in this period, both in planning and in practising fire management.

The year 1959, marked the 'anti-climax for the Forest Department', when 'the activities of the Department were examined in the cold light of the laws of economics': Jack Downie, an economic advisor to the British Government, published a report suggesting that the Department's annual budget be cut immediately.[62] Arguing that there was 'a strong prima facie presumption against a

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[62] Forest Department (1961), p. 1.

poor country investing a big proportion of its capital in a project which yields a return only after so long a period', he advocated cessation of the pine plantation programme.[63] In its draft form, the Department's 1960-65 development plan had made a case for continued pine plantation and large-scale expansion of fire protection to cover the whole southern coastal plain pine savanna throughout Stann Creek and Toledo.[64] The Conservator of Forests was now directly instructed to rewrite the development plan, halving the annual budget and ceasing the plantation programme.[65] In 1965, in the first development plan written under full self-government, the Government further reduced the annual budget of the Department, 'in keeping with the decreasing role which forestry now has in the economy of the country'.[66] In 1966 the Department used the last of its final CDW grant. Its staff and budget were reduced, and its work restricted to fire protection of existing plantation and 'natural regeneration' areas, timber licensing and revenue collection.

For the independent government it was symbolic and politically expedient to reduce the Department's allocation from the territorial budget to a bare minimum, because the Department had, through its reliance on CDW funding and British leadership, retained a public image as a British institution. The strength of this connection was indicated to me by the way in which many former and/or older staff of the Department spoke to me in positive terms of their former British leadership and of the colonial period.[67] Yet, at the time of independence, most Belizeans were keen to break from Britain and the institutions it had supported in Belize. A former

[63] Downie (1959), p. 16.
[64] Forest Department, unknown date, unpublished, draft Development Plan for Forestry, 1960-1965, [Belmopan Forest Office, Cayo District, Belize, uncatalogued in storage].
[65] Forest Department (1960); Belize Ministry of Finance Development Policy and Interim Expenditure Programme, 1961, [TNA CO 1031/3524].
[66] 'New PUP Government's Policies', *The Times*, 20th March 1965. Belize had full adult suffrage after 1954, a quasi-ministerial system since 1955 and full internal self-government from 1964, though it remained a British Colony until 1981.
[67] Interviews 49, 51 and 65.

Belizean Minister explained to me that his support for forestry was unpopular with his nationalist colleagues:

> The system that the British put in were [*sic*] excellent systems … the British were fully into forestry…. You try to keep the *system*, and they attack you, saying "You still want to be British, you want to be a Colony''. And that is what destroyed us when we became self-government. We got destroyed because we were so—all the politician have the fact that "we not British and we run our own thing", that you couldn't keep the good system that the British put in. So they threw away the baby *and* the bathwater, and that is what destroyed us.[68]

After the 1950s, the pine industry in Belize diminished (see Figure 4.11), weakening the direct economic rationale for fire management that had existed in the 1940s and 1950s. After 1958, when BEC was granted pine concessions for these areas, the Swasey-Bladen and Deep River Forest Reserves were successively worked, but several factors were conspiring to reduce the viability of a large-scale pine industry on the southern coastal plain. There were no longer sufficient stocks of pine: most of the area had been heavily worked, and, in 1961, Hurricane Hattie did great damage to the pine forests across Belize.[69] By the 1960s there was also no longer a strong market for pine in the West Indies. These countries could again afford to buy pine from the USA, which was more desirable, having a higher quality of finish than could be achieved with the machinery available in Belize.[70] BEC was simultaneously facing strikes and calls for higher wages from its labour force, which had been unionised from the 1950s.[71] BEC thus closed its Mango Creek sawmill in 1966 and ceased its pine operations.[72] From 1966, pine extraction continued on a reduced scale for the local market, under annual licenses to a few individuals (see

[68] Interview 50.
[69] Forest Department (1962).
[70] Barbara Bulmer-Thomas (pers. comm. 12th December 2018).
[71] '250 sawmill workers now jobless. Belize sawmill ceases production', *The Clarion,* 29th October 1952; '200 workers stage 5-hour strike at Mango Creek', *The Billboard*, 7th February 1964; '314 strike at Gallon jug against BEC', *The Billboard*, 19th February 1958; 'BEC workers strike at Gallon Jug and Hillbank', *The Billboard*, 19th March 1964; Bolland (2003), ch. 8; Alexander & Parker (2004), ch. 2.
[72] Forest Department (1967).

reduced pine log production from 1966 in Figure 4.11).[73] In the early 1960s, there was a short-lived industry to extract resin from pine stumps, and throughout the 1960s and 1970s, hopes for a pulp and paper industry from the pine on the southern coastal plain did not materialise.[74]

By the 1970s, Belize's timber exports were greatly reduced. The independent Government sought to diversify the Belizean economy and forestry ceded its place as the major sector of the Belizean economy to agriculture and then to tourism.[75] Agricultural development also took place in savanna areas, which were sometimes de-reserved for this purpose. In 1969, the entire Mango Creek Forest Reserve was de-reserved and granted to a US millionaire to make way for vegetable cultivation.[76] In the 1970s, a state-managed banana industry was re-established in the northern Toledo District, including in savanna areas (with drainage improvements). These factors led me to examine the role of powerful Belizean elites in directing development at the expense of the Department's work to regenerate pine in savannas.

Simultaneously, the scope of the Department's work was expanding; forestry in the sense of conservation to enable sustained timber production was no longer its sole purpose. In keeping with the rising global nature conservation movement, and the growing importance of tourism in Belize, the Belizean Government began to create new categories of protected areas. In 1966, a commission investigated the potential for National Parks in Belize. This was followed by the necessary legislation in 1981. In 1973, the Guanacaste Park was designated a 'Crown Reserve' and

[73] Johnson & Chaffey (1974); King *et al* (1986, 1989).
[74] 'Hercules B.H begin operation October 1', *The Billboard,* 17th Jul 1962; 'Unforeseen difficulties cause closedown of Hercules'*, The Times,* 20th March 1965; Johnson (1974).
[75] Thomson, 2004, chs. 13 & 16; Bulmer-Thomas & Bulmer-Thomas, 2012, ch. 4.
[76] This proved an unsuccessful venture, and the Mango Creek Forest Reserve was ultimately re-reserved in 1977. Letter from Martin Johnson to Nick Woods on subject 'working plan prescriptions', 25th November 1976, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].

became the first protected area to be co-managed by the Government with Belize's first conservation NGO, the Belize Audobon Society, (established in 1969). The 1980s saw a proliferation of new conservation NGOs and protected areas in Belize.[77] From the Government's side, responsibility for the terrestrial part of this new protected areas system lay with the Forest Department.[78] As the Department's budget and capacity were reducing, its remit expanded to include nature conservation and the illegal wildlife trade.

These factors gradually conspired to reduce the Department's need for, and capacity to conduct, an active fire management programme aimed at pine regeneration on the southern coastal plain. By the early 1970s only four of the six fire towers were still being manned.[79] By 1986, the Department lacked the sustained finances to maintain equipment, fire lines and dedicated firefighting teams and it ceased to conduct fire management in this area.[80] During this phase of decline, sporadic bursts of activity and technical innovations did follow periodic grants of overseas aid. Both CIDA and ODA provided new firefighting equipment, fire management training and consultants to write new plans and policies for the Forest Department in the 1960s and 1970s.[81] Yet none of these external funders provided consistent funding for fire management in practice, as had the CDW grants.

An initial burst of activity was prompted by several years of widespread forest fires that consumed the debris blown-over during Hurricane Hattie in 1961. A Canadian agricultural development team was in Belize in 1961, and a request was made to the Canadian Forest Service to send an additional expert to advise the

[77] Zisman (1998); Young & Horwich (2007).
[78] Young & Horwich (2007).
[79] Johnson (1974).
[80] King *et al* (1986).
[81] Forest Department (1972, 1974); 'Government acquires specialised equipment for fighting forest fires', *British Honduras Newsletters*, 25th June 1973; Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74].

Forest Department on tackling post-hurricane fires. A brief expansion in fire management work by the Forest Department did follow; new equipment and infrastructure were provided for with an emergency budget from the Government.[82] Walkie-talkie sets were introduced at the advice of the Canadian Forest Service to aid communication between firefighters, fire lookout towers and control stations.[83] The hurricane was also the impetus for new fire legislation: the Forest Fires Act of 1962 gave the Governor the power to delimit 'fire control areas', with limited entry, for which the Conservator of Forests could write fire management plans, to be carried out at the expense of landowners or management agencies.[84] This legislation remained after independence, but has not been implemented since the 1960s.[85] After the hurricane, for several years, the Government also financed anti-fire propaganda campaigns, involving newspaper articles, posters and leaflets donated by the US Forest Service (which were dropped by aircraft over villages that were deemed by the Department to be offending particularly often in their use of fire), tours of a mobile cinema showing a fire prevention film, and the use of the US Forest Service's 'Smokey the Bear' teaching materials in schools.[86] This burst of activity dwindled after 1965 as the forest fires subsided. In their histories of fire management, both Stephen Pyne and Simon Pooley have highlighted that large wildfire events play an important role in driving the development of state wildfire

[82] Forest Department (1962).
[83] 'New radio equipment aids in fire-fighting', *The Times*, 15th April 1962; Forest Department (1963).
[84] Ordinance 20 of 1962, [TNA CO 125/21]; Forest Department (1963).
[85] McCalla (1994).
[86] Forest Department (1963), p. 5.; 'Fire is now our only danger', *The Times*, 12th December 1961; 'Try to avoid forest fires, Premier urges', *The Times*, 14th December 1961; 'Prevent fire campaign planned' and 'Avoid forest fires!!!', *The Times*, 17th December 1961; 'Fire', *The Times*, 6th January 1962; 'Disastrous forest fires begin', *British Honduras Newsletters*, 3rd March 1962; 'New radio equipment aids in fire-fighting', *The Times*, 15th April 1962; 'Forest fires take heavy toll of natural resources', *British Honduras Newsletters*, 11th March 1963; 'Government Information Service forest fire prevention campaign intensified', *British Honduras Newsletters*, 8th April 1963; 'Recapitulation on forest fire havoc', *British Honduras Newsletters*, 27th May 1963; Interview 65.

policy.[87] Their argument is supported by the Belize Forest Department's response to the wildfires following Hurricane Hattie, and also those in 1955.

In 1969, Lewis Lindo became the first Belizean Chief Forest Officer.[88] By then, most of the senior staff of the Department were Belizean, yet the Department struggled to fill leadership positions with trained foresters, and in the 1970s and 1980s, a series of British ODA/ODM staff were seconded to the Belize Forest Department for two – four-year periods.[89] They had specific topics on which they were to provide technical advice and assistance. One of these, Martin Johnson was tasked, between 1974 and 1976, to write a fire management plan and a working plan for the southern coastal plain.[90] Johnson had a good knowledge of the Belizean context: he had previously mapped the pine stocks of the southern coastal plain using satellite imagery and fieldwork.[91] His plans demonstrate that he had also done extensive research into the history of the Forest Department. Johnson's plan did not call for new policies or practices. He described the existing fire management infrastructure in detail and called for a renewal of the efforts of the late 1950s, with the resurrection of various fire towers that were now unmanned and funding to replace depreciating equipment. No such funding was forthcoming, and as noted (Chapter three, Section 3.6), Johnson's plan was not put into practice.

The equipment that was sporadically donated to the Department became increasingly sophisticated, yet as had been the case since the 1920s, approaches and equipment designed elsewhere were not always suited to conditions in the

[87] Pooley (2014); Pyne (2015).
[88] 'Chief Forest Officer' replaced 'Conservator of Forests' as the title of the Department head.
[89] Johnson (1974); Forest Department (1974); Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74]; Forest Department (1985).
[90] Johnson (1974); Johnson [unpublished, 1976], discussed in letters from Martin Johnson to the Chief Forest Officer on subject 'working plan prescriptions', 25th November 1976, and from Martin Johnson to Nick Woods, 30th December 1977, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[91] Johnson & Chaffey (1974).

Belizean savanna. For example, one visiting consultant noted in 1976 that the fire tenders that had been supplied by CIDA were 'too light and too "flimsy" for the job they were expected to do and too "fancy"'.[92] In practice, the firefighters were often more nimble in following the furious pace of a fire if they left their mechanical equipment behind. Two former Forest Guards described firefighting in the 1970s:

> we do it [*sic*] with the young pine or palmetto. We cut that and lash…. Well water we never had that too much, right, because the vehicle that carry the water generally could not get into the place. Once we get pumps and then we spray with that, right. But that was too slow for the kind a fire that we had. Those kind a fire was moving like jet. And especially they done get caught up in a breeze. You couldn't pump that fire, it just blow right past. You have to run.[93]

Prescribed fire use remained part of the Department's fire management policy after the 1950s. In the 1960s, the Forest Department's annual reports mention prescribed burning in certain years.[94] It is unclear whether prescribed burning was done annually, and on what scale it was carried out. The older forestry staff I interviewed were mixed in their recollections of how important prescribed burning was in the 1960s and 1970s. Two former Forest Guards remembered no prescribed burning of plantations, but recalled some use of controlled fire along roadsides to create fire breaks to prevent fires spreading from cigarette ends thrown out of vehicles.[95] On the other hand, another staff member remembered that 'prescribed fire was an accepted programme'.[96] The purpose of prescribed burning was still to reduce fuel loads, and also, as the same staff member recalled, 'to reduce the broadleaf species overcoming the pine'.[97]

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[92] Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74], p. 46.
[93] Interview 47.
[94] Forest Department (1958, 1963, 1972); Johnson (1974).
[95] Interview 47.
[96] Interview 65.
[97] Ibid.

While the rationale for prescribed fire use may have been known to the Forest Department staff, it did not have sufficient state support to develop as a programme, and the capacity and leadership to carry out prescribed burns gradually eroded. This parallels the experience elsewhere, such as in South Africa, where prescribed burning did not become commonplace, despite support from the Forest Department from the 1940s.[98] In 1978, Nick Woods, an ODA staff member on a short-term secondment to Belize, wrote that prescribed burning was 'in the experimental stage'.[99] By 1986, there had also 'been a lapse in the prescribed burning trials' in the upland pine forests of the Mountain Pine Ridge (which had had a programme of fire management on a scale paralleling that on the southern coastal plain from the 1950s onwards).[100] After 1986, the Department concentrated its pine regeneration work at the Mountain Pine Ridge only.

5.3 New policies for fire management from 1986 to present

Forestry's funding and importance in Belize declined further after 1990. The USA's economic policy increasingly directed development. Shortly after independence, the Belizean Government signed its first deal with the International Monetary Fund (IMF). As elsewhere in the Global South, the IMF directed Belize towards tariff reductions, reductions in social spending, greater dependence on imported food, and increased exports to industrialized countries.[101] These demands pushed the Government to grant large areas of savanna on the southern coastal plain for citrus and aquaculture development.[102] The forest reserves on the southern

[98] Pooley (2014).
[99] Letter from Nick Woods to the Chief Forest Officer on subject 'Southern Coastal Plain Working Plan', 9th February 1978, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[100] Arnold & Armitage (1989), p. 153.
[101] Wilk (2006); Wainwright (2008); Zarger (2009); Bulmer-Thomas & Bulmer-Thomas (2012), ch. 6.; Shoman (2012), ch. 12.
[102] Zisman (1998).

coastal plain became even less of a priority for the Forest Department. At least on paper, nature conservation was now a major part of the Department's work, and, throughout the 1990s, new protected areas were added to the area that was officially under its jurisdiction.[103] Despite broadening its mandate, the Forest Department was further retrenched. In 1995, the IMF pushed for a reduction in employees across Government, which hit the Forest Department particularly badly.[104] The Department gradually ceded management responsibility for 75 percent of Belize's protected areas to conservation NGOs, or in some cases to community co-management, without being able to provide any financial support to these organisations.[105]

On the southern coastal plain a small-scale pine industry continued, supplying the local market only. After several decades of granting only annual licenses for pine extraction, in the late 1990s, the Forest Department re-introduced long-term forest concessions for pine extraction from national lands and forest reserves, including Deep River and Swasey-Bladen.[106] The Forest Department did not make fire management a condition of such concessions, but as I show in Chapter six, seeing the benefit in terms of pine regeneration, some of these logging concession holders began their own prescribed fire management programmes.

Just as the local political elite undermined the Department's work in the colonial period (see Chapter four), after independence, Belize's powerful elites continued to direct land and natural resource use to their advantage. Belize's politicians retained power through a system of patronage. Only when politically

[103] Today Belize's terrestrial protected area system includes national parks, nature reserves, wildlife sanctuaries, forest reserves, archaeological sites and archaeological reserves, as well as private reserves and 'strategic biological corridors': Salas & Shal (2015).
[104] Interviews 49 and 56; Wainwright & Zempel (2018).
[105] Brechin & Salas (2011, 2018).
[106] This was recommended by the Forest Planning and Management Project, funded by UK ODA: Plumptre (1993). Interviews 2 and 3.

expedient did politicians align themselves with the Department's aims, policies and legislation, or with those of international conservation and development funders.[107] Positions within the Forest Department were granted to political supporters or family of the ruling party, not based on qualifications in forestry or nature conservation.[108] It thus became difficult for staff to retain positions. The Department's right to grant forest licenses became a tool for Ministers to garner political support.[109] Further, after the 1960s, when the Government introduced new land leasehold and titling processes, 'the forest reserves started to be treated as land banks. So, it was a forest reserve until the land situation got so desperate, whether in truth, or just politically. Then it was ok to go in and chop off a piece and hand it out'.[110] Ministerial decisions to excise and grant land from forest reserves as political favours were often made without informing the Forest Department, placing the reserve boundaries under dispute.[111] Thus the aquaculture, citrus and banana industries could expand into savanna forest reserves on the southern coastal plain (compare the present boundaries of the Mango Creek Forest Reserve and Grant's Work Forest Reserve shown in Figure 5.8 with the original boundaries in Figure 4.10).[112]

Since 1986, the Forest Department has only conducted a limited programme of fire management in the Mountain Pine Ridge, but foreign organisations have continued to provide sporadic training or equipment for fire management under short-term projects and consultancies. In 1997, a training module in fire management was written for the Forest Department as part of the six-year, ODA-

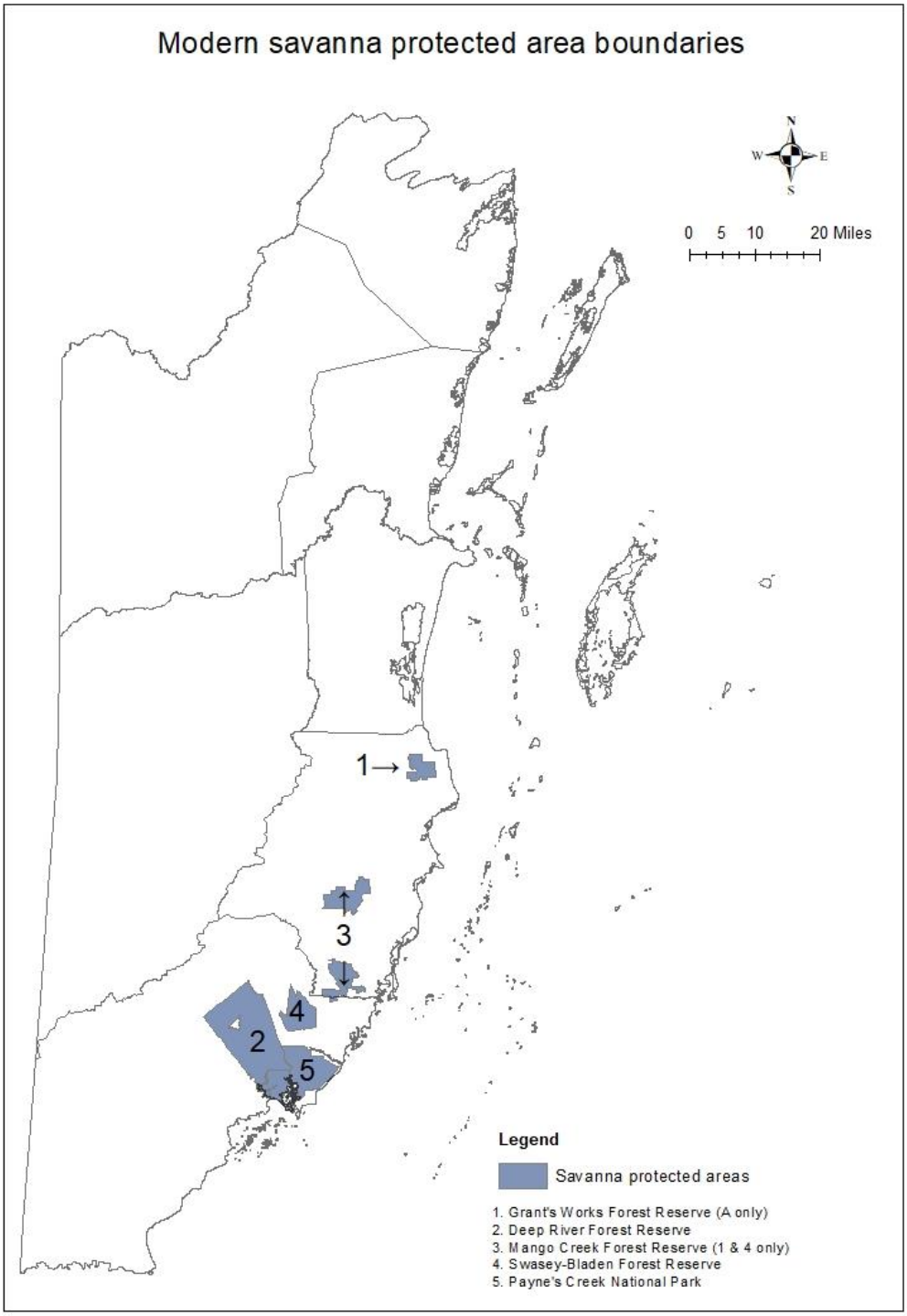
[107] Zisman (1998); Shoman (2012); Wainwright & Zempel (2018).
[108] Interviews 65, 66 and 68.
[109] Wainwright & Zempel (2018).
[110] Interview 3.
[111] Arnold & Armitage (1989); Belize Tropical Forestry Action Plan First Quingennial Report, 1994, [unpublished report viewed in unofficial archive of Neil Bird, Oxford]; Interviews 2, 47, 49, 56, 65 and 68.
[112] Zisman (1998); Interview 68.

funded Forest Planning and Management Project.[113] The Department was provided with firefighting equipment by the Montana Forest Service in the 1990s.[114] Between 2000 and 2009, Forest Department staff took part in fire management training with TNC under the Global Fire Initiative (GFI) (I discuss this in Chapter six in more detail). TNC preached a 'gospel of fire management' that departed radically from previous approaches in Belize.[115] TNC's approach of 'integrated fire management' accepted human fire in the landscape, and proposed that fire management could achieve nature conservation and timber regeneration aims while also being integrated with 'socio-cultural realities'.[116] TNC staff suggested that fire was ecologically appropriate in the Belizean savanna, and at suitable frequencies and intensities, could indeed be beneficial to pine regeneration. TNC strongly promoted prescribed fire use.[117] TNC's approach and rhetoric formed the basis of a Wildland Fire Management Policy and Strategy for Belize published by the Forest Department in 2009.[118] Shortly afterwards, the funding for the GFI was cut, and TNC ceased its support for fire management in Belize.[119] In 2014, the Forest Department received funding from the World Bank and GEF for the five-year Management and Protection of Key Biodiversity Areas in Belize Project (KBA).[120] This provided the latest external support for fire management: training for staff by a Californian consultant, new donations of equipment ('Kestrel' pocket weather stations, GPS units and drones), and the creation of a Forest Fires Communication Strategy for the Department in 2018.[121]

On paper, Belize's new fire policies, produced with TNC's support and under

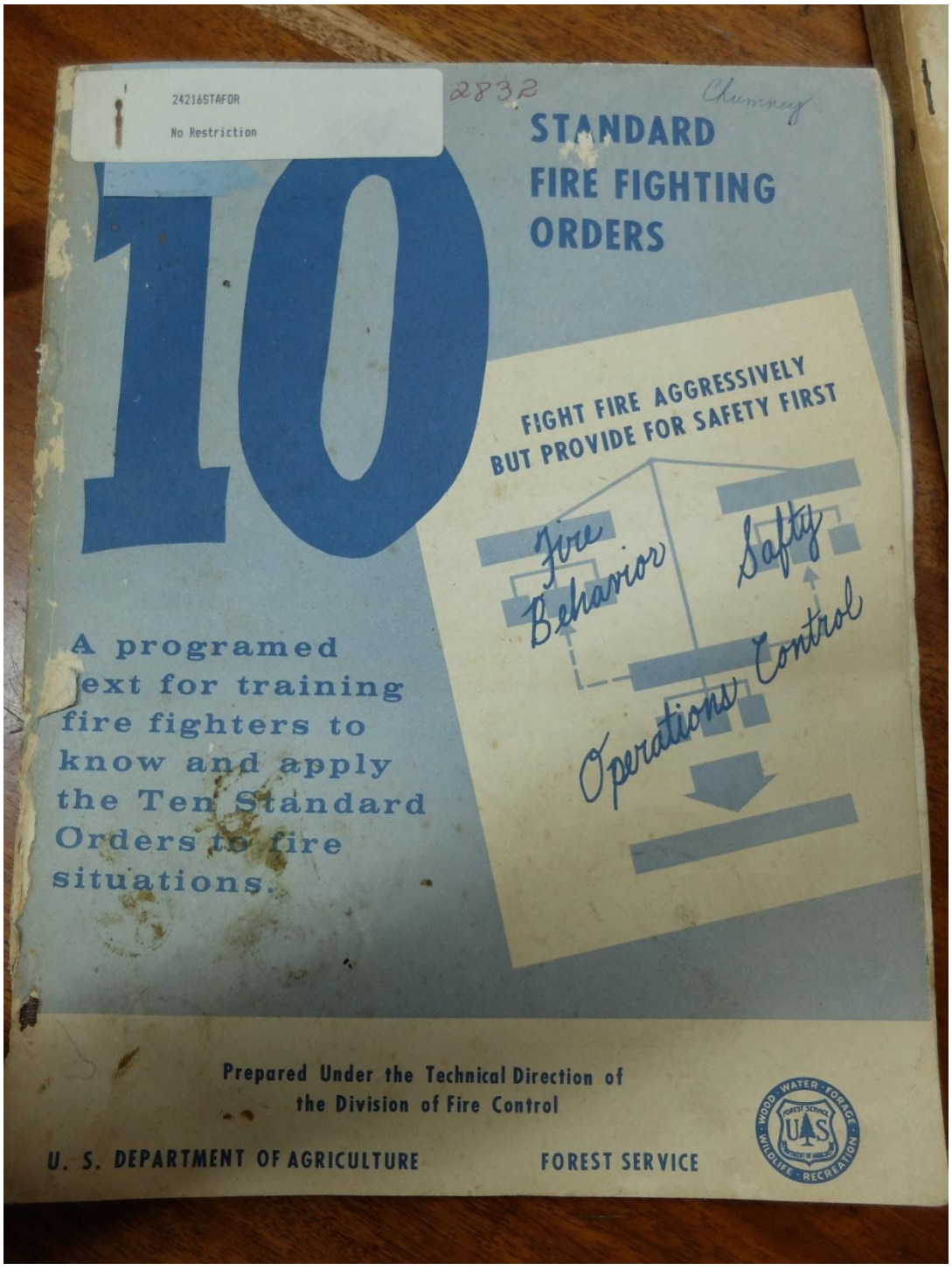
[113] Faizool & Underwood (1998).
[114] Interviews 51, 55, 56 and 66.
[115] Quote from interview 60.
[116] Myers (2006), p. i.
[117] Myers & Morrison (2006).
[118] Sabido & Green (2009).
[119] Interviews 55, 59 and 60.
[120] World Bank (2014).
[121] 'New equipment to fight forest fires', *The Guardian*, 9th February 2017; Yorke (2017).

Figure 5.8



Source: Map created in Arc GIS by author, using Belize Basemap shapefile (Meerman & unknown sources, 2013), and Belize Protected Areas shapefile (Meerman, 2017), both available at http://www.biodiversity.bz/ , [accessed 11/02/2019]. While this map is intended to show the present reserve boundaries, it may not be entirely accurate, since, as noted in Chapters 5 and 6, Ministers have excised land from Forest Reserves without informing the Forest Department.

Figure 5.9



A 1960s firefighting manual produced by the USFS, on the unsorted shelves of the Belize Forest Department office in Belmopan.
Source: Author (2017).

the KBA Project, appear to reflect a radical change in the approach to fire management in Belize.[122] Before TNC's engagement in Belize, fire management was deemed the sole prerogative of Government agencies; the public's use of fire was deemed a threat. Fire management was considered a technical exercise, to which numerous firefighting manuals written by the US and Canadian Forest Services between 1950 to 1980, that now lie among the unsorted archives at the Forest Department's office in Belmopan, stand as testament (Figure 5.9, for example). Fire management was formerly solely directed towards maximising pine production and not towards nature conservation. As one of the TNC staff working in Belize in the 2000s remembered, before their work 'there was not a great deal of receptivity at the agency level to fire—it was not believed that fire was good, or fire was a natural ecological—it didn't have a place in the ecosystem and fire should be repressed'.[123] Belize's Wildland Fire Management Policy and Strategy thus appears to represent a major change from this previous approach in that it calls for consideration of the social and cultural, economic, environmental and institutional dimensions of fire management:

> Wildland fire will be used to protect, maintain, and enhance fire dependent ecosystems and, as nearly as possible, be allowed to function in its natural ecological role.[124]
>
> Fire is an important component of the Belizean rural and agricultural landscape and has been used as an important tool in the pursuit of rural and traditional livelihoods. When fire is used inappropriately and indiscriminately then it becomes a threat to rural livelihoods. Therefore, the appropriate use of fire will be promoted only in those circumstances where all the technical, legal, social, and safety parameters permit its use.[125]
>
> The management of wildland fire will be promoted and developed at the community level in general as an integral component of community resource management. The necessary technical, legal, and other necessary supportive structures will be created and maintained to enable community governance systems to spearhead local

[122] Sabido & Green (2009); Yorke (2017).
[123] Interview 60.
[124] Sabido & Green (2009), p. 13.
[125] Ibid.

> wildland fire management initiatives including the capability for a quick response to wildland fire threats.[126]

Similarly, the Department's 2015 Forest Policy, written under the auspices of the KBA Project to replace the pre-existing policy of 1954, calls for collaborative forest management, community forestry and 'equitable access to and use of forest resources by all persons within the confines of any over-riding public interest'.[127] In 2017, the Department's Forest Fires Communication Strategy, also written with the KBA funding, devoted 151 pages to a 'situational analysis', eleven 'communication principles', twelve 'communication strategic objectives' with hundreds of sub-activities, twenty-nine 'communication approaches' (including the creation of multi-stakeholder fire management working groups, web-based outreach and a forest fire education curriculum) and, finally, seventy-five 'key messages', all aiming to encourage 'a departure from the prevailing technical-focused, one-directional (traditional "top-down") communication approaches often used by government agencies'. The Strategy promoted an approach that 'essentially seeks to promote people as central to forest fire management'. This, it was deemed, would bring about 'a "win-win" situation, engaging local community and indigenous people in determining how they would like to be included in forest fire management, interdisciplinary stakeholders in discussions and working together, and better collaboration both of internal and external stakeholders'.[128]

It is hard to know what role these policies have played or will play in directing the Department's work. The 2015 Forest Policy 'still has not been discussed at a national level', nor followed up with legislation through revision of the Forest Act (which stands more or less as it did in 1926).[129] This echoes the experience in many

[126] Ibid., p. 14.
[127] Forest Department (2015), p. 38.
[128] Yorke (2017), p. 20.
[129] Interview 3.

other countries, where community-based forestry has been endorsed in 'soft laws' such as international agreements and policies but not incorporated into forestry legislation.[130] In practice, the Belizean Government shows little willingness to relinquish control of forest reserves to communities for timber production, let alone to support the establishment of community fire brigades (as I discuss further in Chapter six).[131] Since the 1990s the Forest Department, with the Government of Belize, has repeatedly opposed the interests of the Mayan communities of the Toledo District in an indigenous land rights case.[132] Despite the inclusion in policy of nature conservation as an aim of fire management, the Department shows no move towards this in practice. As far as a former Department employee could see: 'right now you see that they [*sic*] only thinking about just collect revenue from loggers and things like that. Because I don't know any plans that they have … I think everything just trickle down the drain'.[133] In Section 5.5 I give further analysis to the role that these recent policies play, even if not it is not in directly informing the Department's work.

The Department retains a large amount of the fire management equipment that it has been donated, yet few of its staff retain the skill to put it to use. From informal conversations and interviews, few current staff of the Department, or its recent technical consultants, are aware that the Department conducted fire management before the 1980s.[134] A TNC employee working in Belize under the GFI in the early 2000s remarked that at the Mountain Pine Ridge 'they had tools, protective equipment, fire towers that were going unused. They could have equipped 30 or 40 people with safety gear. And it was all just there and they did not

[130] Larson & Ribot (2007).
[131] Wainwright & Zempel (2018); Interviews 3, 48, 49, 59.
[132] Wainwright (2008).
[133] Interview 47.
[134] Interviews 51, 55 and 60.

have the staff'.[135] TNC's training did change the attitudes of some individuals in the Department towards fire.[136] Today, a few of these individuals continue to push for the Department to conduct prescribed burns in the Mountain Pine Ridge.[137] Yet, despite the capacity of these few individuals, the Department lacks wider staff capacity, or support in higher levels of Government to carry out consistent programmes of prescribed burning.[138] In recent attempts to conduct prescribed fires in the Mountain Pine Ridge, the Department lost control of fires, a fact which carries a legal risk.[139]

Thus, today, as with most protected area management in Belize, fires in protected areas, except for the Mountain Pine Ridge, are left to several local NGOs, such as the Toledo Institute for Development and Environment (TIDE), who have capacity for fire management (also largely developed through work with TNC under the GFI: see Chapter six). In recent years, TIDE's staff have provided fire management training to Forest Department staff, cost-free to the Department, under an aid-funded fire management project of their own.[140]

The final sections of this chapter draw conclusions about how foreign 'expertise' and aid have shaped and limited the Forest Department's fire management work throughout its history. They explore the reasons for the gaps between policy and practice in fire management in Belize.

[135] Interview 55.
[136] Interview 51.
[137] Interview 51.
[138] Raines (2002), 'Fire management in the Mountain Pine Ridge Forest Reserve', [unpublished report, BARS MC5299]; Interviews 51, 62.
[139] Interview 62.
[140] This was in 2017 under Darwin Initiative Project 22-013 'Conserving pine woodland biodiversity in Belize through community fire management', for which I was the project officer from 2015 to 2018.

5.4 Expertise in the design of fire management

I have demonstrated that foreign 'experts' have played an important part in directing the Forest Department's work from its inception. In the colonial period, the Department's senior staff were British, and the word of special advisors to the British Colonial Office, such as Robinson, Wright and Downie, played an important role in directing the general fortunes of the Department. Since the 1970s, consultants have been called in from outside Belize, to give training and write policy under short-term projects. In 1957 it was suggested by a British advisor, that 'the basic fault' with the 'administrative machine' in Belize lay with 'the system of posting expatriate officers, with no previous knowledge of the country, for short tours only to this Colony'.[141] This section reviews the implications of this reliance on foreign expertise for the Forest Department's fire management in policy and practice.

If, after Collins and Evans, we take expertise as 'real', in the sense of involving the possession of deep tacit knowledge, we can examine the realms of knowledge in which these people might be understood to have possessed expertise.[142] Despite the fact that the Department's advisors were often granted authority as 'scientific' experts, as was the case of Hummel in 1921, scientific expertise and knowledge, in the sense of induction from empirical measurements, has rarely directed fire management. After Hummel's initial measurements of pine volumes, the Department continued to monitor pine stocks, creating inventories of the southern coastal plain in the 1930s, 1950s and 1970s. Yet no scientific study was carried out to examine wildfire frequency and behaviour in the savanna, and, importantly, its effects on pine growth.[143] In the Colonial period, the Department did

[141] Report to the Colonial Office on 'Economic and Financial Prospects in British Honduras', by A. Gilmour, 1957, [TNA CO 1031/2461], p. 6.
[142] Collins & Evans (2008).
[143] Handwritten report by Phillips entitled 'Short note on the pine cruising in the Deep River Area', December 1935 and data in handwritten tables, [Machaca Forest Station, Toledo District, Belize, uncatalogued in storage]; Cree (1956), 'A pine regeneration scheme for the Southern Coastal Forests of British Honduras', [unpublished, BARS ASR-1505-114]; Johnson & Chaffey (1974).

have a research division, which examined the effects of different methods of forestry on pine regeneration in experimental plots. Yet, as I have shown (using the vignettes in Chapter three, Section 3.6), the collection and preservation of data about Belizean forestry was an enterprise largely driven by foreign scientists and administrators. There was often a form of institutional 'memory loss' as records of research were destroyed or forgotten. A former senior staff member of the Department remembered experiments in the 1960s and 1970s, but he 'didn't see the results…. Research was just not used practically'.[144] Later, under a five-year UK-government funded project in the 1990s, British consultants to the Forest Department introduced long-term monitoring plots which were not maintained after the project ended.[145]

We might thus consider the expertise that informed the Department's fire management, rather than being 'scientific', to have been what Fleischmann and Briske call 'professional ecological knowledge'. The institutions from which these experts derived, be they the Oxford Imperial Forestry Institute or TNC, understood fire's proper role in ecosystems in a general way; their members were experts possessing knowledge as codified their institutions' 'best management practices, procedural manuals, and technical guides that often come to be thought of as verified scientific knowledge'.[146] These experts applied established ecological principles and fire management methods and ecological principles to Belize, rather than deriving them within the Belizean context.

The foreign experts guiding the Forest Department's fire management throughout its history have all been technical experts with professional qualifications

[144] Interview 66.
[145] Interviews 66 and 68. None of these plots were in the lowland savanna, nor were they intended to inform fire management, but this illustrates how science has continued not to inform the Forest Department's work.
[146] Fleischmann & Briske (2016), p. 2.

in forestry and fire management. Yet the extent to which they have also had experience and expertise regarding the ecological and socio-political specifics of the Belizean context—in other words, also possessed local knowledge—has changed. This is related to the trend towards ever shorter consultancies. Colonial Conservators of Forests in Belize spent up to fourteen years resident in the country (as in Neil Stevenson's case). From the 1970s to the 1990s, foreign consultants to the Department under projects such as the ODA-funded Forest Planning and Management Project were not Department staff but did live in-country for several years as project staff. Today, foreign consultants to projects make only brief visits to Belize. The Californian fire management consultant that provided training to the Department staff under the KBA project in 2017 spent only several weeks in Belize.

Based upon interviews with colonial officials whose careers later turned to international development, Uma Kothari has recorded changes in the type of knowledge valued in development experts as part of the trend to spend less time in-country.[147] International development has become increasingly 'professionalised', such that technical expertise and qualifications are valued above local contextual understanding gained through extended residency in a country. These patterns are evident in Belize. Colonial Conservators of Forests wrote and oversaw the Department's budget and work in its entirety, and for this it was deemed necessary to reside in Belize and develop a contextual knowledge of the Belizean environment. Thus, it was possible in the 1950s for observations gained through practical experience of managing the savanna to inform the introduction of prescribed burning in Belize. Today, foreign fire management consultants to the Belize Forest Department fulfil only specific project objectives related to their technical expertise in fire management. In-depth understanding of the Belizean context is not deemed a

[147] Kothari (2005, 2006).

pre-requisite to such a consultancy. As was reported to me of the KBA Project's fire management consultant: 'they imported somebody from California, which couldn't be more different to Belize, to do the training here. And I'm sure they did an … out-of-the-box type of job'.[148] There has thus been an *increasing* reliance on professional ecological knowledge to direct fire management policy in Belize.

From the 1950s, there were efforts to develop technical expertise in forestry among Belizeans, and Belizeans gradually came to take senior positions within the Forest Department. After 1955, a handful of Belizeans received scholarships to study forestry in Cyprus, the UK and Puerto Rico.[149] These individuals trained within European and North American institutions developed similar professional ecological knowledge to their British counterparts. The first senior position in the Department (as an Assistant Conservator of Forests) to be filled by a Belizean was in 1953, and the first Belizean Chief Forest Officer was appointed in 1969.[150] Training in forestry, like the training in fire management given to staff under various aid projects, was available only as long there was external funding; there was no school of forestry in Belize. Further, those individuals that had obtained degrees abroad often preferred to use the status this afforded them to take better paid positions than were available with the Forest Department.[151] There was thus always a shortage of qualified Belizeans to fill senior positions within the Department. British staff were still being called in to fill temporary vacancies in the 1990s.[152] In recent decades, those Department staff who have degrees and professional training, have generally not studied forestry, but rather, in keeping with the rise of nature conservation, have studied environmental science or management. Since 2012 there has been a

[148] Interview 59.
[149] Colin Eric Duff, unpublished report entitled 'History of Forestry in British Honduras', early 1960s, [OWL MSS.Brit.Emp.s.466]; Interview 65.
[150] Forest Department (1954, 1972).
[151] Interview 66.
[152] Interview 68.

degree in environmental resource management available at the University of Belize, and some of its graduates have obtained positions in the Forest Department.

Though qualified Belizeans have held positions of leadership within the Department, they have struggled to use their expertise to direct the Department's work. This has been, in part, because of limited and inconsistent funding (see Section 5.5), but it has also been because staff commonly gain and lose positions because of their political allegiance.[153] 'Qualifications were taken into account when employing staff up to a point, but it was very much what party your family was associated with. This made it difficult for people running the Department to discipline people'.[154] Furthermore, the Department has never had a staff member dedicated to leading the fire management programme. Today the task is managed alongside other priorities by staff members who do not necessarily have training in fire management.[155] Many of the Department's policies are still written by external consultants, often as part of funded projects. In recent decades, the Department has sometimes employed Belizeans as consultants. They have had knowledge of the local context but have still been employed because of their *technical* expertise.

Until recently in the Department's history, local fire users have not been deemed to possess a form of expertise that should inform fire management. Throughout the twentieth century, the Department's attempts to engage with rural fire users were limited and, largely, took the form of propaganda campaigns, such as those that followed Hurricane Hattie. These campaigns gave a strong anti-fire message: 'hunters must not set fires, farmers must be careful…. You can prevent fires. The future is in YOUR hands'.[156] In these campaigns, the Forest Department was presented as the only agency with the technical expertise to manage fires. Fires

[153] Interviews 65, 66 and 68.
[154] Interview 68.
[155] Interview 51.
[156] 'Fire', *The Times*, 6th January 1962.

set by the rural population had no place in forests; even after fire was accepted as a management tool for forestry in the 1950s, only prescribed fires set by the Department were permissible. The Department's recent policies suggest a radical change in approach: there is an appreciation of the role of fire in local livelihoods, calls for community fire brigades and for an end to 'top-down' approaches in communicating messages about fire management.[157] These policies, and the experts that wrote them, follow the latest technical discourse of 'participatory' approaches in international development. So far, the Department shows little real commitment to these policies.

As Fleischmann and Briske note, professional ecological knowledge has more limited feedbacks with real ecological and social conditions than does either scientific or local knowledge.[158] Most foreign experts advising the Belize Forest Department inflexibly 'operated with a particular vision of the world'.[159] As we have seen throughout Chapters four and five, the kinds of policies and plans that these experts produced were often unsuited, in practice, to Belizean fire management. Not only was such expertise practically limited in its relevance in Belize, but, critically, it also held limited authority in Belize. Foreign, technical expertise derived its authority to direct fire management in Belize from the cultures of colonial Britain and international development. The authority of these experts to write plans and policies within the context of international development projects was not disputed, but powerful Belizean elites, the general public, and some Department staff, did not attribute to these people and their plans the same authority. As technical experts were employed for ever shorter consultancies, so their expertise had less ability to direct fire management in practice. Together, the patterns that I have identified

[157] Sabido & Green (2009); Yorke (2017).
[158] Fleischmann & Briske (2016). See also Berkes, Colding & Folke (2000).
[159] Interview 68.

mean that while professional ecological knowledge in forestry and fire management has directed policymaking throughout the Forest Department's history, it has had a declining influence on fire management in practice.

5.5 The implications of international funding for fire management

In beginning this chapter, I presented an argument made by various scholars, that the 1940 CDW Act and its successors were intended as means by which to subdue political unrest and perpetuate British colonial rule through 'constructive trusteeship'.[160] For Tania Li similarly, international development project funding today enables development agencies' 'interventions into the affairs of sovereign nations to be framed in technical terms, avoid diplomatic upset and evade political questions they cannot resolve'.[161] Such a logic, I contend, is applicable to funding received by the Forest Department for fire management projects since the 1949 CDW grant. CDW and international development funding have protected fire management as a project, but it has not had direct political support in Belize.

As noted, before the first CDW grant was allocated to the Forest Department, the Belizean Legislative Council was reluctant to fund the Grant's Works Pine Regeneration Scheme from the territorial budget. The Department's unpopularity in Belize carried onwards from the 1920s and 1930s. The Department's claim to authority based on technical expertise, the high salaries of its senior, British, staff, and its connections with the British Colonial Office, all lay behind the dislike expressed towards it by the labour movement and Belizean elites pressing for self-government. In 1944, for example, the *Independent* called for the Department's retrenchment, arguing that:

[160] Constantine (1984), p. 304, also Lee & Petter (1982); Havinden & Meredith (1993); Cooper (1996); Clarke (2007); Hodge (2016).
[161] Li (2016), p.91.

> The establishment of a department of forestry in the Colony has been rather expensive and while it may be contended that what had been done in the past was necessary (a contention with which we entirely disagree) every care should be exercised over expenditure to avoid extravagance and waste, which was so pronounced in the past that substantial reduction has had to be instituted. And if it was found necessary to institute reduction in expenditure in the past, it should be still more necessary for the simple reason that there is only routine work to be done, which means that the need for a bunch of highly paid technical officers no longer exists.[162]

While it had sustained CDW funding, the fire management work of the Department could not be touched by such arguments, but, as we have seen, after this ended, the independent Belizean Government did not prioritise funding for the Forest Department in its budget. International development funding nevertheless continued to sustain the Department. As a former Minister explained to me, there has been political impetus to maintain a Forest Department because international conservation agendas bring the promise of project funding to the Government: 'it is only because the *world* … they make lot a [*sic*] noise, and all do radical in Europe, starting to make noise about climate and environment and conservation, is why they beginning to make token gestures in Belize, and forestry, ''yes, boy, you need to do this'".[163]

This situation, in which the impetus for fire management ebbed and flowed with the availability of foreign aid, limited the Department's work practically. While international funding drove technical expansion and innovation, its short-term nature after the 1950s limited the coherence of the Department's work. 'Hand-to-mouth' dependency on aid made the Department unable to develop a long-term programme or institutional vision for fire management.[164] As a visiting UN-FAO consultant noted in 1982, 'there is nothing wrong in the acceptance of aid, but … too indiscriminate

[162] 'Our Forest Department', *The Independent*, 6th September 1944.
[163] Ibid.
[164] Interview 68.

an acceptance of offers can simply serve to thwart local initiative … there is a tendency to accept the situation that all acknowledge is unsatisfactory until a new machine comes along to solve it'.[165] The high turnover of senior staff limited the quality of reporting and the consistency of the Department's work: 'there is always one or two people who, you know because of their interest in something can—and maybe the contacts they have—can trigger off things. The unfortunate thing is that when they go, then everything just kind of dies away and you go back to no-where'.[166] The equipment and vehicles sporadically donated to the Department have usually been types for which it is impossible to find replacement parts in Belize.[167] In 1989 when fire management ended on the southern coastal plain, this was attributed to 'the lack of replacement of equipment, which had been provided by donors'.[168]

As we have seen, the culture of colonial and international development has favoured approaches that have treated fire management as a technical exercise. In planning projects for grant funding, the Department thus delineated purely technical programmes of work and the socio-political context to fire management was largely omitted. In 1952, for example, as the Department began planning its CDW grant application for 1955-1960, Department staff questioned whether to limit plantation work to the Stann Creek District, given that existing fire protection work in the Toledo District was limited. On the other hand, it was feared that they 'could not very well desist entirely from plantation work in Toledo as it would raise political issues over unemployment and disbursement of Government funds between Districts'. The

[165] Report entitled 'Forestry and Wood-use in Belize', prepared for UN-FAO project BZE 79/002, 1982, [unpublished, BARS ASR-888], p. 19-20.
[166] Interview 3; Forest Department (1953); Stevenson (1964); Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74]; Forest Department (1985).
[167] Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74].
[168] Arnold & Armitage (1989), p. 17.

Colonial Secretary responded that 'Colonial Development and Welfare grants are not designed to take care of political issues. The aim is to develop the economy of the Colony. If the only reason for dividing the project between Stann Creek and Toledo is a political one, then I think we will have to think again because it is obvious that it will be more costly to undertake two projects rather than one'.[169]

When the Department conducted active fire management, it was with limited ability to reduce the number of savanna fires in Belize, because the work did not attempt to engage with the socio-political context from which wildfires emanated. The fire 'problem' was, of course, still a political one. Fires did not necessarily originate within 'protection areas'. Fires were started by human actors. Fire management was being justified to prop up the pine industry, in which most rural fire users had no stake; it benefitted a few individuals, and, from the 1940s to the 1960s, was monopolised by a single British company. Let me specify how the Department was limited in its engagement with relevant stakeholders in the pine industry, the Agriculture Department and rural fire users in particular.

The Forest Department did make occasional suggestions that BEC, and others in the pine industry should accept some responsibility for the sustainability of the industry, for example by financing fire management. In 1947 it was suggested to charge pine licensees with the cost of constructing fire lines in production areas.[170] At the Departmental Conference in 1955 the need to place more responsibility for fire management on landowners and concessionaires was raised.[171] Finally, in 1957, the pine license agreement with BEC for the Swasey-Bladen and Deep River Forest areas included a term requiring them to provide labour to assist with fire

[169] Correspondence between Conservator of Forests and Colonial Secretary, 29th July 1952 and 1st August 1952, [BARS MP612/1952].
[170] Forest Department (1948).
[171] Minutes of Forest Department Conference of July 1955, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].

management in the concession areas.[172] In reality, the Department enforced no regulations on the pine industry, and companies like BEC did not finance fire management. In 1952, the Department's annual report noted that it was 'misleading to show license areas as being under a management plan of any kind'.[173] By the 1970s, the Department was conducting some fire management on private land, at no expense to the owners.[174]

Those pine concessions granted to BEC secured the Company's monopoly of the pine industry, ensured the flow of capital to Britain and largely prevented local capital accumulation from the pine industry before the resource had been heavily over-exploited: 'everything was for England'.[175] This did not go unnoticed in Belize. In 1961, for example, the *Times* asserted that 'whatever economic help the BEC has given the country in the way of low wages, salaries, harsh working conditions and bad labour relations, all this has been outweighed by the fact that it has failed to contribute sufficiently to the development of the country. On balance it has not put back what it has taken out'.[176] Worker's unions were legalised in Belize in 1942, and the General Workers Union took frequent strike action against BEC to call for fairer wages and better living conditions, including at the Mango Creek sawmill.[177] The strikes prompted little change to working conditions from BEC.[178] In 1957, the

[172] Forest Department (1958).
[173] Forest Department (1953), p. 2.
[174] Fellows (1976), 'The forest resources, forest administration and forest industries in Belize', [unpublished report for CIDA, BARS ASR-955-74]; Letter from Martin Johnson to Chief Forest Officer, 25th November 1976, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[175] Interview 46.
[176] 'Bad record of BEC- and Unbalance. BEC has failed people', *The Times*, 15th July 1961. Similar articles include 'Conditions in British Honduras as we see it', *The Clarion*, 19th January 1954 and 'Monopoly is the destruction of the economy of a country', *The Times*, 16th June 1959.
[177] '250 sawmill workers now jobless. Belize sawmill ceases production', *The Clarion,* 29th October 1952; '200 workers stage 5-hour strike at Mango Creek', *The Billboard*, 7th February 1964; '314 strike at Gallon jug against BEC', *The Billboard*, 19th February 1958; 'BEC workers strike at Gallon Jug and Hillbank', *The Billboard*, 19th March 1964; Bolland (2003), ch. 8; Alexander & Parker (2004), ch. 2.
[178] Reading the Company's Board meeting minutes throughout this period I found note of the strikes and tribunals that resulted, but responses were largely in the form of official statements rather than concrete changes. [Uncatalogued BEC Archive, Ladyville, Belize]

People's United Party (PUP) made a promise to grant the Swasey-Bladen pine concessions to another company as part of its election campaign.[179] After the concession had been granted to the other company, it failed to meet its promises, its manager was exposed as fraudulent, and the concession was transferred to BEC.[180]

The politicisation of the pine concessions is invisible in the pages of the Forest Department's annual reports for this period. In 1959, the Department merely noted that the Government's priority should be to 'encourage the investment of foreign capital in forestry' and that it had 'been necessary to assure the main producer of Pine a future supply of pine sufficiently large to justify the installation of modern machinery…. Although a monopoly in the Pine industry might be regarded as undesirable, the government has found it necessary to grant an option for one large Pine area and agree to the transfer of a license in another area, to one company which now hold concessions covering almost the whole southern coastal area'.[181]

Just as the Department avoided serious engagement with the pine industry, it did little to engage with the Agriculture Department, which shared an interest in fire management. From the 1950s, the use of soil survey to plan 'optimal' land use meant that areas best suited for forestry were distinguished from agricultural development areas. Regardless of these land classification schemes, fires sometimes escaped from agricultural land, mostly into broadleaf forests, but occasionally also into the savanna. For this reason, in the 1940s and early 1950s,

[179] 'Ned Davis to pay 50 cts. Per hour: Ned Davis and associates to operate in Toledo', *The Times*, 17th September 1957; ''Ned Davis to build church, school, theatre at timber works', *The Times*, 27th October 1957.
[180] 'Ned Davis Pulp, plywood, pine schemes hit snags; new terms on pine sought', *The Billboard*, 25th October 1957; 'Ned Davis sued for $81,000 US', *The Billboard*, 21st December 1957; 'We Lose', *The Billboard*, 6th June 1958; 'British American Pulp and Paper Co may lose Swasey-Bladen Timber Concession. Company said failing to observe terms of contract', *The Billboard*, 5th July 1958; 'Pommells and Pilgrim to operate in Swasey', *The Billboard*, 19th March 1959.
[181] Forest Department (1959), p. 1-2.

the Agriculture and Forest Departments cooperated to address agricultural fire use. In 1946, following a hurricane, the Departments collaborated on a fire prevention campaign, visiting farms to check whether farmers were constructing fire traces before burning.[182] In 1952, with CDW funding, a Rural Fire Service was established and administered by the Forest Department. It patrolled farming areas to oversee the construction of fire traces.[183] In 1953, however, the Department handed the administration of the Rural Fire Service over to the District Administration, and the initiative lapsed.[184] The Department argued that responsibility for overseeing agricultural burning should fall to the Agriculture Department alone, since the Forest Department had 'quite enough to do protecting Forest Reserves from fire' and any additional responsibility would 'reduce its efficiency'.[185]

In 1958 the Agricultural Fires Ordinance made it illegal to burn for agriculture without a fire trace or a permit from the Agriculture Department (see Table 4.1).[186] When, in 1962, the Forest Fires Ordinance was passed, the existence of these separate pieces of legislation reinforced the artificial separation between 'agricultural fires' and 'forest fires'.[187] This legislative structure is retained today. Despite recent wildland fire policies that support a more integrated approach to managing fire, and specifically call for cooperation between these Departments, the Agriculture and Forest Departments still have little dialogue around fire.[188]

Throughout the twentieth century, the Department's attempts to engage with rural fire users largely took the form of propaganda campaigns (besides the several

[182] Forest Department (1947). A fire trace connoted a fire line around a milpa.
[183] Forest Department (1953); Correspondence between Conservator of Forests and Colonial Secretary on subject 'Reports on the effects of forest fires', July and August 1953, [BARS MP861/1953].
[184] Forest Department (1954).
[185] Minutes of Forest Department Conference of July 1955, [Mountain Pine Ridge Forest Station, Cayo District, Belize, uncatalogued in storage].
[186] Ordinance 4 of 7th June 1958, [TNA CO 125/20].
[187] McCalla (1994).
[188] Sabido & Green (2009); Interviews 2, 3, 49 and 52.

years of work by the Rural Fire Service in the 1940s). In that wildfires remained frequent, these campaigns appear to have had limited effect. In fact, several former Department staff remembered that in the 1960s and 1970s, local fire users reacted to the Department's fire management work by deliberately setting fires: people who had 'a little grudge with the department, you know, because you stop them from hunt [*sic*]' said '"you guys are sitting there resting ok, we'll give you some work'', and they would be gone, and next you know there is a fire'.[189] Today fire use continues to be widespread in the savanna, in part, because fire users are aware that the Forest Department will not punish fire use.[190] As a logging concession-holder told me, he does not expect any assistance from the Forest Department to prevent fire use in his concession: 'Forestry get info who is taking care of it [*sic*], who is doing these illegal activities…. but they would tell you plain and straight: "sorry we cannot help you, because the Ministers need the votes".... And it's the same thing happening with fire at the present moment. They say they will do something about it but until such time, Lord help us'.[191]

I have argued that many of the plans and policies for savanna fire management in Belize have not been put into practice because of a lack of political support in Belize. Let me conclude this section by reviewing how the creation of such policies within foreign development projects nevertheless benefits powerful actors in Belize. As Li contends for Indonesia, the project set-up in international development benefits government officials because they can divert funding towards themselves.[192] Let me recount an experience by which this became clear to me in Belize. In January 2018, I joined TIDE's protected areas manager at the launch

[189] Interview 51. Also similar recollections in interview 47.
[190] Kull (2002, 2004) makes a similar observation in Madagascar, as does Mathew (2005, 2011) in Mexico.
[191] Interview 2.
[192] Li (2016).

event of Belize's recently published Forest Fires Communication Strategy.[193] This was a ceremonious affair, funded under the KBA project budget and held at Belize City's most expensive hotel, the Radisson Fort George. No expense was spared; all attendees received free KBA project merchandise and a lavish lunch afterwards. The majority of the Forest Department's staff and even the Minister of Agriculture, Forestry, Fisheries, the Environment, Sustainable Development and Climate Change were in attendance, along with NGO staff, like my colleague from TIDE, who had contributed to developing the Strategy. Violet Yorke, the 'communication consultant' who had written the Strategy, gave a PowerPoint presentation. Fire awareness videos made for the KBA project were shown. Several copies of the Strategy were available for me to look at. Copies were, however, not available for the launch attendees to take away, so I exchanged email addresses with Violet Yorke and asked whether she would send me a pdf copy.

Several weeks later, given that none of the Department's policies or key documents are available on its website, and having had no response to my follow up email with Violet, I was in Belmopan and made a visit to the Department's Office to see if I might obtain a copy of the Strategy there.[194] Violet was not in office, but I asked the staff there whether anybody could share the Strategy with me. Despite having attended the launch event, nobody I spoke to possessed a copy or could locate it on the Department's server. Finally, the Department's receptionist was able to find the document in the email chain in which she had been sent it for printing. Through this experience, I understood that the production and celebration of the Strategy functioned to satisfy a project output and the project funders but was not

[193] The event was also a launch for the Department's new 'Sustainable Forest Management Communications Strategy', and the new 'SMART' software tool for protected areas management, also both outputs of the KBA Project.
[194] Wainwright & Zempel (2018) also note the lack of availability of documents on the Forest Department's website.

really intended to orientate the Department's work in practice. In September 2018, my colleague at TIDE confirmed that none of the actions set out in the strategy had yet materialised.[195]

A former Minister described how, to qualify for project-funding, 'you have to write this ponderous amount a [*sic*] volumes of crap'.[196] Today, Belizean politicians are aware that the Forest Department lacks the resources to implement most of its policies and legislation. Ministers use gestures such as creating new policies, legislation or protected areas 'to get some brownie points' with the environmental aid agencies, and sustain their funding, but ultimately, if environmental policy or reserve boundaries do not align with their personal interests, or those of their political supporters, they are ignored.[197] 'Good plans … are just sitting on shelves because politicians don't want to do anything that would upset voters'.[198] The situation is similar in many other countries, where Forestry authorities have created 'soft laws' to gain benefits from donor support, that have seen little realisation in practice.[199] As we have seen there are at least three reasons why implementing fire management policies and legislation is not a political priority in Belize. First, punishing fire use may threaten votes. Second, the savanna is viewed as an asset by politicians primarily as land that can be disbursed for political favour. When the savanna is merely considered *as land*, there follows little reason to conduct fire management. Finally, as I explore in greater detail in Chapter six, incentivising community fire management (as is called for in recent policy) would demand that local villagers were given a form of tenure that enabled them to benefit from the savanna. This would pose a threat to political control over the savanna areas.

[195] TIDE's protected areas manager, personal communication, 11th September, 2018.
[196] Interview 50.
[197] Zisman (1998); Interviews 1 and 68.
[198] Interview 1.
[199] Ribot, Agrawal & Larson (2006); Larson & Ribot (2007); Nelson & Agrawal (2008); Poteete & Ribot (2011).

5.6 Conclusion

This chapter has argued that after 1942, the Belize Forest Department was enabled to conduct savanna fire management, by virtue of short-term, CDW and then international development project funding. Given the lack of local political support for forestry in Belize, it is unlikely that the Department could have continued, and initially expanded, its fire management programme in the absence of this external support. The Department's association with British colonial rule made it an easy target for retrenchment by nationalist and independent Governments. External support enabled fire management to become more technical, providing new equipment and methods. Yet, particularly after the final CDW funding in 1966, the short-term nature of aid and the rapid turnover of staff and consultants made the Department's work inconsistent and made it difficult for a local vision or training programme for forestry to develop in Belize. Expertise in fire management has largely been imported from abroad to write policy and plans.

There are evident continuities in the way that the Forest Department's work has been shaped by colonial and international development. Development projects have been one means through which foreign agencies have pushed their agendas for the Belizean environment, including for fire management, despite resistance or lack of political interest from the unofficial members of the Legislative Council, and later, the independent Government. This is a more common issue. As Uma Kothari and Joseph Hodge among others note, international development emerged gradually from within the context of colonial development.[200] Many of the British staff employed by ODM/ODA after it replaced the Colonial Office in 1966 were former colonial officials. In Belize, where independence came later than for many other

[200] Kothari (2005, 2006); Hodge (2010, 2011b, 2016).

former British colonies, British overseas development staff on secondment to Belize in the 1970s still worked in a colonial setting. There are also discontinuities. After the 1980s, the Belize Forest Department no longer employed foreign experts within the Department. The trend has been towards ever shorter consultancies, involving less time spent in Belize. International development has become increasingly 'professionalised' such that technical expertise and qualifications are valued above local contextual understanding gained through extended residency in a country.

There has also been a change in the types of agenda being pushed by external funders of fire management. Before the 1980s, fire management was supposed to achieve the 'conservation' of pine timber to compensate for the exploitative pine industry. This was to benefit (mostly foreign) companies, the Belizean Government in the form of revenues, and, ostensibly, the Belizean population in the form of opportunities for wage labour. While timber conservation is still the primary rationale for fire management in Belize, the agenda it is supposed to address (in policy terms) has become far broader, and includes nature conservation, climate change, human health, and sustainable rural livelihoods. The Department's understanding of the role of fire in the savanna has also changed. From the 1920s to the 1950s, any fire was deemed destructive to pine, and the Department aimed for total fire suppression in the areas it protected. After the 1950s, the Department changed its policy and accepted that prescribed fire could reduce the risk of catastrophic wildfires by preventing dangerous levels of fuel accumulation. Its most recent policy, published in 2009, went further, suggesting that fire at certain frequencies and intensities is ecologically appropriate in savannas and beneficial to pine regeneration.

Plans and policies for Belizean fire management have rarely corresponded with fire management in practice, nor been effective at reducing the incidence of savanna wildfires. Since the 1950s, rather than funding an active fire management

programme, external aid has provided equipment, training and consultants to write plans and policies. There has been insufficient funding, capacity and will within Belize to make use of this support. The technical approaches described in fire management plans have made them amenable to international development funding, but in practice they have not been suitable for confronting political and ecological realities in Belize. They have been ineffective at reducing the amount of wildfire because they have not engaged with fire users (who have had little benefit from the pine industry that justified fire management). Conservation and development projects and policies have not posed a threat to local elites, who subvert them when necessary in order to benefit from the savanna land and resources. Political elites benefit from maintaining the flow of foreign aid, by ostensibly supporting new conservation policies, such as those recently written for fire management.

As I explore in Chapter six, it may be that the local means and justifications exist by which Belizeans can organise fire management in pursuit of their own objectives. For now, however, the Belize Forest Department, as an agency, lacks the capacity and political will to catalyse such a programme. History suggests that foreign aid is unlikely to change this.

6

Burn bosses: NGO and community-led fire management

Every fire manager in The Nature Conservancy understands that fire is such an important component that we are sort of prone to evangelism and are ready to jump up and go to wherever anybody wants us to go to preach the gospel of fire management (USA fire management consultant who worked in Belize in the 2000s, Interview 60).

Unruly objects of development, these people strive to be modern when we want them to be indigenous, chaotic when we demand order; they present themselves as our clients and employees when we call them partners; dependent when we insist on their autonomy (Mosse 2004, 654).

This chapter examines how, from the late 1990s, a Belizean NGO, the Toledo Institute for Development and Environment (TIDE), became a leader in savanna fire management in Belize. TIDE's work has been influenced by The Nature Conservancy's (TNC) approach of 'integrated fire management', aiming to allow fire-dependent ecosystems to flourish and to facilitate recognition of different human cultures of fire use. In theory, this approach represents a departure from the Belize Forest Department's twentieth-century fire policies which aimed to benefit the pine industry by suppressing rural fire use. In Chapters four and five, I presented evidence to show that the Forest Department faced limitations in reducing local fire use and suppressing fires, in part, because it operated within the constraints of the structure of colonial or international development funding, which supported short-term projects and technocratic approaches. TIDE, like the Forest Department, is also reliant upon such foreign development aid. This chapter examines how, despite different proposed aims and beneficiaries of fire management, similar structural limitations have operated within TIDE's work. Unlike those previously, this chapter primarily uses ethnographic evidence. The focus area for this chapter is narrowed to

the savanna and villages within and surrounding three protected areas in the Toledo District: The Deep River and Swasey Bladen Forest Reserves and the Payne's Creek National Park (see map Figure 1.2). This approach and scale of study make possible greater insight into the agency of individuals within broader structural limitations.[1] It demonstrates the importance of personal relationships in shaping why and how fire management is practised.

Sections 6.1 and 6.2 provide socio-political context to the villages targeted by the Darwin Project in northern Toledo. Section 6.3 describes how the Payne's Creek National Park came to be designated and managed by TIDE, and how TIDE developed a programme of fire management in collaboration with TNC under its Global Fire Initiative (GFI). Section 6.4 explores how the multiple aims and beneficiaries of the 'integrated fire management' promoted by TNC trade-off in northern Toledo. Sections 6.5 and 6.6 examine how the context of international development has shaped TIDE's fire management work, firstly by examining intersections of foreign and local expertise and, secondly, by examining how the structure of short-term funded projects has limited TIDE's work. Finally, Section 6.7 highlights how, because of sustained personal relationships, individuals within NGOs and civil society have been able to take steps towards realising some of the aims of integrated fire management, despite the structural limitations imposed by the funding context.

6.1 Social dynamics in Toledo's coastal savannas

Before European colonisation, the Manche Chol Maya occupied the area that is now southern Belize. The Spanish rounded many Maya in Southern Belize into communal settlements, but after revolts, the majority were forcibly moved to

[1] Note that the names of the individuals referenced in this chapter have been pseudonymised.

settlements in the Guatemalan highlands by the 1690s. British official sources later suggested that British settlers encountered a Belize empty of indigenous people, but there is evidence of continuous occupation by the Maya in both northern and southern Belize.[2] In the early 1880s, a German capitalist, Bernard Cramer, bought large tracts of land and established plantations on the southern border of Belize, for which he imported Q'eqchi Maya workers from the Verapaz region of Guatemala. Coincident with this, widespread privatisation of land in the Verapaces forced the migration of Q'eqchi people northwards, including into southern Belize. This has remained a migration route, particularly during times of government oppression in Guatemala, such as during the Guatemalan civil war from the 1960s to 1990s.[3] Throughout the colonial period, Toledo, remote from Belize City, and with its large indigenous population, was considered the 'least developed' district in Belize. It remains the district with the greatest levels of poverty, with minimal investment in social welfare from the state.[4]

Until the latter twentieth century, Mayan people mostly settled the southern portion of the Toledo district and not near the coastal savanna, which was not suitable for corn cultivation. The people using these savanna areas for hunting were the (largely Creole) population of Monkey River Town, its tributaries, and the surrounding coast. In the late nineteenth century, a banana-exporting industry developed in this area. After the industry collapsed following the introduction of Panama disease in 1914, the population of Monkey River Town declined (see population data in Table 6.1).[5] A settlement was created at Mango Creek (re-named Independence in the early 1960s) with the establishment of the BEC sawmill in

[2] Thompson (1932); Grant (2005); Bolland (2003), ch. 4; Jones (2005); Shoman (2012), ch. 1
[3] Wilk (1991); Moberg (1997); Wainwright (2008); Grandia (2012).
[4] Wainwright (2008, 2015); Caribbean Investment Bank (2010).
[5] Moberg (1997).

Table 6.1 Population of settlements with particular relevance for the thesis*

Settlement	Year											
	1901(1)	1911(2)	1921(3)	1931(4)	1946(3)	1960(5)	1970(6)	1980(7)	1991(7)	2000(8)	2010(9)	2016(10)
Monkey River Town	333	nd	424	396	421	406	279	190	186	176	196	nd
Mango Creek/ Independence	ne	ne	ne	ne	nd	881	827	1474	1890	2881	3739	nd
Bella Vista	ne	ne	ne	ne	ne	ne	ne	ne	ne	710	3508	6000
San Isidro	ne	ne	ne	ne	ne	ne	ne	ne	ne	ne	375	756
Trio	ne	ne	ne	ne	ne	ne	ne	ne	301	383	899	nd
Bladen	ne	ne	ne	ne	ne	ne	ne	ne	158	391	466	538
Medina Bank	ne	ne	ne	ne	ne	ne	ne	ne	148	93	237	273

nd – No data available
ne – Village not yet established

Data sources**

(1) Belize Census of 1901, [BARS Census-11].
(2) Belize Census of 1911, [BARS Census-12].
(3) Belize Census of 1946, (BARS Census- 16].
(4) Belize Census of 1931, [BARS Census-14].
(5) Belize Census of 1960, [BARS Census-16 and Census-17].
(6) Belize abstract of statistics 1973-4, [BARS AR117].
(7) Belize abstract of statistics 1991, [shared by the Belize Government's Statistics Institute].
(8) Belize Census of 2000, [raw data shared by the Belize Government's Statistics Institute].
(9) Belize Census of 2010, [raw data shared by the Belize Government's Statistics Institute].
(10) Data obtained by personal communications with village leaders in Bella Vista, San Isidro, Bladen and Medina Bank. The figures are estimates or derived from census conducted independently by the village leaders.

* There were people in this area of southern Stann Creek and Toledo before 1901, but population estimates are not available. From 1901 onwards, there are also figures for smaller settlements along the branches of the Monkey River, south along the coast from Monkey River Town, and in the area where Mango Creek was established. There is, however, no consistency in the way in which these were grouped, and so I have not presented those figures here.
** These sources did not follow consistent census methodologies.

1948, and a resin plant in the early 1960s.[6] After the resin plant was closed in 1965 and BEC's operations ended in 1966, the population of Independence declined (see Table 6.1).[7]

From the 1970s, coincident with humanitarian crises in Guatemala, Honduras and El Salvador, new settlers were attracted to the northern Toledo District's savanna areas. They and others from southern Toledo were drawn north by prospects of wage labour following infrastructural development and the establishment of new industries on the southern Coastal Plain. In the 1970s, the banana industry was re-established in the northern Toledo District.[8] As I described in Chapter five, from the 1980s the Government granted large areas of land on the coastal plain for citrus and aquaculture development. The banana, citrus and shrimp industries attracted settlement along the Southern Highway (running north from Punta Gorda through Toledo and Stann Creek), which was paved in the 1990s.[9] These new settlements include those targeted in the Darwin Project: the villages of Medina Bank, Bladen, Trio, Bella Vista and San Isidro. These villages were all established after 1989 (Trio and Bella Vista explicitly to house banana farm workers) and are growing rapidly (see the village locations in map Figure 1.2, and population data in Table 6.1). A handful of people, particularly in Medina Bank and Bladen, are employed in the pine industry, which continued on a small scale after 1966. Until the 1990s, pine licenses were renewed annually, but there has been a move, since the Forest Planning and Management Project in the 1990s, and under pressure from the

[6] 'Report on the annual accounts covering period 1st January 1948 to 30th June 1949', [Uncatalogued BEC Archive, Ladyville, Belize]; 'Hercules Factory starts operations at Big Creek', *The Times*, 7th December 1962.
[7] 'Unforeseen difficulties cause closedown of Hercules', *The Times*, 20th March 1965*;* Forest Department (1967); Moberg (1997).
[8] A buying deal was signed with Fyffes in 1973, and the company still monopolises the export of all bananas from Belize. Moberg (1997).
[9] The Southern Highway was first built in the 1960s. Until the 1990s it remained a dirt road, but was the most significant highway in the Toledo District nevertheless.

IMF, to issue long-term forest licenses.[10] Three forty-year pine concessions covering the Deep River and Swasey-Bladen Forest Reserves were granted in the early 2000s.[11]

Since Belizean independence, there has been a widening wealth gap in Belize. Competing claims to 'native' Belizean identity have been implicated in access to land, employment and resources.[12] These 'myths of ethnicity and nation' are both imposed and invoked strategically.[13] For Wilk, 'the modern [ethnic] categories have resulted from both the imposition of categories by government and educational authorities from above, and the efforts of people themselves to find common interest and assert their rights'.[14] As Shoman explains, colonial ethnic and class relations persisted after independence: 'Belize City and what it had come to represent culturally remained dominant, the centre of decision-making despite the physical move of the government offices to Belmopan. And so the new nation was imagined as Creole: people that spoke English, were anglicised in other cultural ways, and practiced a unique "Belizean way of life", which could be interpreted best by members of the Creole elite'.[15] The Creole upper class (an ever smaller proportion of the population), attempted to maintain its position of privilege by asserting descent from Belize's 'original' population (white settlers and African slaves), representing other Belizean peoples as immigrants.[16] For example, the claim of Belize's Q'eqchi and Mopan Maya to land rights, and to 'native' Belizean identity on the basis of indigeneity to Central America, is frequently undermined by

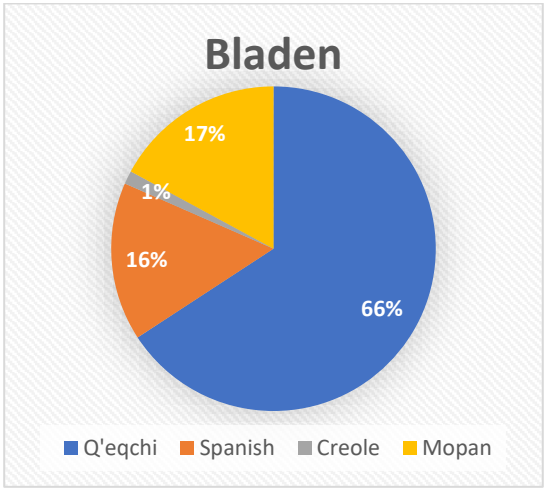
[10] Interview 49; Wainwright (2008).
[11] Interview 2
[12] Moberg (1997); Medina (1998); Shoman (2012), ch. 13.
[13] To use Mark Moberg's (1997) phrase.
[14] Wilk (2006), p. 77.
[15] Shoman (2012), p. 362.
[16] In Belize's 2010 census, 26% of Belize's population identified as Creole. 53% of Belize's population is Spanish-speaking (Statistical Institute of Belize, 2013). Immigration from across Central America has been ongoing for centuries, largely to the the north and west of Belize, and recently to the south.

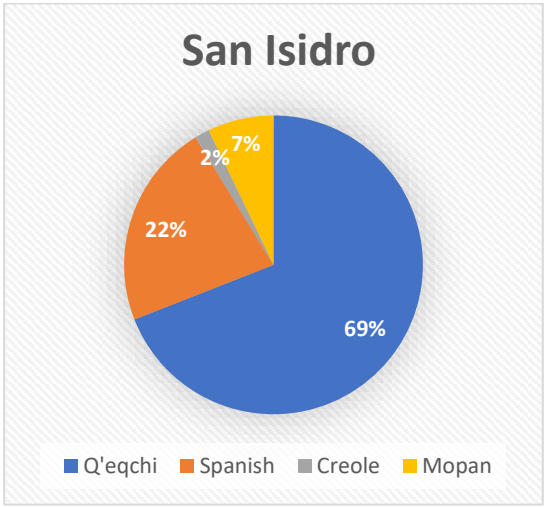
assertions that these linguistic groups did not occupy Belize before European contact, but immigrated from the 1880s.[17] Attitudes towards the Maya from within and outside Belize continue to be shaped by colonial discourses which represented theirs as a bounded and primitive or exotic culture.[18]

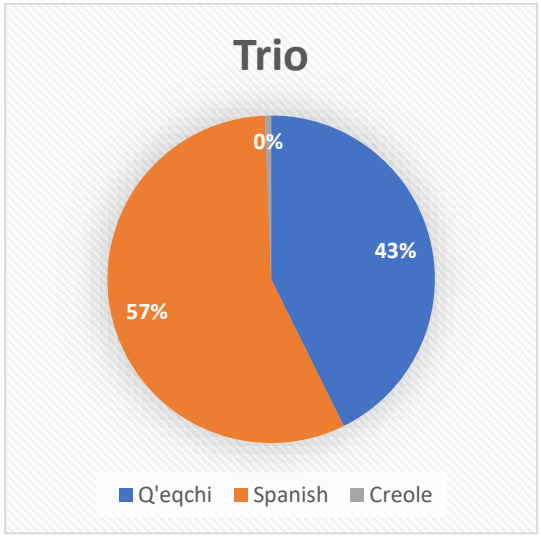
Q'eqchi and Mopan Maya are a minority within the Belizean population (11 percent) but make up 65 percent of the population of the Toledo District.[19] A further 20 percent of Toledo's population is identified as 'Mestizo' (Spanish-speaking); mostly households of immigrants from Guatemala, Honduras and El Salvador since the 1980s.[20] Mayan and Spanish-speaking people make up the majority of people in the villages of Bladen, San Isidro, Trio, Medina Bank and Bella Vista, in and around the coastal savanna in northern Toledo (see demographic statistics in Figure 6.1). A large proportion of households in these villages, both Mayan and Spanish-speaking, are headed by immigrants, who have spent less than twenty years resident there (Figure 6.2 gives statistics for years of residence by heads of household and Figure 6.3 for birthplace). Many people in these villages work as wage labourers on the banana, citrus or shrimp farms, sometimes temporarily before returning to other parts of Central America.[21] This is work most Belizean nationals are unwilling to do: working conditions are among the poorest in Belize, and workers are paid at or

[17] It is often argued against Q'eqchi and Mopan claims to indigenous rights that the Manche Chol Mayas were the linguistic group that inhabited what is now Belize at the time of European contact. Nevertheless, since the 1990s, a Q'eqchi and Mopan Maya land rights movement in Toledo has won court cases against the Belizean Government, at the Belizean Supreme Court, and, in 2015, at the Caribbean Court of Justice. The lands claimed by the Maya have, however, been neither clearly delimited nor explicitly recognised by the Government. The Government appointed a 'Maya Land Rights Commission' in 2016, which is charged to find ways to uphold the CCJ's ruling. The Commission has thus far produced nothing in the way of a resolution, and upholds, in the words of a member of the Commission at a consultation meeting at which I was present in Trio village in 2016, that 'it is still the Government that has the power to deal with the lands in Belize. No one else'.
[18] This is evident, for example, in the way that a stream of development projects has defined and attempted to 'modernise' the 'Mayan farming system', (Wainwright, 2008). Or in the way that Mayan culture is produced and presented for the tourist industry, (Medina, 1998).
[19] Statistical Institute of Belize (2013).
[20] Ibid. Coloured with an anti-immigrant discourse, the term 'Mestizo' is generally applied to all of Belize's Spanish-speaking population, despite their diverse origins.
[21] Moberg (1997).

Figure 6.1 Ethnic identity for households surveyed in Bladen, Trio and San Isidro villages

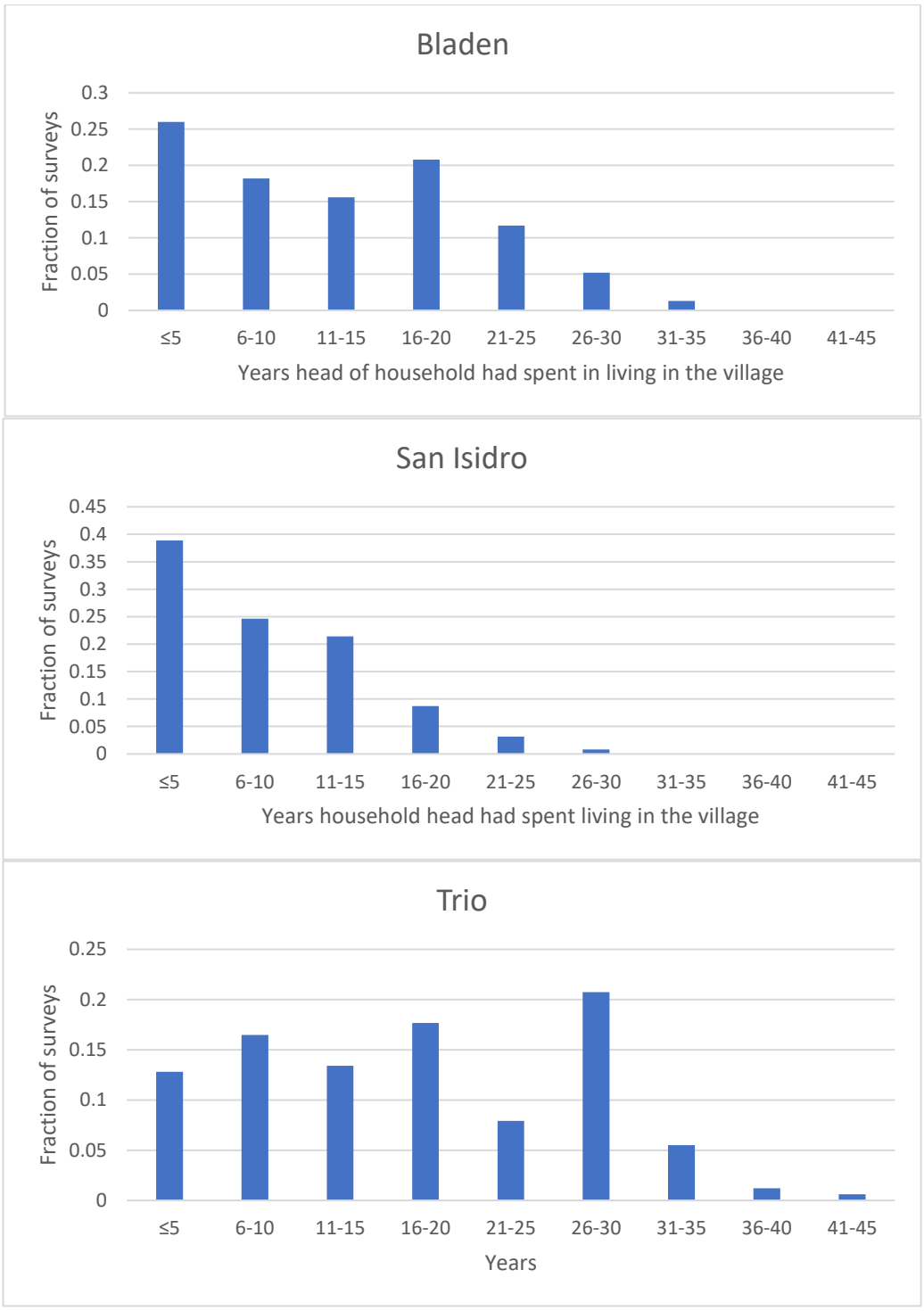






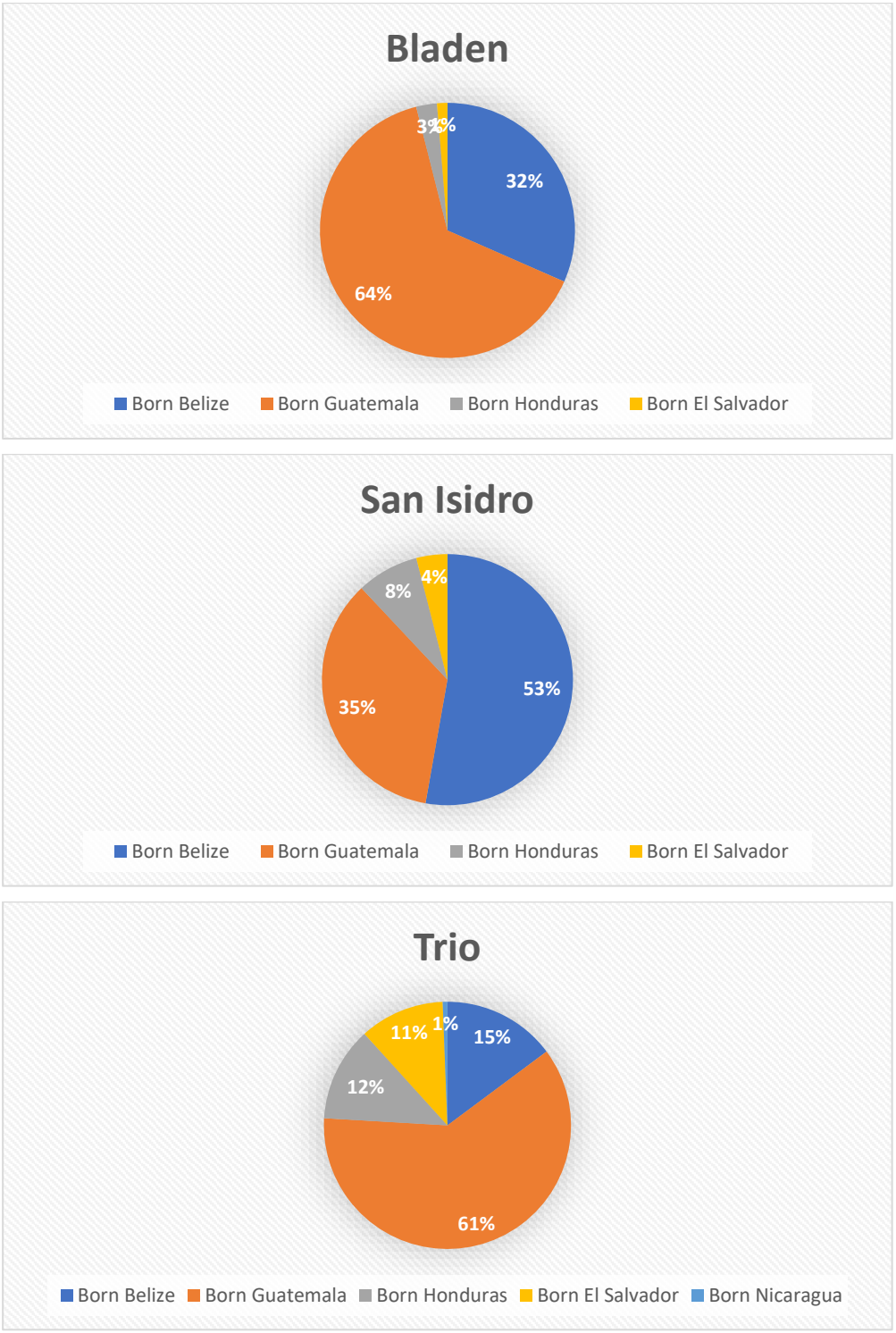
Data source: Survey of 77 households in Bladen (approx. 85% of households), 126 households in San Isidro (approx. 81% of households) and 164 households in Trio (approx. 69% of households).

Figure 6.2 Years spent resident in the village by head of household for households surveyed in Bladen, Trio and San Isidro villages



Data source: Survey of 77 households in Bladen (approx. 85% of households), 126 households in San Isidro (approx. 81% of households) and 164 households in Trio (approx. 69% of households).

Figure 6.3 Country of origin for head of household for households surveyed in Bladen, Trio and San Isidro villages



Data source: Survey of 77 households in Bladen (approx. 85% of households), 126 households in San Isidro (approx. 81% of households) and 164 households in Trio (approx. 69% of households).

below the Belizean minimum wage.[22] For Maya people particularly, wage labour forms part of a diversified livelihood alongside smallholder agriculture and natural resource use.[23]

The social dynamics of ethnicity, class and nationality I have described are important in these villages targeted by the Darwin Project. For Creole, Garifuna and Maya residents of Punta Gorda town, where most of the District's NGOs and Government offices are based, 'just moving to one of those communities would immediately brand you as non-Belizean. That's the type of stigma that is associated with them'.[24] People living in Punta Gorda might not make much distinction between these villages, yet the villagers themselves make competing claims to 'Belizeanness'. Leaders in Medina Bank, San Isidro and Bladen, which have larger numbers of Mayan families that have moved from further south in Toledo, assert that theirs are more 'Belizean' villages relative to Trio or Bella Vista.[25] These three villages impose entry fees on new residents, whereas Trio and Bella Vista do not. As they are considered non-Belizean, many immigrants retain Central American identities; maintaining economic and social networks across the border, hanging national flags in their houses.[26] Ethnicity, nationality and recentness of immigration are reasons for social division within the villages. One Mayan woman of Belizean origin living in Trio felt 'there are too many immigrants and they just walk in free of cost'.[27] Mayan and Spanish-speaking people often segregate themselves within villages, will not commonly work together, and consider their cultures different. In the words of a Trio resident, the Spanish-speaking people want land to grow pineapples, to raise cattle: 'we want development', while Maya villagers 'they just

[22] Moberg (1997).
[23] Wilk (1991); Zarger (2009).
[24] TIDE staff member, pers. comms 15th March 2016.
[25] I base this on various conversations with village leaders.
[26] Moberg (1997).
[27] Pers. comms 16th March 2016.

want to grow corn'.[28] As the following sections show, these dynamics influence resource use and access and attempted interventions in the form of 'community-based' conservation and development.

6.2 Modern human use of resources and fire in Toledo's savannas

Today, different social groups understand the geography of the savanna landscape in the northern Toledo District in different ways. For conservation and development agencies, the most significant lines on the landscape appear to be those colonial Forest Reserve and National Park boundaries that are prominent on maps, but, in reality, these overlap with unmapped agricultural leases, private holdings and mutually understood village land boundaries. Government ministers have de-reserved land to turn it to agricultural development as well as for leases or land grants to smallholders.[29] Often, this is done without consulting the Lands or Forestry Departments so that the reserve boundaries appearing on maps are uncertain (such as in Figure 5.8).

Surrounded as they are by protected areas and, in some cases, the lands of absentee landowners, most people in villages in and around the savannas have insecure tenure over the lands they farm and use. Trio village and its farmlands, for example, exist partially on a large piece of land owned, but unworked by a foreign landowner: 'We are bordered by all these borderlines, so whatever we do looks like a criminal act. But what can we do? We can't sit around doing nothing'.[30] Given this, villagers align themselves strategically with politicians to attempt to secure land access. Assad Shoman writes, 'People align themselves to parties, even militantly support them or run for office, not because they are blind to the corruption and

[28] Spanish-speaking resident of Trio village at a meeting with the Maya Land Rights Commission, 20th August 2016.
[29] Walker & Walker (2009); Interviews 3, 58, 62.
[30] Pers. Comm. 17th March 2016.

uselessness of the parties, but because they know that "in Belize if you don't belong to one of the parties you can't get a job or other assistance". Electors in Belize have learnt to play the game; they make material demands on candidates for political office, haggling their votes in the electoral bazaar'.[31] Village leaders in San Isidro and Bladen both previously secured lands for their community members to farm (in one case inside a forest reserve) via government ministers: 'they worked through politicians'.[32] More recently, these villagers aligned themselves with the Maya land rights movement to secure their claim to these lands. Multiple phases of land leasehold and titling, the overlapping Mayan claim to indigenous land rights, unregistered sales of land titles and leases and poor recordkeeping mean that the status of tenure of much land in the Toledo District is disputed.

Conservation and development actors working in Toledo have generally not engaged directly with these political realities of land use and access.[33] One approach they have taken has been to add their own overlapping layers to the map, convincing the Government to create new legal categories of land within protected areas, such as community concession areas (with rules governing use and access). Another approach has been attempts to create 'alternative livelihoods' for villagers, on the basis that this will reduce their use of protected areas.[34] As long as such interventions do not seriously challenge political control over land and resources, they may be officially endorsed by the Government to appease international funders. This, as I show of elements of the Darwin Project in Section 6.6, does not mean that Government agencies will contribute to realising such policies and interventions.

[31] Assad Shoman (2012), p. 329. In Belize there are, to all extents and purposes only two political parties and these do not clearly represent different political ideologies.
[32] Villager in Medina Bank, pers. comm. 2nd April 2016.
[33] Zisman (1998).
[34] See Wright *et al* (2016).

Today, people living in and around the savanna make use of a variety of its resources, including from reserved areas. This includes hunting (particularly deer and gibnut), collecting housebuilding materials, firewood, palmetto berries (which since 2000 have been sold casually by individuals to a single Belizean buyer based in the Belize District who has a license to export) and capturing yellow-headed parrot chicks for (illegal) sale to the pet trade. With use of fertilisers and drainage improvements, some farmers make use of savanna areas to grow pineapple, watermelon or vegetables, but most assert that corn, plantain and other commonly grown crops cannot be grown on the poor savanna soils. Those making agricultural use of savanna areas are mostly immigrants from heavily deforested parts of Central America where there are extreme shortages of land for farming. For them 'here in Belize it's Mr Freedom. It's here you could do anything what [*sic*] you want'.[35] Despite these casual uses of the savanna and its resources, there is a general perception that the savannas, with their poor soils, are areas of low value relative to the richer broadleaf forests: 'a lot of people see it as wasteland … it's a non-productive area'.[36]

People use fires directly within savanna areas for various purposes. Fire brings fresh grass and ash that attracts grazing deer for hunting. Burning clears dense vegetation and aids access to, for example, fishing areas or palmetto patches, and 'some people say that there are snakes in there, so they have to get rid of the grass so that they could [*sic*] see far'.[37] Shrubs and trees killed by fire can be used for firewood. People travel from villages other than those directly bordering the Deep River and Swasey-Bladen forest reserves to use these areas to hunt and

[35] Interview 5.
[36] Interview 51.
[37] Interview 27.

fish. I was frequently told that people set fires in the savanna 'for fun'.[38] Even TIDE's protected areas manager, Oscar, openly admits that as a youth, he 'used to like to see fires in the savannas, especially in the palmettos'.[39]

Some worry about savanna wildfires, with some justification. Some people fear that heavy smoke that commonly hangs over the savanna areas in the dry season many be a risk to their health. Some palmetto harvesters are conscious that dry season fires destroy palmetto flowers, preventing the formation of berries and reducing their harvest for that year. Those with houses directly bordering the savanna can risk losing their homes to wildfires. On the occasions that this happens (maybe every five to ten years in each village), not only have few households had support from the fire service in Independence, but most also doubt that that service would help as most houses are constructed from wood and many are thatched (Figure 6.4 shows an example): 'if you look at the houses in 20-30 minutes it [*sic*] goes to ashes'.[40] This notwithstanding, fires in savanna areas removed from their villages, while deemed a problem by conservationists or pine concession-holders, are generally not deemed problematic by local people. These villagers have little incentive to care about fires in these areas because they lack clear access rights to the savanna, most do not have crops in the savanna, and most do not directly benefit from the pine industry that uses the savanna lands.

Farmers frequently use fire to clear land for agriculture; a practice learned at a young age from watching and participating in fires with parents or grandparents (statistics regarding farming and fire use are given in Figures 6.5 and 6.6). Many practise 'milpa' agriculture: a cycle repeated between March and October annually,

[38] This came up in many conversations and interviews.
[39] Interview 1.
[40] Interview 12.

Figure 6.4

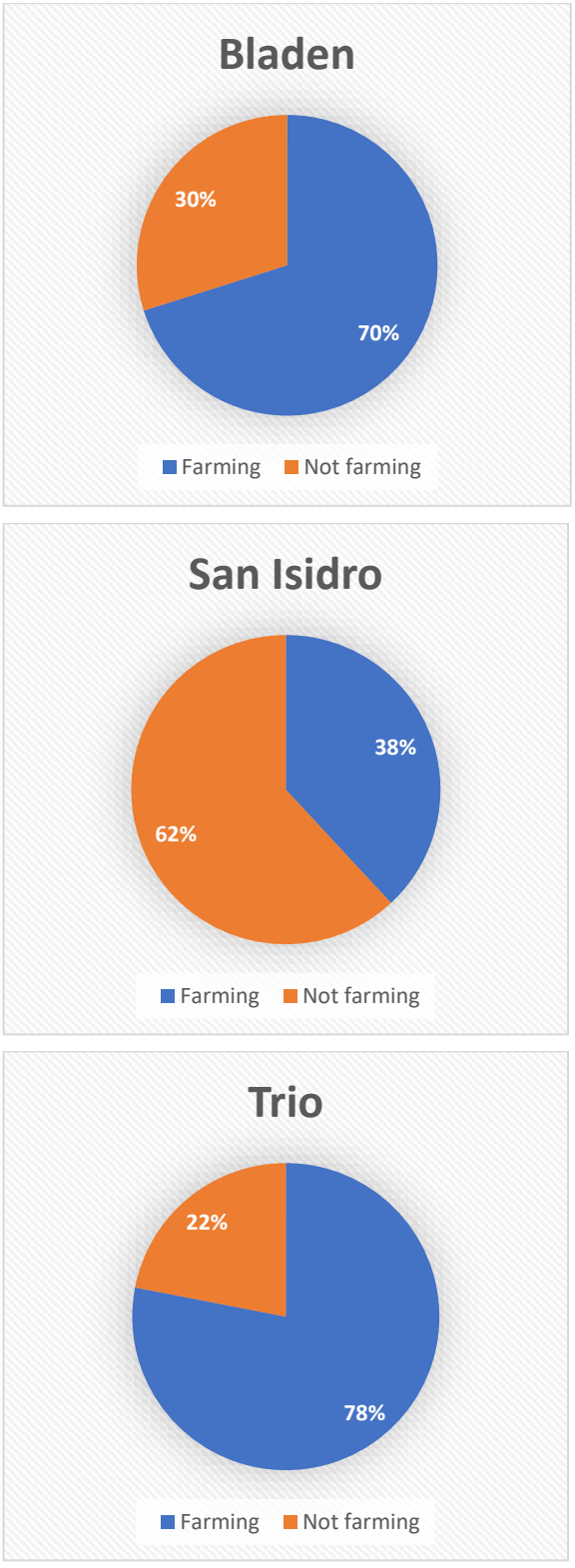
Smoke from a nearby wildfire over thatch houses in the savanna at the edge of Trio village. Source: Author, 2017.

of clearing, burning, planting with corn and beans and fallowing small rainforest plots (sometimes after multiple years of planting).[41] Burning the milpa clears debris and reduces competing vegetation and pests (Figure 6.7 shows a milpa fire). Fire is also used to clear land for longer-term repeated use for growing pineapple or plantain or for cattle pasture. Immigrants have gained their farming experience in diverse places, so farming practices and fire use vary.

Aiming for a hot and 'clean burn', many farmers choose to burn around midday on days of good weather. Such hot burns, when not carefully managed, can escape, and can also destroy milpa soil ecology and reduce soil organic matter. Low temperature carefully-managed milpa fires can, however, contribute to long-term soil fertility.[42] Farmers in Belize have experienced a series of attempts to 'settle' their

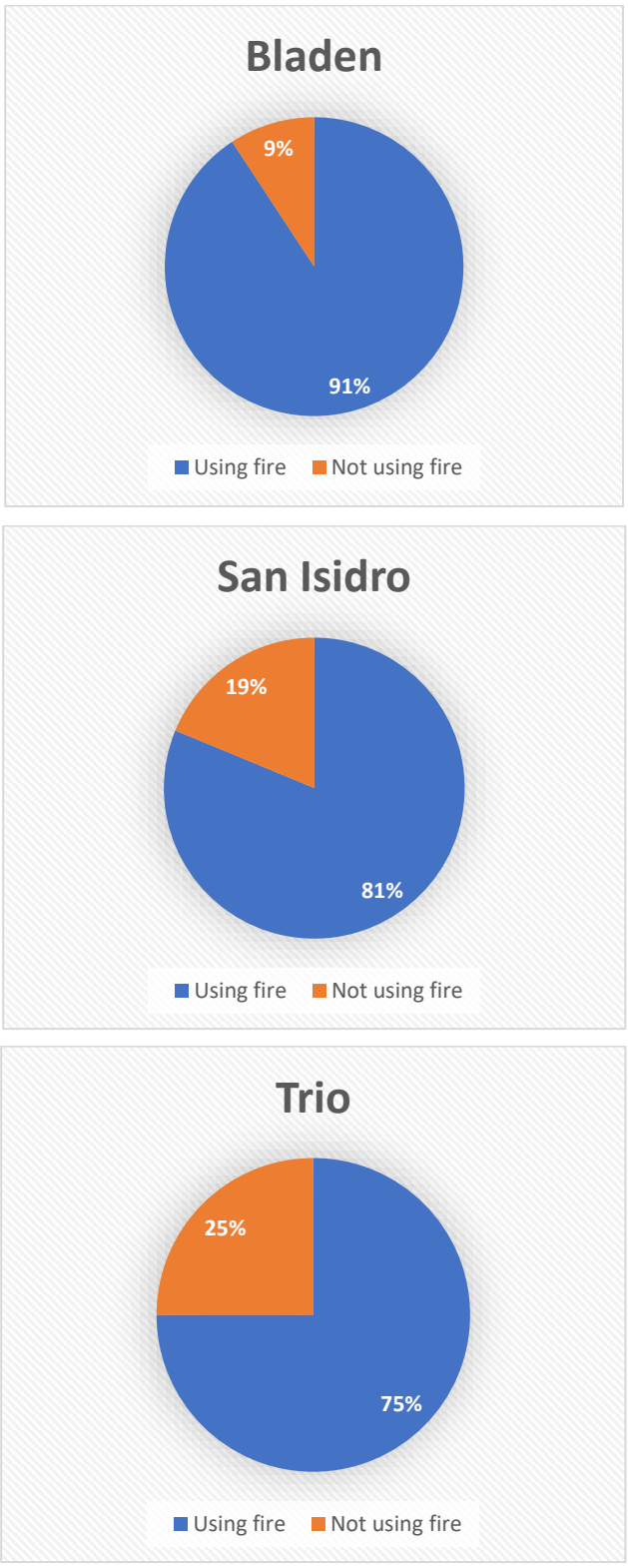
[41] Wilk (1991); Cortez (2009).
[42] Nigh & Diemont (2013).

Figure 6.5 Percentage of households farming for households surveyed in Bladen, Trio and San Isidro villages



Data source: Survey of 77 households in Bladen (approx. 85% of households), 126 households in San Isidro (approx. 81% of households) and 164 households in Trio (approx. 69% of households).

Figure 6.6 Percentage of farming households using fire for any form of agriculture for households surveyed in Bladen, Trio and San Isidro villages



Data source: Survey of 77 households in Bladen (approx. 85% of households), 126 households in San Isidro (approx. 81% of households) and 164 households in Trio (approx. 69% of households).

Figure 6.7

Milpa fire in one of Bladen village's farming areas.
Source: Author, 2017.

shifting farming practices, and to reduce their use of fire. The desire to 'improve' milpa farming originates with colonial discourse positing this as a 'primitive' system, in which 'fire is troped as an elemental, as opposed to a refined, form of power'.[43] Colonial, and later government and NGO-led development projects, have attempted to introduce cover cropping, 'slash and mulch', agroforestry and intensive farming practices, all of which can replace fire use.[44] As a result, many farmers are uncertain of whether using fire is or is not beneficial to milpa soils.

This history of attempts to dissuade agricultural fire use, combined with changes to the social organisation of agriculture that have resulted under immigrant settlement and as farmers combine smallholder agriculture with wage labour, has created conditions not conducive to careful agricultural fire management. For some

[43] Wainwright (2008), p. 82.
[44] Wainwright (2008); Cortez (2009); Interview 58.

immigrants, Belize is the first place in which they have had access to forested land that needs clearing to farm: 'this is my first time seeing a lot of broadleaf forest, and it makes me excited because I haven't seen as much [*sic*] trees like this in Guatemala. Most of the areas, my surrounding areas, is pasture of cows'.[45] Many migrants from further south in Belize remember community-level organisation of agricultural burns, with farmers working in groups to burn and plant together, but this was felt to be less common in recently-established villages near the savanna:

> Not round here but out there to the back, yes, still we have people them [*sic*] do that, them cooperate together and say ''well I going for burn my farm'', "we going burn so much farm". Maybe fifteen men, alright, everybody going. One burning, maybe one 50 acres, everybody protect that and them work together.… Not this time. They just see one li piece a dry bush, pssshhhht set fire, gone. They no care, they no work.[46]

Where farms are close together, some farmers construct fire lines around their land and inform neighbours before burning, but many conduct their burns alone and fires sometimes escape into neighbouring farms. Legally, the Agricultural Fires Act still requires farmers to apply for a permit before burning, but this is not, in practice, expected or upheld by the Agriculture Department.[47] Indeed most farmers I interviewed were unaware of either the Agricultural Fires Act or the Forest Fires Act. As most smallholder agriculture takes place on the fertile soils of the broadleaf rainforest, agricultural fires only occasionally escape to cause savanna wildfires.[48] As villages near the savanna expand, however, and farming increasingly takes place close to and within the savanna, this is likely to be increasingly a cause of savanna wildfires.

An understanding of the social and political dynamics I have described in northern Toledo – local fire use practices; power dynamics based on class, ethnicity and immigrant status; a lack of 'community-level' cohesion; overlapping

[45] Interview 6.
[46] Interview 15.
[47] Interview 52.
[48] Interviews 2, 3 and 57.

understandings of access rights to savanna areas – is not merely context setting for the remainder of this chapter. It is an important inclusion in that it is the 'reality' that local NGOs and internationally-funded conservation and development projects seeking to enrol local villagers in fire management did not engage with. The remainder of this Chapter will examine the disjunct between these projects and the social and political dynamics I have described.

6.3 TIDE, TNC and fire management in the Payne's Creek National Park and Deep River Forest Reserve

As noted in Chapter five, the global discourses of biodiversity conservation and sustainable development were institutionalised in Belize by the 1990s, as a mandate of the Forest Department, and of increasing numbers of grassroots NGOs and local chapters of global NGOs.[49] There was pressure on the Government to designate new protected areas to win green credentials with international funders.[50] In 1991, after lobbying by villagers from Monkey River Town, who hoped to establish local ecotourism enterprises, the Government declared an area of savanna bordering Monkey River Town, the 'Monkey River Special Development Area' (MRSDA).[51] With funding from USAID, a management plan was written for the area by the Belize Centre for Environmental Studies (BCES). In 1994, in the face of potential sale to a US cruise ship developer, the area was extended and renamed Payne's Creek National Park.[52] For conservationists the designation of the Park

[49] Zisman (1998); Young & Horwich (2007).
[50] Zisman (1998); Interview 68.
[51] The SDA designation was derived from an 'afterthought' in the Land Utilisation Act, which stated that a Minister could declare an area an SDA and stipulate the types of development that may take place within it (McGill, 1994). Though other SDAs were declared in the 1990s, and ODA's 'Forest Planning and Management Project' (FPMP) and USAID's 'Natural Resources Management and Protection Project' (NARMAP) both tried to mainstream SDAs as a means to enable community protected areas management, none of the SDAs survived under this designation.
[52] The ODA's FPMP played a role in securing the National Park designation. Meerman (1995); Zisman (1996).

served several purposes. The Park bordered Port Honduras, an area of marine conservation interest, which was threatened by the potential for cruise tourism, and for coastal aquaculture development. There was also particular interest in mangrove conservation and in protecting a 'corridor' from the Maya Mountains to the sea. In the designation of Payne's Creek as a protected area, neither conservation of savanna biodiversity per se, nor wildfire management, were priorities.[53]

By the mid-1990s, there was no management of the National Park and community organisations formed for this purpose were inactive.[54] Community management did not have sufficient governmental support: 'that was not something that the politicians were too comfortable with. Because they wanted to be the ones to control all of this. And so, to have a group of stakeholders, kind of taking the lead and planning, developmental planning, I think they probably felt that their authority was being undermined'.[55] In 1997, the Government handed the management of the park to recently-established local NGO, the Toledo Institute for Development and Environment (TIDE), based in the town of Punta Gorda. In 2004, the reserve was extended to its present boundaries and included an area excised from the southern Deep River Forest Reserve (Figure 5.8 shows the present protected area boundaries). TIDE signed a formal co-management agreement for the Reserve with the Government.[56]

In the decades since it was established, TIDE has, in addition to management of the Payne's Creek National Park, developed various programmes of work, including management of a network of private protected areas and the Port Honduras Marine Reserve and community education and outreach. Though all of TIDE's protected areas management staff, its Director, and most office staff are

[53] Interview 68.
[54] Zisman (1996).
[55] Interview 3.
[56] Mcloughlin (2015).

Belizean, the NGO is sustained by short-term international conservation and development funding opportunities, and it usually employs several foreign office staff as well as a stream of six-month unpaid interns from Europe and the USA. The organisation's scientific direction and reporting has largely come from foreign staff, interns and other foreign consultants.[57] Generally, TIDE has found it easier to access funding and built a reputation for its work in marine protected areas management and research diving, than for terrestrial management. For TIDE, as 'an organisation that looks towards the sea', the Payne's Creek National Park is something of 'an afterthought'.[58]

As I discussed in Chapter five, in the early 2000s, The Nature Conservancy (TNC) changed Belizean government policies towards fire when it brought its approach of 'integrated fire management' to Belize with workshops and training funded under its 'Global Fire Initiative' (GFI). In the USA, TNC has been a pioneer in prescribed fire management for the integrated purposes of nature conservation and timber-production since the 1960s, when it acquired frequently burning landscapes in the Upper Midwest and in Florida (famous for its culture of fire use).[59] 'The Conservancy was unique: it was a private landowner with a public purpose. It showed private landowners why they needed to burn and demonstrated how to burn with care and sensitivity to ecological goods and services. And it showed public agencies how nimbleness and skill could make up for hordes of personnel and big-number budgets'.[60] In the late 1980s, TNC made Ron Myers its national director for fire management in the USA. Myers' extensive experience working with fire combined employment with US federal fire suppression agencies and ecological

[57] Interview 59 and pers. comm. TIDE's Science Director.
[58] Interview 59. Also Interview 67.
[59] Interviews 55 and 60.
[60] Pyne (2015), p. 215.

research in Central America and the Caribbean, where he had encountered diverse rural cultures of burning. He established TNC's approach of 'integrated fire management' and pushed for the extension of their fire work outside the US with the GFI.[61]

Myers' pamphlet *Living with Fire* summarised his guiding philosophy for fire management under the GFI. It is, to Stephen Pyne, 'the clearest expression of modern thinking about fire in the literature'.[62] In keeping with the trend among some environmental managers to assimilate insights from non-equilibrium ecology, Myers held that many ecosystems worldwide are fire-dependent. He asserted:

> More sophisticated fire management technologies are not likely to solve the problem of destructive wildfires, nor are they going to be effective in re-establishing ecologically appropriate fire regimes in places that need to burn. There is a need to integrate socio-cultural realities and ecological imperatives with technological approaches to managing fires.… integral is the recognition that in many societies, burning is an essential tool for people in securing their livelihoods. Understanding the ecology of fire in a particular landscape informs assessments as to whether people are burning too much, too little or inappropriately to meet both conservation goals and to maintain the ecosystems on which they depend. Identifying and understanding society's needs as well as the ecological constraints of an area will lead to the design and application of more effective fire management programs.[63]

With the GFI, he aimed to empower small networks of fire managers worldwide, 'to which outsiders might offer guidance but would not administer', with basic training in prescribed fire management to suit their local conditions.[64] This philosophy fitted within the wider Western discourse of 'participatory' conservation and development.

Myers' connections and specialism in Caribbean and Central American ecology meant that this region received special attention. TNC already had a small local section in Belize, and when the GFI was launched, there was an in-country request for assistance.[65] Under the GFI, Belize hosted regional fire management

[61] Pyne (2016b).
[62] Pyne (2015), p. 401, on Myers (2006).
[63] Myers (2006), p. i.-ii.
[64] Pyne (2016b, p. 116.
[65] Interviews 55 and 59.

workshops and training events, attended by Government Agencies, NGOs, including TIDE, and private interests, such as pine logging concession holders. As we have seen, Myers' texts laid the framework for a new Belizean Wildland Fire Policy and Strategy.[66] Unfortunately, in 2009, TNC ended the GFI, because of the global financial crisis and with a new leadership, which was less encouraging of small-scale projects and fearful of the liability associated with fire work. Myers was made redundant and staff were told '"no more Belize trips … it's done"'.[67]

After the GFI ended, most Belizean agencies that had been trained by TNC did not retain the capacity for prescribed burning programmes. TIDE was an exception.[68] Before attending TNC's workshops, TIDE's rangers were aware of fires as a possible management issue in Payne's Creek, but did not conduct fire management.[69] The Environmental Impact Assessment written for the area in 1995 suggested that treeless areas were expanding and that it was important 'this process of "savannization"' be reversed', which could only be achieved 'by an active policy of fire-prevention'.[70] TNC's approach departed from this perspective but resonated strongly with TIDE's protected areas manager, Oscar.[71] Importantly, Oscar developed strong working relationships with several TNC staff, and continued, even after the closure of the GFI, to seek their assistance (independently of TNC) to train his team further, including on exchange visits to the US. By 2014, many of TIDE's rangers had been trained to 'burn boss' level in prescribed fire

[66] Sabido & Green, 2009.
[67] Interview 55, also interviews 59 and 60.
[68] It should be noted that one other NGO, Programme for Belize (PFB), which manages areas of savanna in the Rio Bravo protected area in northern Belize, has also conducted some prescribed burning since 2009. Like TIDE, PFB staff received further assistance from former TNC staff in this period. TIDE's staff have re-trained staff from PFB in prescribed fire management. PFB has, however, struggled to maintain a continuous programme of prescribed fire management like that of TIDE.
[69] Interview 1.
[70] Meerman (1995), p. 32.
[71] Interview 1.

management, making them capable of planning and leading prescribed burns and training others to do so.[72]

On the southern coastal plain, TNC fire experts had to adapt more technical approaches from the USA for the Belizean context: 'Initially we didn't have tools, we had to make our own tools. We used palmetto fronds for beaters and lit with palmetto and lighter pine'.[73] Soon TIDE found funding for fire management equipment, and today its rangers use purpose-made clothing, drip torches, rakes, fire-swatters, water tanks and bladder bags when they conduct prescribed burning (Figures 6.8 and 6.9 show some of this equipment in use). The infrastructure and means of communication available to TIDE for fire management are far less sophisticated than what is used in the USA. They improve, however, on what was available to the Forest Department when it managed fire on the southern coastal plain. The paved Southern Highway enables quicker access to some of the savanna and there is signal for mobile telephone communication across the area.

TNC emphasised networking between land managers, and Oscar, inspired by Florida's 'Fire Councils', joined together with several other land managers in southern Belize (the pine concession holder for Deep River Forest Reserve and the Ya'axche Conservation Trust), to form a 'Southern Belize Fire Working Group'.[74] In 2009, together with TNC staff, this group wrote an integrated fire management plan for the savanna landscape in Toledo. The plan suggested, 'based on history, anecdotal evidence, and technical input from local and international expertise', that, 'with rapidly increased human activity on the southern coastal plain' in recent decades, the present fire return interval was between six and twelve months, but

[72] 'Burn boss' is a term used in US fire management to denote somebody capable of leading a prescribed fire or attack on wildfire. The term is a vestige from the slave days when many firefighters were conscripted from agricultural work crews or prisons where leaders of any kind were called 'boss' (Rick Anderson, pers. comms. 05/10/2018).
[73] Interview 60.
[74] Interview 1.

Figure 6.8

A TIDE ranger demonstrates how to use a drip-torch and bladder bags during fire management training under the Darwin Project.

Figure 6.9

A prescribed burning team holding the fire line, with bladder-bags, rakes and fire-swatters. Source: Author (2016).

that a more ecologically appropriate fire return interval would be three to five years.[75] This became TIDE's rule of thumb for how frequently to apply prescribed fire in each 'management unit' of Payne's Creek and the neighbouring Deep River Forest Reserve (where they work with the long-term pine concession holder to conduct prescribed burns).[76]

As an organisation reliant on short-term grant funding, TIDE has struggled to find a consistent funding source for its fire management.[77] Thus, in 2014, TIDE's development director, one of the British staff members at the organisation, began to devise a project aimed at finding market mechanisms to finance fire management. He considered carbon markets, sustainable logging and community participation as possible approaches to pitch to a potential funder he had identified- the UK DEFRA/DFID co-funded Darwin Initiative. Darwin generally required a British partner organisation, and TIDE contacted a University of Edinburgh staff member who had previously led ecological research in Toledo's savannas. Together, they successfully won a Darwin grant for a three-year project for the Payne's Creek National Park and neighbouring forest reserves and villages, envisaging the outcome that 'biodiversity of pine woodlands in southern Belize is conserved by developing community-based wildfire management, with local communities incentivised to participate through a more just and sustainable use of woodland resources'.[78] The project proposed to combine ecological monitoring for fire effects in the protected areas, training in prescribed fire use for villagers, 'small forest enterprise' development with groups of villagers, and partnership with the Forest and Agriculture Departments to revise national fire legislation and pilot a community concession agreement for the harvest of palmetto berries from the protected areas. The remainder of this chapter

[75] TIDE, (2009), p. 13 and p. 17.
[76] Interview 1.
[77] Interview 67.
[78] Project proposal for Darwin Initiative 22-013.

examines TIDE's work, the GFI and the Darwin Project to examine how 'integrated fire management' in Belize is shaped in practice, by the structure of international development funding and Belizean ecology and political relations.

6.4 Integrated fire management as a 'win-win'?

The approach to fire management envisioned in Belize's national fire policy, TIDE's management plan for Payne's Creek National Park, and in the proposal for the Darwin Project departs, on paper, from colonial forestry's singular capitalist imperative to optimise pine growth for extraction. It suggests that 'integrated' fire management can fulfil multiple objectives including ecosystem or biodiversity conservation, pine regeneration for extractive use, securing property, securing human health, and benefitting local 'communities' including in the recognition of cultures and livelihoods dependent upon fire. In Table 6.2, I summarise how I understand these objectives to differ in terms of desired savanna ecosystem states, types of fire deemed 'good' and 'bad', accepted human fire users and beneficiaries of 'good' fire management. Here I explore the implications of these differences. I contend that there are logical and practical incompatibilities between prescribed fire management and these multiple objectives in the Belizean context. In Section 6.6, I explore how certain incompatibilities between objectives emerge specifically when integrated fire management is attempted within the context of pre-designed international development projects.

TIDE does not presently extract pine from the Payne's Creek National Park (and is not permitted to do so under the current management agreement), but it is still presumed, perhaps as a vestige from colonial forestry, that a primary outcome of 'good' savanna fire management should be 'pine regeneration'.[79] Based on his

[79] Interviews 1, 59, 64.

Table 6.2 Competing objectives within 'integrated' fire management

Objective	Pine forestry	Traditional ecosystem or wildlife conservation	Conservation informed by disequilibrium ecology	Maintaining local culture and livelihoods	Human health and security
Target state for savanna	Maximised pine growth	Maintenance of historic or 'natural' ecosystem state or target species population (e.g. yellow-headed parrot).	Maintenance of shifting savanna landscape	Burnt areas that attract deer for hunting and facilitate access	No fire near villages or crops
'Bad' fire type to be mitigated against	Frequent and intense fires	Frequent and intense fires that reduce particular habitats or populations	No fire or homogeneous fires (temporally, spatially, intensity).	Prevention of all human fire use	Any fire reaching homes or crops. Smoke from distant fires.
'Good' fire type sought	Low-intensity, infrequent fire	Low-intensity infrequent fire	Random fire effects, historically caused by human fire use for hunting, access etc.	Fires used for purposes of hunting, facilitating access or clearing land for farming	No fires close to homes or crops.
Human fire users allowed access rights to savanna areas	Trained prescribed fire managers	Trained prescribed fire managers	Trained prescribed fire managers but also rural fire users (at low frequency).	Local rural fire users	Trained prescribed fire users (including community members).
Beneficiaries of 'good' fire management	Logging concession holders, waged employees and Belize Forest Department	Conservation target populations and habitat, conservationists	Savanna as an ecosystem, conservationists	Local fire users	Local population

involvement with writing Belize's National Protected Areas System Plan, one ecologist surmised that this reflects a lack of understanding of the savanna as an ecosystem: 'For savanna, our conservation target always focused on pine production. While for the other areas, there was "wildlife this", and there was "this animal that" … I found it very interesting. We don't know enough about savanna to

value it for its own intrinsic value. No, it's a pine resource'.[80] TIDE's institutional objectives of ecosystem and biodiversity conservation are reduced in fire management plans for Payne's Creek to management for two 'keystone species': the Caribbean pine and the yellow-headed parrot.[81] TIDE's staff believe that pine regeneration will be good for yellow-headed parrot populations as well as general ecosystem health and biodiversity.[82] There is, however, no empirical evidence to support this relationship. Indeed, non-equilibrium theories in ecology would suggest that a more biodiverse savanna might include areas of low pine density within a mosaic landscape. Belize's new Forest Policy suggests a potential revision of the present legislation to permit the extraction of pine from Nature Reserves.[83] If TIDE begins forestry in Payne's Creek, the organisation will need to do so with an awareness that this may trade-off with conservation objectives. The same ecologist told me: 'I honestly believe that forestry and yellow-headed parrots are not compatible.… I think you have to set those goals first and be honest about it. Do we want to set aside certain areas aside to be managed for parrots, do we want to set areas aside to be managed for pine?'[84]

Both forestry and a 'traditional' conservationist mentality seek a certain target state for an ecosystem or species, be that aiming to maximise timber growth or to return to a more 'natural' or historic state. Being influenced by equilibrium ecology, both generally seek a *static* target. As we have seen, TIDE has similar management targets for Payne's Creek. This position is not easily reconciled with non-equilibrium ecology in which ecosystems are understood to be inherently in flux.[85] If, instead,

[80] Interview 62. See Driscoll *et al* (2010) discussion of the limited capacity of current empirical scientific research generally to answer key questions required to inform fire management for biodiversity conservation.
[81] Mcloughlin (2015).
[82] Interviews 1, 64.
[83] Forest Department (2015). A report was created under the Darwin Project to assess potential locations for sustainable extraction within Payne's Creek (Anderson & Tricone, 2018).
[84] Interview 62.
[85] Zimmerer (2000); Adams (2003).

conservation of the savanna is informed by non-equilibrium ecology and understood as a shifting patchwork of different vegetation types maintained by fire, then a more appropriate aim for management might be to restore a more 'natural' fire disturbance process. This might involve aiming to create a highly irregular pattern of fire on the landscape. TIDE's management plans target a fire return-interval of three to five years, and in 2017, former TNC employee, Felix, noted that he worried they might be sticking too rigidly to this rule: 'They burned a good part of a four-year fuel accumulation this year'. He felt that TIDE should instead aim for more of 'a mix of fire regimes, and timing and seasonality'.[86] Yet the approach of prescribed burning requires careful planning and is conducted within particular 'burn units' from which fires will not escape. There are limits to the randomness with which prescribed burning can be conducted in pursuit of a highly irregular fire regime.[87]

As noted above, prescribed fire may benefit local communities in that it brings security in terms of protection of property and health and in preventing the loss of palmetto berries. Yet, for two reasons, these are generally insufficient incentives to encourage local participation in fire management. Firstly, this is because fire management is beneficial only in that it offsets possible future losses, and not in that it brings direct gains.[88] Moreover, a few individuals bear the costs of fire management, in terms of time and effort, but the benefit is to all. There is thus little direct incentive for individuals to volunteer to participate in fire management. Aware that it would be difficult to encourage attendance otherwise, we paid stipends to villagers for participation in fire management training under the Darwin Project. We also suggested the potential to establish community fire brigades to villagers in

[86] Interview 59.
[87] See Parr & Brockett (1999) and Parr & Andersen (2006) for discussion of the incompatibilities between the practice of prescribed fire management and non-equilibrium ecology.
[88] Interview 59.

project meetings. It was soon clear, however, that in the long-term, the likelihood of villagers volunteering their time to a community fire brigade was unlikely: 'no-one wants to do things for free'. [89]

Although TIDE's Executive Director contends that 'the main goal' of fire management in Payne's Creek is 'to maintain the ecosystem for the benefit of communities', legislation, reserve boundaries and long-term logging concessions limit community access to savanna land, its pine resources and game for hunting.[90] Local participation might be more likely if villagers had clear access rights and the means to use these resources.[91] As Oscar told me, for local villagers: 'If there's something for them in it, I'm sure they'll be willing to participate, and get involved. But for that to happen you need some decentralisation at the government level, giving the powers into local government in these communities'.[92] If local villagers were truly to benefit from the savanna, this would involve recognition of the inequitable distribution of land and resources in the Toledo District. It would challenge reserve boundaries and logging concessions. Yet as we have seen, the system of patronage in Belize means that political elites are unlikely to relinquish their control over land and the issuance of forest licenses. Similar dynamics of political control have also limited the realisation of community-based natural resources management policies in other countries.[93] Further, some forms of community access, and the recognition of some local fire use in savannas, such as for hunting, are not compatible with the forestry and conservation objectives of local land managers.[94] One TNC staff member's recollection encapsulates the perspective that Toledo's land managers have of local fire users: 'I didn't know how

[89] Interview 9.
[90] Interview 64, also interview 2.
[91] As Kull (2002) writes of community-based fire management in Madagascar.
[92] Interview 1.
[93] See for example Ribot, Lund & Treue (2010); Lund (2015).
[94] Interviews 1 and 2.

to help at first, when I went down there, because the main problem was that the land managers didn't have control of the fire frequency or the fire regime. And so, how do you get that back? How do you get it away from the hunters, and the people who are burning the woods?'[95]

It was primarily from this perspective that local participation was envisaged in the Darwin Project. The channels for local participation in the project were aimed at reducing forms of local fire use deemed inappropriate by the managers of protected areas in the savanna. The project sought to enrol and train locals to conduct 'proper' prescribed fire use, involving planning, teamwork and use of equipment. This training was conducted in the context of management for pine forestry in the Deep River Forest Reserve. We emphasised the transferability of the training to the context of a milpa burn, but not to use of fire for hunting. By the project's logic, support to develop small businesses dependent upon savanna resources would incentivise communities to become 'stewards' of the savanna, reducing their inappropriate use of fire and possibly volunteering to participate in future fire management with local land managers. This was an 'alternative livelihoods' approach, seeking to reduce the prevalence of activities deemed to be environmentally damaging by substituting them with lower impact livelihood activities.[96] As I show in Section 6.6, we struggled to find and support business concepts that were both legal uses of Forest Reserves and dependent upon savanna resources (and thus linked clearly to fire management to protect those resources).

While recent policies and project proposals in Belize suggest that integrated fire management can benefit wildlife, ecosystems and various local agencies and local people, the reality is that these multiple objectives may trade off against each

[95] Interview 60.
[96] Wright *et al* (2016).

other. By posing fire management as a 'win-win', these texts do not account for the ecological dynamics of the savanna and the political dynamics in Belize. I argue below (Section 6.6), that these policies and projects *cannot* engage comprehensively with these Belizean realities, because they are constrained within the context of international conservation and development. First, in Section 6.5, I look at TIDE's work to explore the extent to which foreign technical expertise plays a role in NGO-led 'integrated' fire management in Belize.

6.5 Expertise and authority in integrated fire management

As we have seen was the case with the Forest Department after the 1960s, most of TIDE's staff, including all protected areas management staff, have been Belizean. Many of TIDE's rangers are from villages close to the savannas and Payne's Creek, including the villages targeted in the Darwin Project (indeed three rangers were recruited because they proved themselves as keen participants in the Darwin Project activities). Unlike in the case of the Forest Department, where appointments based on political allegiance bring rapid staff turnovers, TIDE's core protected areas management staff have longer tenure with the organisation. Oscar has worked for TIDE since the 1990s. This has allowed the organisation to retain skill in prescribed fire management gained through training and experience. Nevertheless, as has the Forest Department, TIDE has relied upon external expertise to provide training and assistance with planning fire management. For example, Felix, a former TNC GFI staff member, has remained a friend and advisor to Oscar, and was employed as a consultant to design and deliver fire management training and fire effects monitoring under the Darwin Project.

Let me explore the implications of this in terms of the forms of expertise that inform TIDE's fire management. As with the Belize Forest Department, the expertise

and training provided by external consultants to TIDE has largely been technical. Similarly, this has been expertise in fire management methods (how to plan prescribed burns and use specialist equipment) and in general ecological principles, as codified by organisations such as TNC: what Fleischmann and Briske term 'professional ecological knowledge'.[97] TIDE's consultants thus have expertise largely based upon experience and theory developed outside Belize. As one of TNC's staff recalled, 'I don't think we relied on any scientific research or actual fire monitoring in savannas, but there was other scientific work that showed the influence and the importance of fire in tropical savannas. Maybe not specifically in Belize, but in very similar habitats in other places…. I don't think that [Myers] relied on his or other scientists work in Belize, to develop the philosophies that directed us to do the education and work that we did'.[98] Though TNC's staff made efforts to adapt some of their techniques to the Belizean context, in Section 6.6 I show some of the practical limitations of TIDE's use of fire management techniques largely developed in the USA.

This generalised technical expertise is in dialogue with other forms of expertise informing TIDE's fire management. TIDE's rangers have a tacit local knowledge of the geography of the savannas they manage, and of fire's behaviour within this ecosystem. Being local to the area, they also understand local social relations, politics and fire use well: Oscar, himself, set fires for hunting as a young man.[99] After Collins and Evans, we can consider this local knowledge as a form of expertise guiding TIDE's work, even if it is not generally regarded as such.[100]

[97] Fleischmann & Briske (2016).
[98] Interview 60.
[99] Interview 1.
[100] Collins & Evans (2008).

There are also recent attempts to guide TIDE's management using scientific expertise, gained by empirical measurement of fires and their effects in the Belizean savanna. Some research has used satellite imagery to link different management regimes to fire frequency.[101] There have also been attempts to introduce long-term fire effects monitoring for adaptive fire management. In 2016, TIDE established long-term monitoring plots in Payne's Creek, designed by Felix and with funding from the Darwin Project. Let me briefly recount how these efforts, like earlier collection and preservation of data about the Belizean environment have been largely driven by foreign scientists.[102]

Between 2016 and 2018, I joined and observed Felix and French ecologist Chloe, as they established the long-term vegetation monitoring plots in Payne's Creek, collected data biannually, analysed the data and produced a report of fire management implications for the savanna. They worked painstakingly with Oscar, his rangers and a handful of local community members, allowing them to collect the data, despite errors that this introduced (which necessitated repetition of the data collection). The data was shared with TIDE's office staff, but Felix and Chloe also quickly copied it onto their own hard drives. Both had had past struggles trying to obtain or recover data from TIDE's staff and server. As TIDE's former Science Director (one of the organisations two non-Belizean staff, whose work was in marine research and who therefore did not manage or use the terrestrial data) told me, the server is not backed up, which has multiple times, during tropical storms, resulted in the loss of years' worth of data records. Felix and Chloe were aware that scientific reports they wrote as Darwin Project outputs were unlikely to speak directly to Oscar and his rangers. Instead, as I demonstrate in Section 6.7, their scientific findings

[101] Michelakis *et al* (2016); Roper (2016).
[102] Note that this is changing, with the work of Belize's Environmental Research Institute (ERI), established at the University of Belize in 2010. The ERI is curating a digital archive of historical data and reports about the Belizean environment, available at http://eprints.uberibz.org/.

were communicated successfully to Oscar because of his strong personal relationship with Felix. TIDE's rangers could, theoretically, continue to independently collect data on these monitoring plots: the process is time and cost efficient. Yet there is no Belizean ecologist specialising in fire ecology and no staff member at TIDE capable of statistical analysis of the data.

The history covered in chapters four and five tells us that science, in the sense of empirical data collection about the environment, has rarely informed Belizean savanna management in practice. When scientific research has been conducted, Belizeans have not been those with the 'vision' driving data collection. It remains difficult to bridge scientific expertise with the local expertise of land managers like Oscar. Yet, drawing more on these forms of expertise might make TIDE's fire management more responsive to local conditions. As Fleischmann and Briske point out, both scientific and local knowledge possess stronger feedbacks with real social and ecological conditions than does professional ecological knowledge.[103] Let me explore the social context in which professional ecological knowledge comes to be the primary form of expertise to direct TIDE's fire management.

Professional ecological and scientific knowledge retains authority in the context of international development. This is despite the rhetoric for local empowerment and cultural recognition within 'integrated fire management'. For example, in the proposal for the Darwin Project, the success of the project was deemed to rest upon the assumption that 'personnel with *required expertise* for biodiversity / resource monitoring, and design / provision of training courses remain committed to the project'.[104] The funder demanded monitoring and evaluation of the project's impact and outcomes, giving authority to evidence in quantifiable formats.

[103] Fleischmann & Briske (2016)
[104] Proposal for Darwin Initiative Project 22-013 (December, 2014), p. 23. Emphasis added.

For example, in a mid-term review by the funder, it was noted (in negative terms) that the project could only present Oscar's word, and not *data* to demonstrate that fire use and wildfire incidence had reduced as a result of project activities. Oscar and his rangers have an internalised local knowledge of the history of fires in the areas they manage (which informs their management work), but their word alone did not count with the project funders.

Let me consider the implications of this valorisation of technical expertise and quantifiable evidence for 'participatory' fire management. It has been noted that participatory forestry, in the tradition of forestry, continues to promote technical expertise and 'professional' practices, which, paradoxically, inhibits local participation.[105] I argue that this applies to participatory fire management in the Darwin Project, where 'participation' consisted of attending training delivered by technical experts. In a context where foreign experts deliver training and access to benefits within international development projects, Belizeans who have developed expertise in communicating with 'outsiders' have a relative power in their villages. One such individual was my host in Bladen, discussed in Chapter three (Section 3.2). In 2016, under the Darwin Project, a 'basic-level training' was given to fifteen villagers from each of Bladen, San Isidro, Trio, Bella Vista and Medina Bank. In 2017, a week-long 'burn boss' training was given to five of these villagers, chosen by Oscar. These five individuals had grasped the principles of the training quickly and communicated easily with Oscar and Felix who led the training. Each of these individuals already held positions of leadership in their villages. Each spoke good English and had prior experience working with external agencies. Frederico, for example, had worked for several years as an assistant to biologists from the USA doing research in a nearby protected area. Frederico could quickly develop technical

[105] Nightingale (2005) Green & Lund (2015); Lund (2015); Scheba & Mustalahti (2015).

expertise in prescribed fire management because he had developed a tacit ability to communicate with outside experts. Integrated fire management in the context of the Darwin Project thus involved the participation of certain powerful individuals in each village, rather than the 'communities' in general. These individuals benefitted from their participation because they received stipends for attending training events, and because three of them, with the training they had received and social connections they had forged, went on to gain employment as rangers with TIDE. Similar patterns of elite capture have been commonly identified in critiques of 'participatory' conservation and development.[106]

While professional ecological and scientific expertise commands authority in the context of international development, it holds less authority within Belize's social context, as also noted in previous chapters. Instead, class and ethnicity are of more importance in granting authority to certain voices in Belize. For example, in Toledo's rural villages most people cannot afford to run a car. So, when we, as the Darwin Project staff arrived in the villages for meetings and training events in TIDE's air-conditioned trucks, it was with connotations of elite status and authority. When Felix and Oscar gave fire management training in these Spanish-speaking and Mayan villages, they commanded authority, in part, by virtue of being white and Creole (respectively), rather than through local evaluation of their technical or scientific expertise in fire management. Similarly, when it comes to the management of land and resources in Belize, as we saw in Chapter five, and as I explore further in the following section, policies designed by scientific experts take less precedence than do the priorities of political elites.

[106] Agrawal & Gibson (1999); Mosse (2001); Berkes (2004); Nightingale (2005); Dressler *et al* (2010); Green & Lund (2015); van Kerkhoff & Lebel (2015).

6.6 Integrated fire management in the context of international development

Some of the dynamics identified in the previous sections derive specifically from the context of international conservation and development. This section explores the structural limitations that international funding places upon the fire management practised by TIDE. We have seen how international development projects in Belize often favour methods and general principles that have been designed outside Belize. As throughout the history of the Belize Forest Department, the fire management methods introduced to TIDE under short-term aid funding have not always been suited to the specific social and ecological context of Belize.

Under the GFI, without time for detailed ecological study in Belize, TNC's staff left TIDE with generalised rules for prescribed burning which may be insufficiently irregular to mimic a 'natural' fire regime for these savannas. Similarly, even when downsized, the USA 'military' style approach to leadership and communication in fire management was not immediately suited to Belize. As a former TNC staff member recalled, in Belize 'there was a lot of communications problems on burns that we participated in and that we conducted down there with them … I wasn't really very successful at controlling—that's kind of a cultural thing of how they interact was not very conducive to American style order. It was pretty foreign to me, and that was a cultural thing that was an impediment to successful burning'.[107] The same TNC staff member secured funding to bring Oscar and some of his rangers to take fire management training in the USA. Returning from this exchange, the TNC staff member recalls how Oscar mimicked approaches from the USA that were not suited to the context in Belize:

> I brought several people up here from Belize, to see how we do it here, and that was almost an unfortunate decision, because they saw us, you know, how we rely on roads and how easy it is to burn when you have roads and all. So I think [Oscar], when he went back, after I quit … he had them, you know, bulldoze some roads and stuff through Payne's Creek. And I was really opposed to that, you know, I thought it

[107] Interview 60.

> would really be unfortunate to put roads through that pristine, 30,000-acre savanna. I mean there was already one or two roads, but I was trying to get them to focus on using blacklining, you know, temporary fire breaks. And using the natural fire breaks, and the weather conditions to create prescribed fire areas, you know. But that was toward the end of my work down there, and I didn't really get to carry on experimenting with that at the level I wanted.[108]

Such situations arise because TIDE's consultants have had limited funding and time to design fire management and work specifically within the Belizean context. When it is Belizean savanna ecology that is poorly accounted for, empirical scientific approaches can help overcome these limitations, to some extent. For example, after seeing prescribed fire management in North Carolina, other assumption that Oscar transferred from the USA to Belize, was that prescribed fire should be used to limit encroachment of hardwood scrub because this will enable pine regeneration.[109] Yet preliminary results from two years of data collection on the monitoring plots that Felix and Chloe established during the Darwin Project 'highlighted different effects of fire on pine seedling survival according to vegetation type' and also suggest that in Belize hardwood scrub may facilitate rather than inhibit pine regeneration by protecting pine seedlings (Figures 6.10 and 6.11).[110] As I demonstrate in Section 6.7, when communicated successfully by scientists to land managers, empirical scientific measurement like this can help organisations like TIDE work past some limitations of general approaches and methods introduced with short-term funding.[111] However, when, as it often is, the political context is poorly accounted for in international development projects, science is less helpful.

[108] Interview 60.
[109] Interview 59.
[110] Tricone & Anderson (2018), p. 1. Ecological research in the Mountain Pine Ridge upland savanna in Belize in the 1970s and 1980s also suggests that broadleaf shrubs act to concentrate nutrients in the soil which may enable pine growth: Kellman (1979); Kellman & Hudson (1982); Kellman, Miyanishi & Hiebert (1987).
[111] Sullivan (2000), similarly, argues that empirical science can help land managers to work past environmental 'narratives' introduced from elsewhere.

Figure 6.10

Pine seedlings in the Payne's Creek National Park killed by a severe (prescribed) burn the previous year.
Source: Author 2018

Figure 6.11

Pine seedling (circled in yellow) in the Payne's Creek National Park protected by broadleaf shrub from mortality during a severe (prescribed) burn the previous year.
Source: Author 2018.

James Ferguson and Tania Li have argued that international development actors frame the problems they would solve as technical, which makes their proposed technical interventions appear desirable and possible.[112] In so doing they avoid reference to the political dimensions of the problems that they cannot address, but which nonetheless frustrate interventions on the ground. In part, the logic of integrated fire management developed in the USA as a reaction to the ecological and social problems caused by previous technically- and scientifically-informed fire management approaches that did not engage with the culture and politics of human fire use (such as the fire management practised by the Belize Forest Department throughout the twentieth century).[113] Yet, as the GFI and Darwin Project both demonstrate, when integrated fire management is *itself* rendered technical in the

[112] Ferguson (1990); Li (2007a).
[113] Pyne (2015).

context of international development, engagement with the socio-political dimensions of fire management remains limited.

The GFI and the Darwin Project took 'building capacity' through technical training as a central approach to engaging local people and government in fire management. As we have seen in Section 6.5, this approach reinforced the authority granted to technical experts in fire management.[114] Further, as was clear in Section 6.4, even with such training, people are unlikely to reduce their use of fire or conduct their own fire management, both because fire management, at best, reduces the likelihood of future losses, rather creating direct benefits, and because they do not have ownership over or rights to access many resources from the savanna. The Darwin Project intended to create benefits for local villagers to incentivise fire management but sought to do so without challenging the reserve boundaries or political control over land and resources. Consequently, nothing we *could do* in the project represented a new benefit for villagers that was clearly linked to (and thus an incentive for) fire management of the savanna landscape beyond their villages.

Firstly, the Darwin Project engaged with the issue of community access to the savanna by attempting to negotiate with the Forest Department for formal community palmetto concessions for protected areas. In the project proposal, palmetto concessions were a concept that was easily rendered logical for the project funder. They were compatible with the protected area boundaries visible on maps and required little understanding of how local people negotiate the landscape. They were a clear and quantifiable technical output. The Forest Department had just published its new Forest Policy, which pointed towards enabling community benefits

[114] Nightingale (2005); Bruges & Smith (2008) and Lund (2015) argue, similarly, that the logic of professionalism in participatory development represents a contradiction in terms.

from forest reserves.[115] The palmetto concessions would have been the first community-level concession to harvest a non-timber forest product from forest reserves in Belize. Yet had palmetto concessions been granted to the communities, they would not have represented a substantial new benefit for the palmetto harvesters themselves, nor a surrender of power by politicians or local logging concessionaires. This was because all parties were aware that the villagers were anyway making unrestricted use of the palmetto resource in the savanna both inside and outside protected areas. If, instead, there had been suggestion of granting community concessions to harvest pine in the savanna, that would have represented a substantial new benefit for them. This was never discussed. This case supports Ribot, Agrawal and Larsen's assertion that in many countries, state authorities have sought to maintain their control over natural resource management despite policies calling for its decentralisation, by authorising small community concessions that do not represent a significant transferral of rights.[116] Ultimately, in Belize, we were unable to negotiate for even the palmetto concessions because of a lack of serious commitment from the Forest Department and an insecure market for the palmetto.[117]

As a second approach to incentivising fire management the Darwin Project offered training and mentoring in business development to groups from each village. When, initially, we openly asked villagers what businesses they might like to develop in the savanna, some hoped to obtain land in the forest reserves for cattle ranching or to construct tilapia ponds. These are not, however, legally compatible uses of forest reserves. Ultimately the businesses the project could support (an ecotourism project, a restaurant, pig-rearing and chicken-rearing) were based in the villages or

[115] Forest Department (2015).
[116] Ribot, Agrawal & Larsen (2006).
[117] In 2016 and 2017 the sole buyer of the palmetto did not purchase palmetto from the villagers, ostensibly because his (Canadian) market was insecure.

removed from the savanna, and thus without a direct link to fire management of the savanna landscape. Moreover, the business development work was treated as separate from the fire management work, in that they were distinct project 'outcomes', and, beyond myself, separate project staff were responsible for delivering each.

The pre-designed interventions in the Darwin Project relied upon participation by 'communities' and the Forest Department. This was presented as unproblematic in the project proposal: there was no reference to the power dynamics between different local resource users and the Government. As is often the case in development texts, the project documentation used the term 'community' to represent the diverse and incohesive villages described earlier as homogeneous and cooperative.[118] It was assumed that initial research into the context of each village would enable success by allowing us, the project staff, to tailor our work to each village. In practice, as noted in Section 6.5, because of their experience and social status, certain community members were able to engage with and benefit from the project, whereas others were not. We also struggled to get mixed groups of Spanish-speaking and Q'eqchi villagers to cooperate. Most of the business groups that formed were made up either of Spanish or Q'eqchi-speakers: only a limited demographic within each village.

The Darwin Project made efforts to collaborate with the Forest Department. Yet, as we saw in Chapter five, the system of patronage in Belize limits the willingness of the Forest Department to engage with conservation agendas, even if supported in official policies. Fire use is widespread in the Belizean savanna, in part, because villagers are aware that the Forest Department is unlikely to punish fire users (for risk of losing political favour). Villagers are also aware that the Forest

[118] See Li (1996), Agrawal & Gibson (1999), Mosse (1999) and Mohan & Stokke (2000) on use of the term 'community' in conservation and development texts.

Department is unlikely to act in their favour unless it is politically expedient. Political elites value the savanna, primarily, as land to grant to political allies. Managing savanna fire is generally not a priority. Further, as we have seen, politicians are unlikely to relinquish their control over this pool of land by granting tenure over it to entire communities (in such a way as might incentivise community-based fire management of the wider savanna landscape). Belize seems to support the case that in many countries, political patronage and corruption create incentives for central actors to maintain control, limiting meaningful shifts of authority associated with participatory natural resource management policies.[119]

These things were also understood by the Belizean project staff, but they maintained that 'anything we do, the Forest Department has to be involved'.[120] The Project proposal suggested that the Department's staff would take training, work with TIDE and communities to enable community fire brigades to be established, develop a legal category for community concessions for palmetto harvesting and work with the Agriculture Department to revise the fire legislation. In practice, while Forest Department representatives attended project events and meetings, they made no effort to institute legal reforms or to support community fire management. To secure funding, international development projects must be pre-designed, and propose a solution to a problem defined in such a way that an external technical intervention could solve it. Yet, just as pre-designed prescribed fire management has limited potential to mimic random fire effects in an ecosystem, externally-designed formats of local participation are limited in their ability to engage with local power dynamics and politics. This limits the extent to which the goals of benefit-

[119] Ribot, Agrawal & Larson (2006); Larson & Ribot (2007); Nelson & Agrawal (2008); Poteete & Ribot (2011).
[120] Interview 1.

sharing and recognition of local fire use can be achieved in integrated fire management *projects.*[121]

Despite the limitations posed by socio-political realities on the realisation of the Darwin Project's desired outcomes, I, with my colleagues, was required to make efforts to present the project as successful in project reporting. In reports, the Forest Department was described as a partner committed to the technical execution of project activities: 'Like many government departments in developing countries, the Belize Forest Department manages areas rich in biodiversity but has very limited resources to implement policies such as its national wildfire management strategy.… At the local level, participation from the Forest Department remains strong, with two staff attending our fire management training programmes this year'.[122] When the project failed to negotiate community palmetto concessions, our reports pointed to 'a number of factors, outside our control', such as the insecure market for palmetto, and 'various changes in the socio-political situation over land rights in southern Belize since the proposal was written'.[123] When it was clear that some outputs would not be met, as described in Chapter one, at the end of the first and second years we amended the project's reporting framework to replace them with outputs that were realisable. For example, the negotiation of palmetto concessions was replaced with the production of a report examining the potential for such concessions in the future. All changes were approved by the funder. David Mosse described similar dynamics in his ethnographic research on international development; textual adjustments like these enable projects to succeed (but on their

[121] See Brosius, Tsing & Zerner (1998); Nadasdy (1999); Cleaver (2001); Mosse (2001); Mosse (2004); Berkes (2004); Kothari (2005) and Brockington, Duffy & Igoe (2008) on the limits of 'participation' within the structural limitations of international development.
[122] 'Darwin Initiative Project 22-013 Second Annual Report', submitted to UK DFID/DEFRA in April 2016, p. 3.
[123] Ibid. p. 22.

defined and revised terms).[124] Yet, by upholding simplistic representations of the relationship between the Forest Department and other project partners, the project continued to obscure the political realities that preclude reform in fire management.[125]

As was the case for the Forest Department in the twentieth century, the short-term nature of conservation and development funding has limited TIDE's ability to develop a long-term programme of fire management responsive to Belizean ecology and politics. The organisation must repeatedly devote attention to new projects and funders and cannot always continue with work started under a project once the funding ends: 'It's conservation attention deficit disorder. It's the crisis of the day. It's the grant of the year. And it's understandable to chase that'.[126] The business groups and long-term monitoring plots established with the Darwin Project funding, for example, had no guarantee of continued support after the project ended, although project staff attempted to secure further funding for them.[127] The Darwin Project was not able to fulfil TIDE's Development Director's initial aim of enabling long-term financing for fire management based on a carbon credit scheme or pine logging in Payne's Creek National Park.[128] In recent years TIDE has, however, found additional funding and a market for its fire management training to other NGOs and agencies in Belize, and elsewhere in the Caribbean. The organisation seeks to promote itself as a technical consultancy for fire management. This may support financing the organisation's fire management, but it also upholds the emphasis on capacity building in technical fire management methods rather than attention to the socio-political context to wildfires.

[124] Mosse (2004); Lewis & Mosse (2006).
[125] See Li (2016) for discussion of similar dynamics.
[126] Interview 59.
[127] Several funding proposals for the business groups submitted during the final year of the Darwin Project failed to attract funding, but modest follow-up funding was secured by TIDE in the months following the end of the Project to continue work with two of the four groups.
[128] Interview 67.

6.7 The human relationships in building fire management

Even if absent from project reporting, social and political relations shape how conservation and development projects take place.[129] The foregoing section showed how this can frustrate project activities which have necessarily been pre-designed to persuade funders. Yet strong social connections can also facilitate change despite those structural limitations with which development actors operate. As anthropologists of development emphasise, personal relationships can bring continuity where project funding is sporadic and create dialogue between different knowledges and approaches.[130] I argue similarly, that where the GFI and the Darwin Project catalysed modest change toward some of the aims of integrated fire management it was because TIDE's staff had lasting friendships and working relationships with external consultants, logging concession-holders, other NGO staff and local villagers.

One of TNC's staff described how personal relationships were central in the GFI:

> Fire management is really so dependent upon individuals and what they are motivated by and what they believe … some people were just more inspired, you know by what they had learned from our trainings and maybe what they already knew. They didn't start from zero these guys, you know, they already knew a lot about fire. So I kinda [*sic*] went wherever I found a person who wanted to do fire, you know, clicked on fire in their belly, and if they didn't have that, you know, you probably didn't go very far with them.[131]

TIDE's prescribed fire programme continued to grow after the GFI ended because several of TNC's staff had developed strong friendships with Oscar and his rangers, and both parties were committed to continuing a working relationship, even at their own expense: 'The Nature Conservancy had pretty much done with fire in Belize

[129] Mosse (2004, 2011); Fechter & Hindman (2011).
[130] Eyben (2006, 2012); Girgis (2007); Fechter (2012); Heuser (2012).
[131] Interview 60.

and [Felix] was trying to put a training together, so we sat down over beers and made a plan to put one together. I took vacation time and bought myself a flight and we did a week and a half of burn training for the non-profit there.... that was just me going down once—but he did it year after year'.[132]

I described earlier how monitoring plots established under the Darwin Project yielded results that demonstrated the limitations of some methods of prescribed burning transferred directly from the USA to Belize. Felix shared the results with Oscar in informal conversations as they worked together: the scientific data was communicated to Oscar and his rangers and began to influence their management of Payne's Creek, not because of the technical reports written by the Felix and Chloe as project outputs, but because of their strong personal relationship with Felix. Felix described how important his relationship with Oscar was to this success:

> we only have a few years of monitoring data, and we already have the operational people, the people who make it happen on the ground, discussing the data … perhaps I've built some credibility by being shoulder to shoulder with these folks, and then once we had the opportunity through the Darwin funding, to do quantitative photo monitoring, following the species that were important to local land managers, this is one of the most responsive incidents I've ever seen, and I think it's—my bias would be it's because of the trust and the relationship in the data.[133]

As we saw in Section 6.5, the fire training that TIDE gave to villagers during the Darwin Project had reach to individuals such as Frederico, who, through prior experience and social standing, were well positioned to develop strong relationships with the project staff (including myself). In dialogue with Felix, Oscar and myself, Frederico examined the potential to create fire breaks around his village of Bladen. In the early dry season of 2018, he, together with Sebastian, one of TIDE's rangers and a resident of Bladen, borrowed equipment from TIDE and, led a small group from their village to conduct a prescribed burn to create a burned area to protect the

[132] Interview 55.
[133] Interview 59.

buildings in the village from fires. Here, where there was a clear benefit to the village, and because they were respected by other villagers, Frederico and Sebastian were able to convince others to give their time, unpaid, to conduct fire management. In this case, the basic model of a project providing training had some effect, because it reached individuals who saw the potential benefits of fire management in their context and were socially positioned to make it happen.

TIDE has also developed strong working relationships with other non-governmental agencies in Toledo who have a stake in fire management: logging concession holders, and another NGO, the Ya'axche Conservation Trust (YCT). Through these organisational bridges, TIDE has been able to move, unlike the twentieth-century Forest Department, beyond consideration of the management of individual protected areas, to think about fire in savanna areas of different legal designation, and even in farmland areas outside savannas. Oscar was able to begin prescribed burning within the Deep River Forest Reserve, in collaboration the logging concession-holder, George, because of his strong friendship with George's son, Denver. Oscar remembered how, through sustained conversation, he gradually built enough trust with George to begin prescribed burning in his logging concession:

> at first, I approach [*sic*] [George] as our neighbours, on the issue of fire, and in his view, fire was all bad, so, I turned to [Denver], his son [laugh], who was—is more or less in my age group. And I started talking to him…. He said 'look we need to address fire', he said, 'but the old man' –that's his dad- 'is the real man that we need to get on board'…. [George] had some little areas blocked off near the sawmill, with excellent pine regeneration, and he didn't want to lose them in a wildfire so I said 'let us burn it for you then', and he was there thinking for a long time and he says 'you know what, go ahead man, and let me see what you guys gonna do, because if a wildfire comes then something will happen anyway, so let's see'. So we just picked the right time. He brought out his wife, the kids, everybody, to see this burn, and then by the time we were done he said: 'you guys, you have my go-ahead. Let's do it'.[134]

[134] Interview 1.

With assistance from TIDE, YCT (an NGO which works with local farmers), has developed a programme of assistance with milpa burning. Strong personal relationships enable Oscar to work shoulder-to-shoulder with YCT's staff, despite the strain on cooperation that exists at higher administrative levels between TIDE and YCT, who are in continuous competition for very limited conservation and development funding. One of YCT's staff described his relationship with Oscar and his rangers: 'we look at ourselves as a team … on the ground, right'.[135] These relationships between organisations began with strong personal relationships between their staff members, but have also been formalised with the establishment of the Southern Belize Fire Working Group.[136] To TNC's current Director of Fire Management, because of this social organisation, within Central America and the Caribbean, when it comes to fire management, Belize as a country 'is pretty advanced—I'd say that in the region they're advanced. It's mostly because of the Southern Belize Working Group'.[137]

6.8 Conclusion

This chapter has examined fire use and management by NGOs and civil society in Belize's northern Toledo District, using evidence drawn from primary ethnographic enquiry. Here, a variety of people, immigrants of diverse origin, and migrants from further south in Toledo, use fire in the savanna to enable hunting and physical access, and for 'fun'. They also burn to clear land for agriculture, which, occasionally, starts savanna wildfires. Lacking secure land access for farming, and with only poorly-paid employment available, people opportunistically employ a mosaic of livelihood strategies including hunting and fishing, for which fire is used in

[135] Interview 58, emphasis added. See Brechin & Salas (2011) on competition between conservation NGOs in Belize.
[136] Interviews 1, 2 and 58.
[137] Interview 55.

savanna areas. The savanna areas these people use are mostly state land and protected areas managed by long-term pine logging concession holders and conservation NGOs. As part of aims of nature conservation or maximal pine growth, these land managers seek to control the fire regime in the savanna and reduce the fire frequency in the savanna to an approximate fire return rate of three to five years. The Forest Department, which is ostensibly the co-manager of these protected areas, does not conduct active fire management or uphold legislation forbidding fire use. This is apparent to villagers. Despite government policies calling for more equitable community benefit from protected areas, it is common practice for government officials to grant land and resource access to villagers based on political allegiance. Local people thus have little direct stake in fire management for the purposes of nature conservation or pine forestry, though there may be some benefit to them of reducing wildfire incidence near their homes.

As an approach, integrated fire management attempts to facilitate recognition of the social and ecological dimensions of fire particular to different places. In Belize it promises fire management informed by an understanding of savannas as ecosystems dependent upon fire, and in collaboration with local fire users. Its framing suggests that fire management can fulfil economic and conservation objectives and support local livelihoods. The evidence presented here shows that advocates of integrated fire management have failed to directly engage with the ecological and political realities that cause trade-offs between these objectives in Belize. This is in part because of the structural limitations placed on NGO-led fire management funded by international conservation and development organisations. Funders seek solutions that can be framed in technical terms, valorise technical professional expertise, and generally fund short-term interventions. This limits the extent to which work within such funded projects can engage with local ecology and politics. Where small successes have been built by

TIDE and other agencies and villagers in Belize towards some of their aims for fire management, they have been through strong personal relationships that have interfaced with technical projects and helped overcome some of their limitations. Such relationships enable different bodies of expertise to interface and sustain work over longer time periods, despite the short-term nature of funding.

What is needed in northern Toledo is open discussion of the trade-off between different aims for fire use and management. Experience elsewhere suggests that if local people are truly to participate in fire management this will require institutions at the village level, and the political will of the Government to enable community benefit from savannas and create some mechanism to compensate communities for conducting prescribed burning.[138] Building fire management networks like this in Belize would take strong cooperation between Government, NGOs and villagers. Without these relationships, technical training and legislative instruments will have limited impact. For now, although successful relationships for fire management are building between NGOs and civil society in Belize, support from the Government is lacking. This limits the extent to which external funding and actors, and Belizean people can build a more just approach to Belizean fire management that accounts for the ecology of the savanna and for the needs of local fire users.

[138] Kull (2002); Rodríguez-Trejo *et al* (2011); Petty, DeKoninck & Orlove (2015); Mistry, Bilbao & Berardi (2016). Berkes (2010) argues for the role of the state in enabling devolution of environmental management.

7

Conclusion

> *Renewal doesn't have the cultural cachet of restoration, particularly in the sense of rewilding. It doesn't come with the moral radiance surrounding redemption, and its aura of attrition and promise of atonement. But it is a way to keep fire on the land in ways that will allow the future to recover and to draft from flame in new and unanticipated ways. The land does far worse unburned than burned poorly. If it holds fire, it will remain malleable enough to be resilient and allow future fire practices to evolve* (Pyne, 2016b, 147).

This thesis has examined wildfire management in Belize's coastal savannas from 1920 to the present. The research it reports upon sought to examine the relationship between ideologies and plans of fire management, and fire management in practice. This research grew out of my observations of working within a three-year UK Darwin Initiative Project in Belize. I found that the Project's documentation lacked attention to the historical and political context of fire management. The Project proposed technical solutions to Belize's fire 'problem', which it presented in apolitical terms. Politics and human relationships limited and shaped the project's outcomes in practice, but this was rarely acknowledged in project reports. In this research I made it my explicit aim to study these political dynamics and to examine how contemporary Belizean fire management is a consequence, planned and not, of previous fire management regimes in Belize.

In focusing on the politics of fire management, I situated my research within political ecology. My research, like most political ecology, borrowed theory and methodologies from multiple academic disciplines. I drew substantively from historical geography and also anthropology and science and technology studies. Thematically, the research speaks to literatures examining fire management (and,

more generally, environmental management), and the changing nature of colonial and international conservation and development.

In Chapter one I laid out five research questions. I addressed each question in Chapters four, five and six. In this chapter I integrate these findings. In Section 7.1, I address each research question in turn and relate my findings to literatures on fire management and colonial and international development. Section 7.2 returns to my research aims and draws conclusions about the continuities and discontinuities between past and present fire management in Belize. Section 7.3 points to broader theoretical implications of the research for the study of environmental management within political ecology. Section 7.4 examines how the research might be useful to stakeholders in Belizean fire management. In Section 7.5, I conclude by suggesting that Stephen Pyne's concept of 'renewal' might be a constructive way to imagine future fire management in Belize's savannas.

7.1 The political ecology of fire management in Belizean savannas, 1920 to present

My first research question asked **which organisations and actors have funded and organised fire management in Belizean savannas over the past century**. Broadly, we may attribute this fire management to two Belizean organisations, the state Forest Department and the NGO TIDE. This makes Belize like many former European colonies, where forestry departments often instituted fire suppression and management.[1] Belize also follows a global trend in which environmental management and development have in the latter twentieth and twenty-first centuries, increasingly been the prerogative of NGOs.[2] The Belize Forest Department and TIDE have both obtained funding from international

[1] Pyne (1997); Kull (2004).
[2] Jasanoff (1997); Lewis & Kanji (2009).

organisations and employed foreign staff and consultants, who have generally been those who have designed fire management plans and policies. Fire management has thus been assembled by international networks of actors, bridging different organisations. Let me review the work of the Forest Department and TIDE in turn, to draw conclusions about how these networks have operated and evolved.

The Forest Department was established in 1921, in colonial Belize, by recommendation of Cornelius Hummel, a forester commissioned to report on the forests of Belize by the British Colonial Research Committee. From its origins, the Forest Department was as much a child of the British Colonial Office as a part of the Belizean state. The Forest Department was considered one of many colonial state forestry departments within a wider British 'Empire Forestry'.[3] Its senior staff were appointed on recommendation by special advisors to the Colonial Office. These staff were trained in forestry in Britain and were British.[4] The Department had limited funding from forest revenue gathered by the state and depended upon finance by loans from the Colonial Office and from the 1930s to the early 1960s, from colonial development and welfare (CDW) grants. There was a constant struggle for control over the Forest Department and the broader Belizean state apparatus between the British colonial administration and local political elites, who comprised a majority in the Legislative Council. These elites opposed the Forest Department because the forms of state regulation the Department advocated threatened their private interests. The Department was constrained in its ability to regulate private industries because of its mandate from the Colonial Office to appease British private interests in Belize. The Forest Department was thus beholden to two different interest groups, both through the placement of personnel and its funding.

[3] Barton (2002); Powell (2007).
[4] With the exception of Hummel, who was German, and had first been employed by the British state at a time when Britain lacked British foresters.

As the Belizean state moved to independence from Britain (reaching full independence by 1981), British influence over the Forest Department, through providing funding and personnel, diminished. By the 1970s, the Department's senior staff were mostly Belizean. Staff increasingly gained positions by virtue of their political connections within Belize. Yet obtaining qualifications in forestry or environmental management was still a factor in procuring senior positions. These qualifications were, by necessity, gained abroad with funding from international aid organisations. These scholarships were limited, and, as late as the 1990s, the Department was still forced to fill vacancies with British foresters. The Department's funding from the Belizean state was repeatedly cut after 1960, and it remained reliant upon international aid funding, sourced from Britain, but also from Canada and the USA. This funding came with training and advice from international consultants. The Department has, thus, remained obligated both to local and foreign interests.

This tension between outside and local control that has characterised the operation of the Department throughout its history has been evident in its organisation of fire management. The Department's policies and practices of fire management have waxed and waned with the availability of funding from the Belizean government and colonial and international aid. In the 1940s and 1950s, when there was a successful pine industry and greater control over government budgets by the Colonial Office, the Department had a large allocation from the government budget. In this period it received sustained CDW funding specifically to finance fire management. After 1960, the CDW funding ceased and government funding diminished. Fire management was curtailed, and new equipment, training and policy-development were sporadically financed by short-term international development projects.

Throughout the past century, international funding, staffing and consultancies have meant that the Department's fire management policies have predominantly been designed by foreign actors: from Forest Department staff, like Cornelius Hummel and Charles Cree, to shorter-term British consultants like Martin Johnson, to USA fire managers with the Nature Conservancy. The labour-intensive practice of conducting fire management has, however, always been done by junior staff and contracted labourers, generally Belizean. The extent to which fire management has been organised following the policies written by international actors has increasingly been subject to the interests of local political elites, with whom Forest Department staff have often been aligned. Fire management has not necessarily been contrary to the interests of political elites, but for reasons reviewed later in this section, neither has it been their priority.

As with the Forest Department today, the NGO TIDE's protected areas staff are all Belizean. TIDE, like many grassroots NGOs in the Global South, also relies upon international aid funding and is advised by foreign consultants. TIDE's fire management grew out of the Nature Conservancy's (TNC) Global Fire Initiative (GFI). Former TNC employees from the USA continue to advise TIDE's protected areas staff on fire management. TIDE has continued to finance fire management through aid projects like the Darwin Project, which had UK government funding.

Unlike the Forest Department, TIDE conducts fire management in collaboration with a network of actors across civil society: The 'Southern Belize Fire Working Group' (SBFWG). This fire management network leveraged by TIDE's staff includes not only international advisors, but also other Belizean actors: staff from other NGOs, logging concession holders and local villagers. Although this parallels similar situations elsewhere, in that local stakeholders are involved in fire

management, unlike elsewhere (in Madagascar, Australia or Brazil for example) state agencies have had minimal involvement.[5]

TIDE's fire management is less the product of TIDE as an organisation, or of any one funding opportunity, and more the result of sustained relationships between individuals from different organisations. In TIDE's case, I was able to identify the importance of these personal relationships from my experience of working with the people involved. I can speak less about the role of personal relationships in the Forest Department's fire management over the past century. I have no doubt, however, that connections forged by Belizean foresters with British foresters, and, occasionally, with the staff of the Agriculture Department, played a role in sustaining fire management despite inconsistent leadership and funding.

Second, the research addressed the question of **how wildfire has been cast as a 'problem' in the texts of these organisations and with what aims fire management has been designed as a solution**. By and large, these texts have been written by the foreign staff and consultants of these Belizean organisations. The framing of the fire 'problem', and the aims of fire management have therefore, unsurprisingly, followed the Anglo-American trends in the understanding of fire ecology, and broadly in conservation and development, that I identified in Chapter two. Let me recapitulate how these discourses presented themselves in Belizean fire management.

In 1921, in his *Report on the Forests of British Honduras*, forester Cornelius Hummel framed savanna wildfire as a problem in presenting it as hindrance to the development of a pine industry.[6] Informed by equilibrium theory in ecology, Hummel understood the savanna (a term he reserved for grassy treeless areas) as degraded pine forest. Frequent wildfire was a cause of this degradation. If fire was

[5] Kull (2002); Petty, deKoninck & Orlove (2015); Mistry, Bilbao & Berardi (2016).
[6] Hummel (1921).

suppressed, the savanna would revert to pine forest. Fire management by the Forest Department was seen as a means for the state to support development. Development was understood as enabling capitalist investment in, and government revenue from, a pine industry. This was presented as beneficial to the Colony at large: legislation restricting fire use in savannas was justified for the greater good. In drawing upon equilibrium theory in ecology, associating fire use with primitive livelihoods, and appealing to elite economic interests, Hummel's arguments for fire suppression were akin to the arguments of foresters in many European colonies in the early twentieth century.[7]

In the 1950s, the way in which the Forest Department framed the fire problem changed. The aim of fire management was still to sustain the pine industry, which had grown significantly in the 1940s and 1950s. Fire was still deemed to hinder pine regeneration, yet Conservator of Forests Charles Cree, observed that complete fire suppression led to the accumulation of fuel.[8] This made wildfires, when they inevitably occurred, very intense and destructive. Cree referenced similar observations by some fire managers in the southern USA, particularly in Florida.[9] The policy of total fire suppression was replaced with one of occasional burning under controlled conditions early in the dry season. Similar policies making controlled 'early burning' acceptable were also instigated in other European colonies in the mid-twentieth century, in Australia and various parts of Africa, for example.[10] Like elsewhere, this use of fire was deemed a 'necessary evil': in general, fire exclusion remained the goal. The Department did not suggest that low-intensity fire was or might enable the propagation of pine (as it is understood to today). Fire

[7] Pyne (1997); Kepe & Scoones (1999); Kull (2004); Kepe (2005); Laris & Wardell (2006); Pooley (2018).
[8] Cree (1956), 'The present forestry programme. A reassessment', [unpublished, BARS ASR-45-4], p. 9.
[9] See Pyne (2016b).
[10] Laris & Wardell (2006); Van Wilgen *et al* (2004); Pooley (2014) .

management was still the sole responsibility of trained Department staff: fire use by local people was still to be curtailed.

Since 2009, the Forest Department has had a new wildfire policy.[11] Following an approach introduced through fire management training given by TNC under the GFI in the early 2000s, the policy calls for 'integrated fire management'.[12] The policy recognises Belize's savannas to be among those fire-dependent ecosystems in which fires play an important ecological role. This follows the paradigm shift in the science of ecology towards non-equilibrium theory, in which disturbances like fire are understood to maintain ecosystems like savannas in constant flux between different vegetation types in a mosaic. The fire problem is re-framed as one in which fires are too frequent and too intense, calling for use of prescribed fire and fire suppression to create ecologically-appropriate fire regimes. The policy does not, however, clearly articulate what such a fire regime might be for the savanna.[13] Elsewhere, non-equilibrium theory has informed 'patch-mosaic burning' approaches, which aim for more random fire effects on the landscape. This is not explicitly suggested in the Belizean policy.

The policy of integrated fire management suggests that fire management should pursue multiple aims concurrently. In so doing it aligns with the dominant global narrative of 'sustainable development'. A feature of this discourse is to suppose that conservation and development aims can be achieved simultaneously as a 'win-win'.[14] Within Belize's new fire policy it is argued that fire management should still aim to facilitate pine regeneration to support the timber industry (and now it is understood that low-intensity fires at some frequency are beneficial to pine regeneration). Aligning with the rise of the nature conservation movement in Belize,

[11] Sabido & Green (2009).
[12] Myers (2006).
[13] Parr & Brockett (1999), Brockett, Biggs & Van Wilgen (2001), Parr & Andersen (2006).
[14] Adams (2008).

and awareness of its contribution to the tourist industry, the policy also argues that fire management should support wider ecosystem health. The policy recognises the 'responsible' use of fire in local livelihoods. It is also suggested that fire management should also reduce the risk of fire and smoke to human health, and the risk of damage to property. There is no clear explanation in the policy of how a fire regime simultaneously pursuing each of these aims might look in practice. Nor does it address how approaches to fire management might differ in pursuit of these different aims, leading to trade-offs between them.

Belize's 2009 policy of integrated fire management aligns with further elements of the discourse of sustainable development. Following the trend towards 'participatory' approaches in conservation and development, it calls for local fire users to be enrolled in fire management.[15] It also follows the tendency towards market-based approaches, in speaking of recognition of the economic benefits of fire management, and of demonstrating these to local communities.[16] The policy does not elaborate further on possible mechanisms by which to involve local fire users. Belize's policies promoting participatory fire management parallel changing policy elsewhere – in Venezuela, Brazil and Australia for example – though certainly not everywhere.[17] Official policies still limit fire use in many places. Similarly, Belize's new policies have not been reinforced with new legislation: existing laws still limit local fire use in savannas.[18]

TIDE also draws upon the notion of 'integrated fire management' in its fire management plan for the Payne's Creek National Park, and surrounding savanna areas, written in the same year with assistance from TNC staff.[19] Similarly, the plan

[15] Brosius, Tsing & Zerner (1998); Adams (2008); Brockington, Duffy & Igoe (2008); Dressler *et al* (2010); Raymond *et al* (2010); Calfucura (2018).
[16] Igoe & Brockington (2007); Adams (2008).
[17] Petty, deKoninck & Orlove (2015); Mistry, Bilbao & Berardi (2016); Eloy *et al* (2018).
[18] A similar situation exists in Madagascar (Kull, 2004).
[19] TIDE, (2009).

recognises that fire management should support pine forestry in the forest reserves, nature conservation in the National Park and the security and livelihoods of local communities. The management plan does not set out clear conservation targets for the National Park, although it suggests that the yellow headed parrot and Caribbean pine are keystone species in its management. It suggests, based on similar savannas elsewhere in Central America, that an ecologically-appropriate target fire return frequency would be every three to five years.[20] The management plan does not lay out an approach for engaging local villagers. In 2015, aligning with examples of community-based conservation elsewhere, TIDE's proposal for the Darwin Project suggested that local participation in fire management could be incentivised through the development of small businesses dependent on savanna resources.

These policies follow trends in Western ecology, conservation and development, and move towards a recognition of the importance of fire both ecologically and socially. Yet, strikingly, each policy lacks clear engagement with the specific role of fire in the ecology of the Belizean savanna, and for its local people. None clearly defines the relationship between fire and pine or other conservation targets. Below, I will consider why knowledge and expertise regarding the local context has not informed these policies.

The research addressed **what expertise has been called upon in planning and implementing fire management, and in what contexts this expertise was granted the authority to do so.** In Chapter two, I identified different ways of understanding expertise: as socially constructed and enacted, and deriving authority from its discursive context, or as possession of 'real' deep and tacit knowledge. Let me review how expertise has informed fire management in Belize in these terms, beginning by considering the 'real' forms of expert knowledge involved.

[20] Myers & Morrison (2006).

In Chapters four and five, I showed that for most of the Forest Department's history, the expert knowledge deemed necessary in those leading the Department and designing fire management plans and policies was a formal training in forestry. Formal qualifications were, however, not deemed important for those junior staff and labourers implementing fire management on the ground. Since the 1990s, less senior staff have held qualifications in forestry, and the more recently appointed staff usually have qualifications in natural resource management or environmental science. Recently, those consulting for the Department on its fire policies have been experts in fire management specifically, working, for instance, with TNC. In TIDE's case, the design of fire management on paper has also been informed by foreign fire management experts from TNC.

Importantly, qualifications in forestry, or a formal training in fire management, have never been available at Belizean institutions. A bachelor's degree in natural resource management has only been available at the University of Belize since 2005. Most foresters leading the Department's work were thus trained abroad, largely in Britain. Initially all were British, but by the 1950s, Belizeans were sporadically being granted scholarships to study in Britain, Cyprus, Costa Rica, Canada and the USA. They gradually came to take senior positions within the Department. Similarly, TIDE's staff (all Belizean), and some local community members, have become technical experts in fire management by training under foreign experts, sometimes travelling to the USA to be trained.

Thus, whether foreign or Belizean, those leading fire management in Belize have all possessed tacit expert knowledge of Anglo-American traditions of forestry and fire management; forms of what Fleischmann and Briske would term 'professional ecological knowledge'.[21] Of course, those Belizeans involved in fire

[21] Fleischmann & Briske (2016).

management have additionally possessed local understanding (also a form of tacit expertise), of the savanna's geography, and of local culture and politics. These forms of expertise have, no doubt, informed fire management practices, but there is little evidence of them in plans, policies and report of fire management. Interestingly, rarely has scientific expertise regarding the ecology of the Belizean savanna specifically informed fire management in plans or practice. Although the expertise called upon has been considered 'scientific', science, in terms of induction from observations in the Belizean savanna itself, has rarely informed the design of fire management. Only recently have TIDE's foreign consultants introduced long-term plots for fire-effects monitoring, intended to enable adaptive management. That Belize's fire management policy has rarely evolved in response to local conditions or research, mirrors experiences elsewhere in the Global South.[22] Yet it is also true that, compared with other European colonies, there was a paucity of environmental research conducted in Belize.[23] The lack of local research in Belize, is of course, in part the result of limited resources, but more broadly there has also been a privileging of general, technical knowledge over knowledge of the local context. To understand why, I must turn to the social construction of expertise in the Belizean case.

General expertise in Anglo-American traditions of forestry and fire management has had authority to design fire management in Belize within the context of colonial development or international development. In other words, these forms of expertise have commanded authority with the agencies funding fire management. Forestry (as a science) was allied with colonial development in the

[22] Van Wilgen *et al* (2004).
[23] Burning experiments were, for example, carried out across French and British African colonies in the twentieth century (Laris & Wardell, 2006; Pooley, 2014, 2018). More generally-speaking, substantial scientific research was systematically instituted across the British Empire after 1940 (Clarke, 2007). Belize was small and received little scientific attention.

discourse of a British 'Empire Forestry'. The proponents of Empire Forestry believed that similar models of forestry should be introduced across the British Empire, in line with its economic unification. Colonial forestry departments were to be staffed by foresters trained in Britain at the Imperial Forestry Institute, and thus to follow common forestry practices. Similarly, international development has valorised universal technical approaches.[24] In Belize, like elsewhere, science's discursive authority has lent authority to certain environmental narratives, even in the absence of data collection following the scientific method.[25]

By contrast, less authority has been granted to these forms of expertise by political elites and fire users in Belize. In Belize, professional qualifications and expertise compete with claims to authority over management of land and resources that are often stronger: those based on class, ethnicity and nationality. Today, Belize's political elites understand that technical expertise draws funding in the context of international development, but they do not always intend that the policies designed by experts should direct conservation and development on the ground. The implication is that the foreign scientific and technical forms of expertise discussed above have informed fire management plans and policies to a greater extent than they have informed fire management in practice. I return to this in addressing my fifth research question.

The authority of foreign expertise in Belize has also been influenced by the social practices of these experts: as Wynne argues, social identities shape the public acceptance of expertise.[26] For example, in the 1920s and 1930s, British foresters were disliked by the Belizean public, in part, *because* they positioned themselves as superior to other members of society. By the same argument, today,

[24] Ferguson (1990); Li (2007a).
[25] Sullivan (2000); Forsyth (2011).
[26] Wynne (1992).

TIDE's staff trust the foreign consultants with whom they work and grant them the authority to inform the organisation's fire management work, because of their strong inter-personal relationships.

Let me review the **methods of fire management that have been planned and those actually practised** in Belize's savannas, and, importantly, highlight gaps between the two. In the 1920s and 1930s, the Forest Department's fire management was part of the Department's routine work. It was not planned as part of time-delimited projects. As such, it was informed by the general approaches laid out in Hummel's 1921 report.[27] Hummel envisaged a new Forest Act covering reservation of forests and defining regulations for their use. He called for an expert-led forest department to manage state forests, collect forest revenue and uphold the Forest Act. In terms of fire management specifically, he suggested that the Forest Department construct fire lines and fight fires in pursuit of complete fire suppression in areas to be delineated for pine regeneration. He also planned to introduce a licensing system for hunters, which he thought would enable regulating their use of fire.[28] These suggested methods of fire suppression – physical and legislative – were akin to the methods of forestry departments in other European colonies.[29]

Let me now compare these plans with fire management in practice in the 1920s and 1930s. In 1926, a Forest Act was passed, which included rules forbidding fire use in forests on crown land. At this time only one area of pine savanna was delineated as a Forest Reserve: the Belize Pine Reserve near Belize City. Until 1935, the Forest Department carried out fire suppression work (constructing fire lines and firefighting) only in two small parts of the Belize Pine Reserve. This work was experimental and different methods of constructing fire lines by hand were

[27] Hummel (1921).
[28] Letter from Hummel to Colonial Secretary, 9th January 1923, [BARS MP149/1923].
[29] Pyne (1997); Kull (2004); Bennett (2015).

trialled. The planned licensing system for hunters was not implemented, though Department staff gave verbal warnings to local people they encountered when patrolling the Forest Reserve. The Department made ad hoc use of local media outlets to highlight the new fire regulations. In 1935, when the Belize Pine Reserve was de-reserved, the Department moved its fire suppression work to an area of Crown Land in the Stann Creek District known as the Grant's Works.

In the 1940s and 1950s, the Department wrote detailed plans for fire management to attract CDW funding (on approximately five-year timescales).[30] These called for an expanded network of fire lines and additional infrastructure to support firefighting: new roads, forest stations and fire lookout towers. New mechanical equipment was called for. As explained above, as in some other European colonies, from the mid-1950s, the Department began to plan prescribed burning early in the dry season (as well as continued wildfire suppression).[31] The scale of the Department's fire management work did expand in the 1940s and 1950s, in line with these plans written to attract CDW funding. New equipment was purchased, and new infrastructure for fire management built. This, however, never reached the scale envisaged in the CDW funding plans. That, even at its peak, the colonial Forest Department's fire management work fell short of that planned, supports Brett Bennett's argument that many historians have attributed too great a power to colonial foresters to remake colonial environments.[32] Bennett asserts that 'though foresters succeeded generally in convincing governments to create state forestry programs, foresters themselves had little power. Foresters usually wanted more forests and greater control over them, but they rarely received these requests

[30] Stevenson, 1944, [OWL MSS.Brit.Emp.s.366NeilStevenson(1)]; Stevenson & Lamb, 1947, [OWL MSS.Brit.Emp.s.366NeilStevenson(2)]; Cree, 1956b, [BARS ASR-1505-114]; Cree (1957).
[31] Laris & Wardell (2006); Van Wilgen *et al* (2004); Pooley (2014, 2018).
[32] Bennett (2015). Scott (1992, ch. 1), for example.

in the face of competing claims by industry, local residents, and other government agencies'.[33] I return to examining how local politics limited forestry in Belize below, in addressing my final research question.

After 1960, the Department no longer planned fire management in schemes to attract CDW funding but instead intended to continue with fire management work under its general budget. There was a short-lived expansion of fire management work in the years after 1961, as an ad-hoc response to widespread fires resulting from fuel accumulation during Hurricane Hattie. In these years new fire equipment was donated to the Department, including radios. The Government ran a media campaign around forest fires, involving newspaper and radio communications, distribution of leaflets and a mobile cinema unit. A new Forest Fires Act was passed in 1962, enabling the Department to direct fire management on private land. Pyne has similarly noted how transient bursts of fire management activity by the state have often been triggered by large wildfire events in the USA.[34]

After the mid-1960s, the Forest Department's active fire management work in the coastal savannas gradually declined. In the 1970s, a new fire management plan for the Southern Coastal Plain was written by a British forester on a short-term secondment to the Department.[35] There was no clear budget allocated for the work he planned. Rather, he detailed possible work were the budget to be allocated by the Belizean Government or were it to attract external funding. His plan called for restoration of existing lookout towers and stations that had fallen into disrepair, expansion of the network of fire lines, and a renewed effort with prescribed fire use and fire suppression. The plan was never funded.

[33] Bennett (2015), p. 36.
[34] Pyne (2015).
[35] Johnson (1974).

The Forest Department has written no new plans for fire management in the coastal plain savannas since the 1980s. Provision of general fire management training to Department staff, the purchase of new firefighting equipment, and the development of new fire policies and strategies have been planned as outputs of short-term aid projects such as the Forest Planning and Management Project (FPMP) in the 1990s, TNC's GFI and the World Bank-funded Key Biodiversity Areas Project (KBA), from 2015 to 2019. The Department's 2009 fire policy lays out general principles for fire management, for example promoting prescribed fire use, and the development of community-based fire management.[36] There is, however, no accompanying plan to lay out steps or allocate Departmental budget for achieving these policy objectives. The Department's Forest Fires Communication Strategy, written in 2017 under the KBA project, lays out clearer activities and a timeline of media and outreach work for 2018 to 2022.[37]

Despite these policies, since 1986 the Department has not conducted any fire suppression or prescribed fire management in the coastal savannas. It has made little effort to enforce the fire legislation or to facilitate community-based fire management. The Department has participated in fire management training, received equipment, and written policies to fulfil the necessary outputs under various funded projects. To date, it does not appear that the programme of work laid out in the 2017 Fire Communication Strategy is being carried out. In its lack of action towards instituting community-based fire management, the Department differs from state agencies in some other countries which have similar policies. In Madagascar, Mexico, Australia, Venezuela and Brazil, for example, states have actively

[36] Sabido & Green (2009).
[37] Yorke (2017).

attempted to involve local fire users in the management of protected areas or have funded community fire brigades.[38]

Unlike the Forest Department, TIDE, together with other members of the SBFWG has conducted prescribed burns and fire suppression in the Payne's Creek National Park and neighbouring Deep River Forest Reserve each dry season since the early 2000s. TIDE's fire management work draws upon a dedicated fire management plan for this area, written with assistance from TNC staff in 2009.[39] This plan calls for maintenance of fire lines, prescribed burning and firefighting to recreate a fire regime of low-intensity fire every three to five years. Fire management is planned in collaboration with other members of the Southern Belize Fire Working Group (SBFWG), including another NGO, local logging concession-holders and community members. The group draws up detailed plans for the individual prescribed burns planned each dry season, which are (after the law) sent to the Forest Department in advance.

TIDE has also planned and conducted fire management training for its staff, staff of other organisations and community members, and the purchase of new fire management equipment, as outputs of short-term funded projects, such as TNC's GFI and the Darwin Project. The Darwin Project proposal also included activities designed to incentivise community-based fire management, like the development of small community-based businesses. These businesses were intended to incentivise fire management, both by creating alternative livelihoods to hunting, and by being dependent on savanna resources. In practice, the businesses developed had only tenuous links to savanna resources (and thus to fire management of the savanna at large). Elsewhere, there have also been attempts to create economic incentives for

[38] Kull (2002); Rodríguez-Trejo *et al* (2011); Petty, deKoninck & Orlove, (2015); Mistry, Bilbao & Berardi (2016); Eloy *et al* (2018); Mistry *et al* (2018).
[39] TIDE (2009).

community-based fire management, but more direct payments have been made to local people for their participation, for example through the establishment of paid fire brigades such as those that exist in Brazil, or through REDD+ schemes as in Australia.[40]

I have shown that there have been significant discrepancies between fire management as planned, and fire management in practice (particularly in the Forest Department's work since 1960). Fire management work was conducted on a far smaller scale than planned. Fire management often failed to achieve its broad aims as articulated in plans and policies.[41] There have also been discrepancies between fire management in practice and written reports about it. **How, then, can these discrepancies between the texts and the actual practices of fire management be explained?** I have made the case that, in large part, they can be explained by the situation in which fire management has largely had foreign, rather than local, funding and impetus. Before I review this argument, it is worth noting that an additional factor of relevance is that some of these texts were created as part of a short-term heightened response to large wildfire events but lost their salience later. An example is the Forest Fires Act, which was passed following the wildfires associated with Hurricane Hattie in 1962 but has rarely been implemented since. Pooley has also highlighted how 'boom and bust cycles of controversy and forgetting' follow large fire events.[42]

The Forest Department's fire management work has had short-term funding from various colonial or international aid agencies. The leaders directing fire management – British colonial foresters, Belizean foresters and foreign consultants – usually had short tenures with the Department. This was both because they were

[40] Petty, deKoninck & Orlove (2015); Mistry, Bilbao & Berardi (2016).
[41] As Kull (2004) has also demonstrated in Madagascar, wildfire policies and legislation have been insufficient to change local fire use, and reduce the number of wildfires.
[42] Pooley (2014), p. 7. See also Pyne (2015).

part of the colonial administration or were employed for short-term projects, and because Departmental positions for Belizeans have often been granted based on political allegiance. The Department thus struggled to maintain a consistent programme and to retain staff with expertise and interest in fire management. In Chapter five I described how this limited the potential for prescribed burning or scientific research to inform fire management.

There has also been a change in the types of activities that are funded by foreign aid in pursuit of fire management. CDW grants directly funded the Forest Department to construct fire lines, fight fires and conduct prescribed burning. Since the CDW funding ended, foreign aid projects have generally funded training, policy development and limited new equipment (both for the Forest Department and TIDE). There has been no funding to ensure that these are then employed to carry out fire management in practice. Active programmes of fire management have depended on limited local impetus from Government and NGOs to finance staff time and transportation. With its limited resources, the Forest Department has generally limited its work to certain protected areas, limiting its ability to manage fires at the landscape scale, or to engage with local fire users.

Belizean policies for fire management have often followed general, technical approaches. This has been because those designing the policies have had limited experience of Belize as a context, and because these approaches have been valorised by funders. As Ferguson and Li note, colonial and international development have tended to 'render technical' the 'problems' they would solve.[43] In the colonial period, the philosophy behind British 'Empire Forestry' was that similar methods of forestry could and should be applied across the British Empire. Likewise, in international development it has been posited that foreign consultants with certain

[43] Ferguson (1990); Li (2007a).

areas of technical expertise could solve Belize's fire 'problem'. As a result, texts planning fire management have generally not attended to the working conditions and fire ecology of the Belizean savanna. They have not considered the economic and political influences on fire management. Even if largely unaccounted for in plans and policies, let me review how local factors have nonetheless frustrated fire management in practice.

Regeneration of Caribbean pine has been an objective of fire management throughout the past century, but there has been a limited understanding of how this species behaves under different fire regimes in the Belizean savanna. Initially, the Forest Department believed that complete fire suppression would lead to pine regeneration. For three reasons this was mistaken: the resultant fuel accumulation eventually led to intense and destructive wildfires; pine was adapted to low-intensity fire and its seedlings grew rapidly in sunlit post-fire conditions; other factors, such as poor drainage, limited pine regeneration. Understanding is improving (in part as a result of studies elsewhere that have contributed to the general shift towards non-equilibrium theory in ecology) but the complex *local* relationship between pine growth and fire continues to limit the applicability of externally-designed fire management approaches. In Chapter six I described how long-term plots established recently in Payne's Creek National Park are demonstrating that TIDE's staff have sometimes been mistaken in directly transferring approaches to prescribed burning from the USA to Belize. This is because these approaches have been developed for other pine species under different ecological conditions. For example, where prescribed fire is used to remove hardwood scrub in North Carolina because it limits pine growth, hardwood scrub may facilitate pine growth in Belize.

In early plans for fire management in Belize, it was assumed that a pine industry would develop to justify fire management locally. In practice, because Belize was remote and lacked infrastructure, foreign capitalist investment in such an

industry was risky. It also depended on an international market for what was a poorly finished product, when compared to pine from the USA. In practice, only in the decades of timber shortage following the Second World War did a sufficiently strong market exist to justify large-scale investment in the Belizean pine industry. For the remainder of the past century the economic incentive for fire management has been weak. Even in the 1940s and 1950s, the pine industry primarily benefitted a single British company (rather than the local economy). Generally, the potential economic benefits of fire management in terms of pine regeneration, have been too long-term to be of interest on political timescales. For the Belizean political elite, the savanna's primary value has been as land to grant for political favour, or as concessions for logging. There has thus been limited impetus for the Belizean Government to fund fire management in the coastal savannas for forestry or nature conservation objectives. After 1960, the Belizean Government repeatedly reduced the funding allocated to the Forest Department in general. This was due to growth of other sectors of the Belizean economy, and because of the Department's connection with British interests, which made it unpopular as Belize sought its independence.

Christian Kull has documented how, in Madagascar, the anonymity of fire users and weaknesses and peasant sympathies within the state have limited the implementation of fire management legislation forbidding fire use.[44] Mathews describes a similar situation in Mexico, where official fire regulations 'are part of the official discourse which justifies the forest service's authority by representing the forests of Mexico as being at the mercy of destructive peasant farmers', but, in practice state officials rarely enforce the regulations, and many are sympathetic to local fire use.[45] The Belizean experience is similar, where legislation restricting fire

[44] Kull (2004).
[45] Mathews (2005), p. 812.

use in savannas has existed throughout the past century but it has not been enforced by Forest Department officials. Inconsistencies within the Belizean state have limited the realisation of fire management policies and legislation.

Local political factors have not only been unaccounted for in plans and policies for fire management, but, even when shaping fire management in practice, they have rarely featured in reports to international funders. Local hostility towards the Forest Department in the 1920s and 1930s, for example, was not mentioned in the Forest Department's annual reports to the Colonial Office, which followed a standard format used across the British empire. Project reports for the Darwin Project, for example, neglected to discuss the trade-offs between different objectives in fire management, and presented the Forest Department as a cooperative partner. In TIDE's case, strong personal relationships between various actors have sustained fire management over the past decade. Being independent of any one funded project, the importance of these relationships in fire management has not received due attention in reports for international funders. David Mosse's ethnographic analysis of development projects provides a useful framework to understand this. Mosse suggests that local social and political relations strongly shape development, but that development actors must present their work in such a way as to makes the policies of funders appear to have determined project outcomes.[46]

By examining both, I have demonstrated that there have been significant gaps between vision and execution in Belizean fire management. Carrier and West argue that too many scholars privilege a 'book view' over a 'field view' of the conservation and development institutions and projects that they study.[47] In Chapter two I showed how this emphasis on discourse has often been inspired by the work

[46] Mosse (2004).
[47] Carrier & West (2009), p. 12.

of Michel Foucault. My work supports Carrier and West in their argument that this focus on vision and intent over actual practice has led to a literature that treats conservation and development interventions as overly powerful.

7.2 From colonial to post-colonial fire management in Belize

Let me tie these findings together with recourse to my research aims. First, I sought to **examine how colonial and post-colonial fire management have addressed the ecological and political context of wildfires in Belize.** In the previous section, I spoke to this aim with my first, third and fifth research questions. I described how throughout the past century there has been some continuity in the way in which fire management approaches have been introduced to Belize from elsewhere, with little attention to the local ecological and political context. This has been because fire management has often been funded and designed by agencies foreign to Belize. Funding and leadership for fire management have generally been short-term and lacked time to respond to local conditions. The agencies funding fire management favoured generalised technical approaches, because these were *what it was possible to provide* in pre-planned projects delivered by foreign experts. There have been some changes to the nature of foreign consultancies for fire management. Since the 1960s, consultants have less commonly held positions within Belizean agencies and have had ever shorter tenures in Belize. This has further reduced their potential to understand and consider local contextual factors. Kothari makes a similar observation that, with the transition from colonial to international development, development agencies have increasingly valued specialist technical expertise in development professionals, over the local contextual knowledge they might gain through extended residency in a country receiving aid.[48]

[48] Kothari (2005, 2006).

In recent decades, studies of colonial science and environmental management have overthrown the 'diffusionist hypothesis', which imagined that knowledge and practices were directly transferred from colonial centres to colonies.[49] This study contributes to this literature. Echoing other studies of the variation in forestry practices in different ecological, economic and political contexts within the British Empire, Belizean fire management was strongly shaped by conditions *in* Belize.[50] I gave examples in the section above and described how the effects of these local factors were sometimes written out of reports about fire management. This does not mean, however, that there was not, *in practice*, some adaptation of general methods to suit the context of Belize.

Pooley emphasises that scientists think and write differently in the field and in dialogue with land managers, from the way that they do in official texts or more general theory.[51] Foresters in Belize also experimented in response to conditions in the field, even if their official texts suggested that they were still following more universal principles. Methods were changed in response to local ecological conditions to a greater degree than in response to local politics. This was particularly the case between 1920 and 1960, where British foresters held senior positions with the Department for sustained periods. For example, in the 1920s and 1930s, the foresters experimented with different ways of cutting fire lines. In the mid-1950s, prescribed burning was introduced, to address the observation that there were risks attached to fuel accumulation after fire suppression. More recently, scientific monitoring of the effects of fire management introduced by TIDE's foreign consultants has informed fire management practices. This was because sustained personal relationships outlasted individual funding opportunities. The ability to

[49] McManus (1999); Goldman & Turner (2011). Hodge (2011a); Vandergeest & Peluso (2011); Pooley (2014, 2018).
[50] Sivaramakrishnan (1997); Vandergeest & Peluso (2011); Hansen & Lund (2017).
[51] Pooley (2014, 2018).

respond to local ecological conditions thus depended upon those designing fire management spending time in Belize. Of course, to some extent, where there has been attention to local conditions it has also been as a response to a growing awareness of similar issues elsewhere. For example, when the Forest Department introduced prescribed burning, it was a response to local observations, but was influenced by the response of foresters to similar observations in the USA. The USA influence during the colonial period is another suggestion that the colonial Forest Department was not solely directed from the colonial centre of Britain, as the diffusionist hypothesis would suggest.

Throughout the past century, fire management leaders and consultants have been far less responsive to local economic and political factors, including the limited long-term local economic benefit from fire management, the granting of savanna land for political favour, and the continued use of fire by local people despite legislation and propaganda campaigns designed to deter them. I should note that in Chapter four we saw one exception to this. John Oliphant, Conservator of Forests in Belize in the late 1920s, recognised that elite control over land strongly limited the work of the Forest Department. His attempts to initiate legislative reforms that might change the balance of power led to his removal from Belize by the British Colonial Office (who feared he might cause local political unrest). After Oliphant no forester made similar attempts to address these local political issues. They do not have technical solutions, nor are they amenable to foreign interventions.

It is true that recent calls for community-based fire management appear to recognise the importance of fire use for local livelihoods and seek to create benefits from fire management for local people. Yet it is important to understand that these calls are not directly a response to recognition of the limitations of past approaches *in Belize itself*. Rather, they result from broader trends in mainstream 'sustainable development' towards 'participatory' approaches. Following this trend, in the Darwin

Project, activities were designed that were intended to create local benefits to incentivise fire management. Constrained by the limitations of a pre-designed aid project, however, the project staff did not challenge legal categories of use of Forest Reserves, nor the control of land by political elites. The Darwin Project was thus unable to create strong local benefits from fire management of the savanna landscape.

My research suggests that the gap between plans and practices of fire management is one caused by a failure of plans and policies to account for local ecology, politics and social relations. It is interesting to reflect upon the extent to which this might have been otherwise. Undoubtedly, had more empirical scientific attention been paid to the fire ecology of the Belizean savanna, this could have led to more appropriate fire management approaches towards aims of forestry or nature conservation. Yet any scientists that might have conducted such work would still have been limited in their ability to influence fire management in practice by local political and social relations. All pre-designed attempts to manage socio-natures are fundamentally constrained in their ability to account for local complexity.

All my research questions, aimed, in one way or another, to **consider the Darwin Project in the light of previous fire management in Belize.** It is useful to consider continuities and discontinuities, both ideological and practical. Ideologically, the Darwin Project (with recent official fire policies in Belize) departed quite radically from the twentieth-century fire management approaches of the Forest Department. These earlier fire management approaches, informed by equilibrium ecology, understood savannas as potential forest, degraded by fire. The aim was to grow pine for forestry. The Darwin Project, by contrast, was broadly informed by non-equilibrium ecology, understanding the savanna as a fire-dependent ecosystem. The Project proposal recognised that the use of fire by local people was an important part of their livelihoods. The proposed activities were intended to reconcile

the differing aims of nature conservation, forestry and local economic development. The Project promoted the use of prescribed fire, which had been used only after 1955 and in limited ways by the Forest Department. The Darwin Project was influenced by the idea of adaptive management. Unlike the Forest Department, the Project made efforts to introduce scientific monitoring of the ecological effects of fire management. Yet, like previous fire management programmes, the Darwin Project gave precedence to foreign technical and scientific expertise in the design and delivery of training in fire management. In the Darwin Project, as throughout the past century, environmental managers called upon local people to restrict their fire use in the name of conservation and development of the savanna.

In practical terms, the Darwin Project was aided by infrastructure and technologies that were not available in twentieth-century fire management. This included the paved Southern Highway, mobile technology for communication, and more sophisticated equipment, such as fire weather meters capable of measuring factors such as relative humidity and wind speed. Yet there are continuities in the way in which the Project encountered practical limitations as a result of foreign funding and pre-design. Like previous fire management it was limited by its short-term funding and faced political dynamics that could not be addressed using technical interventions. It was similarly limited because local political elites did not support fire management and its aims.

All the same, the Project successfully enrolled a wider range of actors in fire management than did the Forest Department. The Project's activities brought NGO staff, local pine concession holders and community members together to conduct prescribed burns. We might ask whether the relationships between these actors in the Project were more equal than previously, both in terms of conducting fire management but also determining the aims of fire management. In Chapters four and five I described how twentieth-century foresters cast local fire users as irrational

and aimed to prevent their fire use. Prescribed fire use was understood as the sole domain of the Forest Department. I showed how local field assistants working with Cornelius Hummel were barely acknowledged in his reports on Belize's forests. Before the 1970s, a single British company monopolised the pine industry, such that local people saw little benefit from fire management for forestry (despite the foresters' discourse that would benefit the Colony at large). In many ways, in the Darwin Project relations between similar actors were more equal. Prescribed fire was something that local people could participate in and lead. There were efforts to involve local people in conducting and understanding field research. Today, local pine logging concession-holders are Belizean.

In other ways, strong power imbalances were retained in these contemporary relationships. Long-term logging concessions are held by a handful of individuals, and few local villagers benefit from the pine industry. Political elites retain control over land and resources, despite policies calling for community based natural resource management.[52] The Darwin Project paralleled experiences in other countries, where local recognition is constrained within participatory fire management schemes, as imagined by development projects and by official agencies. Like in most other examples of participatory fire management, there was little attempt to create space for local fire use, *as it is already practised within local livelihoods.*[53] Environmental managers sought, instead, to involve local people in a separate and planned set of prescribed burning practices. This was coupled with attempts to create alternative livelihoods to reduce local fire use for hunting. As with examples of participatory forestry elsewhere, the valorisation of 'professional' experts limited local participation. Those defined as 'expert', designing project

[52] As is the case in many countries: see Ribot, Agrawal & Larson (2006); Larson & Ribot (2007); Nelson & Agrawal (2008); Poteete & Ribot (2011).
[53] Kull (2002); Petty, deKoninck & Orlove (2015); Mistry, Bilbao & Berardi (2016).

activities and writing training materials and reports were predominantly foreign to Belize. All written outputs were in English. Local fire use was still subordinated to external technical expertise. [54]

There has been much scholarly debate over whether international conservation and development mirrors colonial conservation and development.[55] Given that this study spans a period in which Belize was a colonial and then an independent state, I can make some provisional observations in this regard with reference to Belizean fire management. I have identified three continuities in the history of fire management from colonial to independent Belize. First, throughout the past century, environmental managers have called upon local people to restrict their fire use in the name of conservation and/ or development of the savanna, posed as a 'greater good'. Second, I have shown that plans and policies for fire management in Belize have generally been written by foreign 'experts' and funded by foreign agencies. Finally, both the colonial and independent Belizean state have been internally riven by competing local and external interests, with important implications for fire management in practice. In other words, similar configurations of power have been reproduced between foreign experts and funders, local elites, and local fire users. Countless studies have drawn similar conclusions about the persistence of power relations from colonial to international development.[56] We might ask how significant this is, since the aims of these actors have not just remained locked in a static pattern, and fire management has evolved significantly over time. As Uma Kothari notes, while similar power relations are evident from colonial to international development, there have been divergences: 'processes of globalisation, the setting up of the Bretton Woods institutions and the nature of international finance and trade

[54] Nightingale (2005) Green & Lund (2015); Lund (2015); Scheba & Mustalahti (2015).
[55] Cooke & Kothari (2001); Adams & Mulligan (2002); Kothari (2005, 2006); Wainwright (2008); Hodge (2010; Folke Ax *et al* (2011).
[56] For example, Cooke & Kothari (2001); Li (2007a); Wainwright (2008).

have altered the environment within which development takes place. Moreover, within the development process, changing discourses of foreign aid, theories and policies have successively shaped practices as have the evolving relations between the West and its former colonies'.[57] The question is a complex one, and, because it is, neither broad generalisations nor too finely-drawn a comparison are appropriate. We can also question the extent to which the traces of fire management with which I worked enable direct comparisons between the past and the present. As I will discuss momentarily, the nature of my sources differed significantly for different time periods.

An important finding of the research is that personal relationships between foreign and local actors in Belize shaped the outcomes of the Darwin Project. Some of these relationships were forged during the Darwin Project, but many of them pre-dated the Project. The Project is unlikely to have long-term effects unless these relationships persist. More generally, TIDE's fire management work in the future rests upon sustaining these relationships. This points to an important conclusion. It was perhaps not useful to *isolate* the Darwin Project as a focus for this research. In so doing, I presupposed that the Project, or other individual fire management programmes or policies were the most useful unit of analysis for understanding how Belizean fire management has evolved. Rather, contemporary Belizean fire management has resulted from sustained relationships between networks of actors, with which individual projects have articulated. As Rosalind Eyben notes, the history of international development is often 'written about in terms of a succession of policies, discourses or institutions', but 'rarely considered is the interplay of these with individual lives'.[58] For David Mosse, this emphasis on projects and policies over

[57] Kothari (2005), p. 433.
[58] Eyben (2014), p. 22.

social relations, is one upheld by the development industry itself, which demands in its texts, the 'effacing of individual action, or denial of relationships'.[59] Certainly, this was the structure demanded of me, in writing the Darwin Project reports.

It would, however, be difficult to compare the human relationships involved in contemporary fire management with those historically. Many of the remaining traces of historical fire management represent individual projects and organisations. They do not reveal the extensive networks of actors which these projects and organisations interacted with or depended upon. Using such sources, I have largely written the history of fire management in Belize in terms of funding opportunities, projects and policies. This reminds us that research findings are structured by those traces of the past to which we, as researchers, have had access. The evidence I worked with was fragmentary and differed in nature in different time periods. My understanding of the more recent history was more richly informed by oral histories and for the last three years, my own observations. The Colonial Office records available for the 1920s and 1930s provided far more evidence of the political context to fire management than did the records available for the 1940s onwards, which were biased towards official plans and reports. My research findings are limited by my ability to take account of these limitations.

7.3 Implications for further research in political ecology

Let me draw some more general conclusions for studies of environmental management in political ecology. This research has demonstrated, after Lippert, Krause and Hartmann, that we should understand environmental management 'as situated practice' rather than as 'the implementation of dominant projects and the materialisation of hegemonic discourse'.[60] It calls for further detailed studies of

[59] Mosse (2011), p. 22.
[60] Lippert, Krause & Hartmann (2015), p. 1. See also Carrier & West (2009).

environmental management as it exists in different ecological and political contexts. In this way we might avoid re-inscribing the power of scientific discourse to make 'rules, technics or institutions appear separate from the apparently material world they govern'.[61] This establishes a base from which to question the assumption that the environment *can be* designed or managed by scientific expertise.

The research has highlighted two areas that merit greater attention in future studies of the practice of environmental management. First, much research in political ecology (this included) does not engage directly with state theory, or clearly articulate how it understands 'the state'. The state is often treated as exogenous to local study sites, or as a hegemonic force opposed to local interests.[62] My research findings, with other studies, suggest that political ecology must move towards a more nuanced conceptualisation of the state.[63] I found that while fire management has been organised by the Belizean state, the state is and has not been a uniform entity. The state's fire management has never been directed by a single rationality. The Belizean state has been a space continually contested by foreign and local interests. The relative influence of different actors over its policies or its practices have differed. Environmental management has been shaped by social relations between government officials and 'local' actors. This suggests that more attention should be devoted towards the implications of internal inconsistencies, competition, and conflicts within states for environmental management in other contexts. Globally, NGOs have increasingly played a role in environmental management. Belize itself has been termed a 'hollow state', in which a network of NGOs provides

[61] Mitchell (2002), p. 12. Cooper (2005), makes a similar argument that scholars have maintained a 'Europe-centred narrative of progress' in upholding the analytical categories of 'modernity' and 'colonialism', despite the disparate practices of which they have consisted at different times and in different places.
[62] Robertson (2015).
[63] Mathew (2005, 2011); Moore (1993, 2005); Whitehead, Jones & Jones (2007); Robertson (2015); Wainwright (2015).

a ‘state-like presence’ for environmental governance.[64] Theorisation of the state within political ecology must carefully engage with the role of NGOs vis-à-vis the state. If the state is understood to be composed of social relations, we might question whether NGOs or civil society should be understood as separate from the state at all.[65]

Second, my research suggests that we should observe more closely how trust and inter-personal relationships shape environmental management. It is easy, as a researcher, to focus on individual policies or projects, because these commonly leave a trail of texts for study. Yet a singular focus on individual policies or projects as drivers of environmental management detracts from understanding the ways in which they interact with existing social networks. In the past decades, anthropologists have drawn attention to the importance of inter-personal relationships in shaping international development practice.[66] There has been recent recognition of the relevance of this work for examining environmental management practices, and this would be an interesting field for future study.[67] As Fechter notes, an emphasis on agency need not replace, but, rather, should complement more structural analyses of development (or conservation).[68]

Finally, this research points to the value for political ecology of continued engagement across the disciplines of historical geography, science and technology studies and anthropology. Each of these fields has developed rigorous empirical analysis of the *practices* constituting science, environmental management and development in different contexts. They offer methodologies – archival, oral histories, ethnography – that, in combination, can provide a strong platform from

[64] Brechin & Salas (2011, 2018).
[65] Sending & Neumann (2006).
[66] Mosse (2004, 2011); Eyben (2006, 2012); Girgis (2007); Fechter (2012); Heuser (2012); Fechter & Hindman (2014).
[67] Lippert, Krause & Hartmann (2015); Stern & Baird (2015).
[68] Fechter (2012).

which to question dominant assumptions about how environmental management should be and *is* shaped.[69]

7.4 Implications for stakeholders in Belizean fire management

This research speaks of and speaks to various stakeholders in Belizean fire management: local fire users, international funders, the state Forest Department, Belizean NGOs, logging concession-holders and Belizean politicians. Here I turn to the question of whether, and if so, how, this research should be *useful* to these stakeholders. As a caveat, it is important to stress that the research has not suggested that these are homogeneous groups of stakeholders. Rather, it has demonstrated that these groups are interrelated and cross-cut by power-relations and divergent aims.

This research, like most in political ecology, was driven by normative aims towards environmental justice. Yet there is an argument that too much research in political ecology offers only academic critique and not practical strategies in pursuit of such aims.[70] At the same time, there are many perspectives regarding the form that practical strategies for a more 'useful' political ecology might take.[71] Some would argue that critical research, if carefully communicated beyond academia, can inspire new ways of thinking and plant seeds for practical change, over which others should take ownership. Others argue that political ecologists should be directly involved in activism. Many stakeholders expect researchers, at the very least, to provide them with explicit recommendations, in the form of policy prescriptions, for example.

[69] Brannstrom (2004); Offen (2004); Goldman & Turner (2011); Fleming (2014); Davis (2015).
[70] Walker (2007).
[71] Blaikie (2012).

One important conclusion of this research is that there are significant structural constraints facing actors in Belizean fire management. Practical strategies suggested for these actors must address or acknowledge these constraints. Some limitations could be ameliorated, but as I will stress in the final section, many are inherent to the very notion of planned environmental management. Another conclusion of this research is that a more environmentally just approach to fire management will, in Belize's current political climate, not gain traction and acceptance on the ground simply from the development of new policies for fire management, even if these are officially adopted by the Belizean Government and its agencies. Indeed, Belize's official fire management policies are relatively progressive compared with those in many countries, in that they recognise the ecological and social importance of savanna fires. As TIDE's protected areas manager puts it: 'We have developed a lot a *[sic]* plans, good plans, and they are just sitting on shelves'.[72] This thesis, therefore, does not conclude with explicit policy recommendations for fire management in Belize. Instead, I identify three areas which need deeper consideration in the future, informed by the findings of this research. I then provide reflections on the practices by which I might bring these to the attention of stakeholders in Belizean fire management, beyond simply placing them in this text.

First, the research draws attention to the importance of local ecology and politics in shaping Belizean fire management. It suggests that external advisors in fire management should aim to gain understanding of this context, by consulting and creating more local and scientific knowledge rather than relying on professional ecological knowledge. It implies that local fire managers should more carefully evaluate the relevance of externally-derived approaches. Importantly, it points to a

[72] Interview 1.

need to enable local ownership of ecological and historical research to inform fire management. The little research that has been carried out on wildfire in Belize, has been conducted by actors foreign to Belize (my research is not an exemplar of this long-established tradition: I sit with Hummel here). There are many reasons for this, among them limited opportunities to obtain academic qualifications in Belize, limited funding for research available to Belizeans and poor access to relevant primary and secondary sources in Belize. It is no simple matter to overcome the significant limitations facing research institutions in the Global South: they are intricately intertwined with broader structural inequalities in the international political economy.[73] Yet future funding for fire management might begin, in small ways, to address some of the barriers facing local research. Funding might favour wildfire research conducted at Belizean institutions, such as the Environmental Research Institute. Foreign scientists working in Belize should, at the very least, engage with and collaborate with researchers at these local institutions.[74] This research has demonstrated that social, political and historical research are pertinent to environmental management in Belize. Many historical records located in Belize are poorly preserved, and there is limited local recognition of their potential relevance for contemporary environmental management.[75] There is potential for researchers and students of the Environmental Research Institute in Belize to archive and make more use of these records in research.[76]

Second, this research suggests that fire use and management must be understood in the context of broader struggles over land and resources in Belize. If

[73] Alatas (2003); Unterhalter (2010).
[74] Paige West and John Aini, for example, demonstrate that meaningful, long-term research collaborations are possible between scholars in the Global North and South (West & Aini, 2018).
[75] The Belize Archives and Records Service, while aware of various decaying deposits of records across Belizean Government departments, lacks the resources and space to preserve and house them.
[76] During my PhD, I worked with a student intern at the Environmental Research Institute to catalogue the records at the Forest Department's head office in Belmopan. Similar efforts might be made to examine and digitise some of the decaying records at other Forest Stations.

NGOs and members of civil society in Belize wish to use fire management in pursuit of nature conservation and/or to benefit local villagers, they must be prepared to advocate more comprehensively, more forcefully, and more politically, against the control of land by local political elites and by absentee landowners. This is not something that international development funding is likely to readily support, nor is it something that external consultants or technical interventions can easily address. But, paradoxically, these will only be effective if they communicate and interact with social movements in Belize. As Williams argues, 'participatory development' is not inherently doomed to failure, but, rather, is enabled or constrained by its political context.[77]

Finally, the research calls for recognition of the fundamental importance of long-term inter-personal relationships in sustaining fire management in Belize and enabling it to adapt to local conditions. To external funders of fire management, it suggests a need to support existing relationships, and to be aware that technical interventions rely upon these relationships. It points to a need to support these continuing relationships with funding. To existing networks of fire managers across government, NGOs and civil society in Belize, it re-affirms the importance of sharing and replicating their model more widely. Similar associations of land managers using prescribed fire have successfully shared knowledge and resources elsewhere.[78]

These lessons from my research, as they apply to external advisors to Belizean fire management, apply no less to me as I attempt to make my research useful to stakeholders in Belize. As Piers Blaikie suggests, 'to ask whether political ecology should be useful … is to become involved in a critique of development

[77] Williams (2004).
[78] Stevenson (1998); Weir, Twidwell & Wonkka (2016).

practice itself in its broadest sense'.[79] My research suggests, and others attest, that external actors aiming to influence environmental management will only have local impact through sustained engagement and personal relationships that go beyond written outputs.[80] I certainly do not assume that this thesis, being lengthy and written for an academic audience, will automatically reach Belizean stakeholders. I have begun to build personal relationships in Belize, but it is difficult to have a sustained engagement within the timeframe of a PhD. It will be important for me to continue to communicate this research, through informal conversations and actions in Belize. I will have to tailor how I present the research to different stakeholders, who will hold different expectations of me and of the research.[81] Their expectations of me will be influenced by my involvement with the Darwin Project. They may for example, expect me to play the role of the 'development expert', expecting clearer technical recommendations to guide fire management than I have been able to provide here.

7.5 Renewal and fire management in Belize

In examining the politics of fire management in Belize, I believe that I have identified two of its fundamental failings throughout the past century. First, in their aims to enable the development of pine forestry or nature conservation, fire managers have not recognised local livelihoods involving fire use as legitimate. I would argue that this represents an environmental injustice. Second, fire management has been planned with too much confidence of remaking fire regimes in the Belizean savanna. Fire managers have not recognised fire management as locally inflected. I have linked these attitudes to the structural limitations of development and to persistent power relations between foreign agencies, local

[79] Blaikie (2012), p. 232.
[80] Jones (2014); Staddon (2014).
[81] Roper (2002); Ward *et al* (2010); Jones (2014); Staddon (2014); Mackenzie, Christensen & Turner (2015).

political elites, local fire managers and fire users. In so doing, I have not offered much hope for future fire management in Belize.

Political ecologists often tell stories like these. It is the very nature of political ecology to challenge fixed assumptions about the environment. Robbins has called political ecology the 'trickster science' in that it 'emerges from the instability of other fields of study, developing time-and-again from the internal contradictions and weaknesses that lie within these very fields'.[82] I, with most political ecologists, would, however, be the last to suggest that this calls for the abandonment of other disciplines of study, or of normative stances and action towards issues of environmental justice. This research is wholeheartedly not a call to abandon the issue of wildfire in Belize's savannas. As long as the savanna ecosystem exists in Belize, fire will be irrevocably bound to the future of this landscape and its people and biodiversity.

I opened this chapter with a quotation from Stephen Pyne, in which he describes an approach to fire management that he calls 'renewal'.[83] He was inspired by the work of a friend of his who managed fire in Everglades National Park in Florida, and who, it happens, also featured in this thesis as the fire management consultant to the Darwin Project. In this quote, Pyne makes some important observations, which have relevance for fire management in Belize and more widely.

Pyne distinguishes between renewal and restoration. Restoration suggests that we have the ecological knowledge and the practical means to return to a desired historical environmental state or fire regime. In Belize, as in most places, there is very little knowledge regarding historical fire regimes. More fundamentally, as I discussed in Chapter two (Section 2.2), ecological research suggests that feedbacks within ecosystems often prevent simple reversals of change. Non-

[82] Robbins (2015), p. 98.
[83] Pyne (2016b), p. 147.

equilibrium ecology teaches us that ecosystems are in constant flux, suggesting that there is no 'ecologically appropriate' *fixed* state for the Belizean savanna.

Pyne also separates renewal from redemption. He goes on to argue that fire management in the Everglades National Park is limited because the land is subject to many interests and influences, from local American peoples, commercial developers, a local nuclear power plant and environmental groups with differing interests. Similarly, in Belize, environmental managers cannot ignore the multiple interests with which they compete. Neither should they assume that their work can satisfy all these interests, as in the framing of 'integrated fire management' as a 'win-win'. A call for redemption might suggest that it was possible to undo the legacies of former approaches to fire management, in that they have had unequally distributed costs and benefits. To make such an assumption would be to ignore the structural constraints operating similarly in contemporary fire management and in historical fire management. It might also suggest that we can operate independently of those power relations with which international development, like colonial development, is infused. External agencies cannot, for example, bring about the participation of local communities in fire management, independently of these power relations.

To me, Pyne's 'renewal' implies a recognition of the limitations inherent in the very notion of environmental management. It suggests working with an awareness of the deficiencies of *all* plans and prescriptions to account for ecological complexity and political realities. It calls upon us to recognise that fire behaves differently and takes on new social meanings across time and space: fire, and its management are always context specific. Most importantly, Pyne does not dismiss the need for continued human engagement with fire in the environment.

To me, this concept of renewal has a strong affinity with political ecology. Bruce Braun has identified an 'experimental turn' in political ecology that he

identifies as ‘the expression of an emancipatory or at least democratic desire that in important respects extends political ecology’s critical impulse’.[84] ‘Experiment’ is a re-framing of our engagement with socio-natures away from the idea of environmental management. It calls for recognition that what we term environmental management ‘is necessarily an experiment in producing novel ecologies’, but, more importantly, that it plays out within sites of political struggle.[85] In other words, to be experimental should not be to suggest that all novel ecologies will have equivalent outcomes for different human groups. All interventions should be accompanied by explicit acknowledgement of the politics involved.

In many ways, Belizeans are well placed to be experimental in their future relationship with savanna wildfires. Belize is not beset with the legal and bureaucratic barriers that limit practical experimentation with fire management in the USA, for example. In conducting this research I came to understand that Instead of relying on professional ecological knowledge, a greater emphasis on existing local knowledge, and on developing scientific knowledge, would enable fire management to be more reflexive to local conditions.[86] Neither ‘renewal’, nor ‘experiment’ provide a clear way forward for fire management in Belize. They do not have a solution to Belize’s fire problem. They merely suggest a more realistic way for fire managers to consider their work in respect of local ecological and political complexity.

Bibliography

[84] Braun (2015), p. 103. See also Robbins & Moore (2013); Lorimer & Driessen (2014).
[85] Braun (2015), p. 111.
[86] Berkes, Colding & Folke (2000); Fleischmann & Briske (2016).

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