

2023-08-10

Revolution and Continuity? Reassessing Nineteenth-Century Moorland Reclamation Through Palaeoecological and Archival Research

Baker, L

<https://pearl.plymouth.ac.uk/handle/10026.1/21104>

10.1080/01426397.2023.2244904

Landscape Research

Taylor and Francis Group

All content in PEARL is protected by copyright law. Author manuscripts are made available in accordance with publisher policies. Please cite only the published version using the details provided on the item record or document. In the absence of an open licence (e.g. Creative Commons), permissions for further reuse of content should be sought from the publisher or author.

Revolution and Continuity? Reassessing Nineteenth-Century Moorland Reclamation Through Palaeoecological and Archival Research

Accepted manuscript for *Landscape Research*, July 2023

Authors

Baker, Leonard ^{1*} (l.j.baker@exeter.ac.uk)

Rowney, Francis M ² (francis.rowney@plymouth.ac.uk)

French, Henry ¹ (h.french@exeter.ac.uk)

Fyfe, Ralph M ² (ralph.fyfe@plymouth.ac.uk)

*Corresponding Author

¹ Department of Archaeology and History, Faculty of Humanities, Arts and Social Sciences, University of Exeter, UK

² School of Geography, Earth and Environmental Sciences, University of Plymouth, UK

Abstract

The upland moorlands of Britain are environmentally and culturally important ecosystems. Yet, our understanding of historical attempts to ‘reclaim’ these landscapes is often based upon incomplete accounts of agricultural ‘improvement’. Studies of historical landscape change have frequently focused on singular ‘revolutionary’ moments due to the limitation and biases of surviving historical sources, which has created a contemporary fixation on ‘reversing’ singular interventions. By combining palaeoecological data (pollen, coprophilous fungal spores and microcharcoal) from a recent study of five upland sites with newly rediscovered archival documents, this paper details the differences between how nineteenth-century actors described ecological interventions and some of their actual characteristics and consequences. Through interdisciplinary synthesis, we reveal how perceptions of ecological change were filtered and shaped by the sensibilities and motivations of ‘improvers’. This enables us to

position 'reclamation' within a sequence of long-term management practices that shaped these complex ecosystems.

Keywords

Interdisciplinary; Moorlands; Peatlands; Palaeoecology; Reclamation; Restoration; Perceptions; Motivations; Nineteenth Century

Introduction

Understanding the impact of human activities on the upland moorlands of Britain has become a vital concern due to their specialised ecosystems and importance in climate change mitigation (Grand-Clement et al., 2013; Littlewood et al., 2010; Minayeva, Bragg, & Sirin, 2017; Ritson et al., 2016; Rotherham, 2015; Zak & McInnes, 2022). Similarly, environmental historians have become increasingly interested in how subjective perceptions shaped interactions with these landscapes. (Atkins, 2015; Di Palma, 2014). Unfortunately, the physical and cultural evolution of modern moorlands is often overlooked, with these landscapes presented as eternally ‘untameable and hostile, desolate and uncultivated’ (Fowler, 2020 p. 183). Such static perceptions ignore historical interventions that continue to influence these ecosystems. In particular, attempts to ‘reclaim’ these landscapes throughout the eighteenth and nineteenth centuries remain understudied. Spurred by new ‘ideologies of improvement’, private landowners and governments sought to transform ‘unproductive’ wastes into new farmland through experimental technologies and techniques. Despite numerous studies of the social, economic and cultural factors that underpinned nineteenth-century agricultural ‘improvement’, few works have explored the long-term ecological impacts of these schemes (Mingay, 1997; Winchester, 2022; Chapman & Seeliger, 2001; Gritt, 2008; Phillips, 1989). Instead, historical analyses generally focus on singular moments of ‘upheaval’ and ‘revolution’ (Shaw-Taylor, 2001; Whyte, 2003; Allen, 1992; Turner, 1980; Rodgers *et. al.*, 2011). Across these works, and in many modern ‘restoration’ projects, the ecological impacts of historic ‘reclamation’ schemes have often been inferred from contemporary observations. By linking a cache of detailed archival material with palaeoecological evidence (Rowney *et al.*, 2022, 2023), we examine the effects of ‘improvement’ on the ecologies of five moorland sites that were subjected to intensive nineteenth-century ‘reclamation’ projects. In turn, we detail the critical differences in

how human interventions were perceived or recorded and their actual consequences within complex ecosystems.

Area of Study

We examine the reclamation of Exmoor, an upland area in Southwest England that was subject to repeated interventions between 1818 and 1897. In these years an intense upswing in parliamentary enclosure across Britain was accompanied by similar advances in livestock breeding, agricultural technologies, and fertilisers (Billingsley, 1798; Winchester, 2022; O'Donnell, 2015; Shaw-Taylor, 2001). In 1818 the Royal Forest of Exmoor, a c. 60 km² estate straddling North Devon and West Somerset, was sold to the Knight Family, a dynasty of iron founders from the Midlands. They then conducted the largest single land reclamation scheme witnessed in Southern England. Although elements of their agricultural endeavours have been previously assessed, comprehensive studies of these activities have been stymied by a lack of historical evidence (Siraut, 2009; Hegarty & Wilson-North, 2014; Orwin & Sellick, 1970; Riley, 2014; Riley, 2019). However, the recent rediscovery of the Knights' estate papers and personal correspondence provides new insight into how the family, and their agents, envisioned their impact on the moorland.

The abrupt arrival of the Knights in 1818 provides a precise date at which to locate the beginning of 'reclamation'. Unlike the piecemeal and protracted transition to private property witnessed elsewhere, enclosure on Exmoor was dominated by a single family. (O'Donnell, 2015; Winchester, 2022; Rodgers *et. al.*, 2011). The combined assessment of archival records and palaeoecological data for five sites located across the Knight estate allows us to relocate previously 'singular' moments within long-term ecological contexts. The pollen, coprophilous fungal spores and microcharcoal analysed in our palaeoecological research provide reliable indicators of variation in stocking densities, changes in plant life and the deployment of moorland burning (Rowney et al, 2022, 2023). As these activities were also some of the most

documented and discussed ‘reclamation’ projects, two different, but complementary, histories of agricultural ‘improvement’ can illustrate the complex and intertwined processes of social, cultural, and ecological change on the moorland.

Historiography and Theory

To deepen the synthesis between ecological histories and palaeoecological studies, we attempt to reconcile the cultural and ideological positions of the historical actors who engaged in agricultural ‘improvement’, with surviving palaeoecological evidence of their interventions (c.f. Hanley et al., 2008; Hanley et al., 2009; Whyte, 2006; Tipping, 2005). As research into ‘more-than-human’ histories of ecological change has demonstrated, nonhuman actors were critically important in providing opportunities for humans to assert their visions of how landscapes, and their inhabitants, ‘should be’ (McDonagh 2019; Baker, 2019; O’Gorman & Gaynor, 2020). Similarly, recent interest in the political languages of nineteenth-century enclosure necessitates an assessment of how contemporary discourses shaped perceptions of ‘reclamation’, and its ecological consequences, ‘on the ground’ (Griffin, 2023).

In 1878, the agriculturalist Samuel Sidney created an easily digestible story of the ‘reclamation’ of Exmoor (Sidney, 1878), which has influenced all subsequent accounts. Prior to 1818, Exmoor had been ‘in a state of nature, wild and desolate as an American prairie.’ The arrival of the Knights then heralded ‘great improvements’ across the estate. Although they were ultimately defeated by a ‘climate that made corn-growing at any price unprofitable’, Sidney depicted their efforts as a ‘very bold, not to say revolutionary, experiment’. Although subsequent retellings have added nuance and detail, the nineteenth-century ‘reclamation’ of Exmoor remains a story of ‘revolutionary’ transformations (Orwin & Sellick, 1970; MacDermot, 1973; Siraut, 2009), focused on ‘proactive’ regimes of change and individual moments of upheaval (Williams, 1972; Chapman & Seeliger, 2001; Turner, 1980). Yet, the surviving archives of moorland reclamation were created by landowners, stewards or

commentators who had a vested interest in emphasizing positive action rather than long-term dynamism, continuity, or failure (Goddard, 1983; Fisher, 2022; Griffin, 2023). To rectify this, we complement historical enquiries by drawing on palaeoecological research to reassess the surviving accounts of nineteenth-century Exmoor.

Materials and Methods

Estate Correspondence

The Knight family archive has two distinct components: letters reporting management of the estate, and financial records of rents paid or owed. It records the construction of new farms; drainage, irrigation and infrastructure projects; the successes and failures of tenant farmers tasked with ‘reclamation’; and the financial health of the estate (Wilson-North, 2018; Riley, 2019). Precise chronologies or geographies of improvements are sometimes difficult to reconstruct, but documents frequently pinpoint activities to properties connected with palaeoecological sampling sites (Orwin & Sellick, 1970; Riley, 2019), in this paper and Rowney *et al.* (2023).

Critically, important agents in these processes expressed their opinions about their impacts on local ecologies, environments or ‘climates’. Robert Smith (the estate’s steward between 1848 and 1862) was a nationally renowned expert on ‘upland farming’ before his arrival on Exmoor (Smith, 1847; Smith, 1848; Orwin & Sellick, 1970). Estate correspondence allows us to assess how ideologies of improvement and personal prejudices shaped perceptions of ecological change (Fisher, 2022).

Estate Accounts & Other Sources

Accounts and finance books for Exmoor cover fewer years than the estate correspondence. General accounts and receipt bundles survive for 1819-1820, 1833, 1835-1843, 1849-1853, 1858-1861 and 1864-1867, plus papers covering farm building projects 1850-1861 and detailed

farm-rent accounts for 1852-1886 (Knight Family, 1819-1867; Knight, 1852-1863; Knight, 1864-1886). Unlike the correspondence these reveal the location and chronology of ‘improvement’ schemes, providing one of the most complete accounts of landscape-scale ‘reclamation’ in Britain (Wilson-North, 2018; Williams, 1972; Buchanan, 1982).

From 1866 the Board of Agriculture returns list the acreage dedicated to corn crops, green crops, grasses and pastureland, horses, cattle, sheep and pigs (Ministry for Agriculture, Fisheries and Food, 1866-1901). Seven bordering parishes with similar landscapes have been selected to compare with Exmoor (Exford, Porlock, Luccombe, Oare, Withypool, Hawkridge and Dulverton). Numbers of different types of livestock (horses, cattle, sheep) per parish were calculated, and equivalent modern livestock units (Rural Payments Agency 2021) (Table 1).

Table 1 Summary of livestock unit calculations (n.b. an average value of 0.1 was applied to sheep, as the distinction between upland and lowland is not clear in the Board of Agriculture returns)

Rural Payments Agency (2021) Categories	Board of Agriculture (1866-1901) Categories	Livestock Units Per Animal
Cattle over two years	Cows and Heifers of All Ages in Milk or In Calf Two Years of Age and Above	1.0
Cattle over six months to two years	One Year Old and Under Two Years Under One Year Old (including calves)	0.6
Lowland ewe and lamb; ram	Ewes Kept for Breeding Other Sheep of One Year Old and Above Lambs Under One Year Old	0.12
Store lamb, hill ewe and lamb, hogg, teg	Ewes Kept for Breeding Other Sheep of One Year Old and Above Lambs Under One Year Old	0.08
Horse	Horses Used Solely for Agriculture or by Market Gardeners and all Mares kept for Breeding Unbroken Horses of One Year Old and Above Horses Under One Year Old	1.0

Estimated available grazing land was calculated by subtracting parish acreage under crops from total parish acreage. From 1876 the size of the Knights' sheep herds was also independently recorded by their head herdsman, and the herdings at Larkbarrow Farm and The Chains align with palaeoecological sampling sites (Tait-Little, 1871-1905).

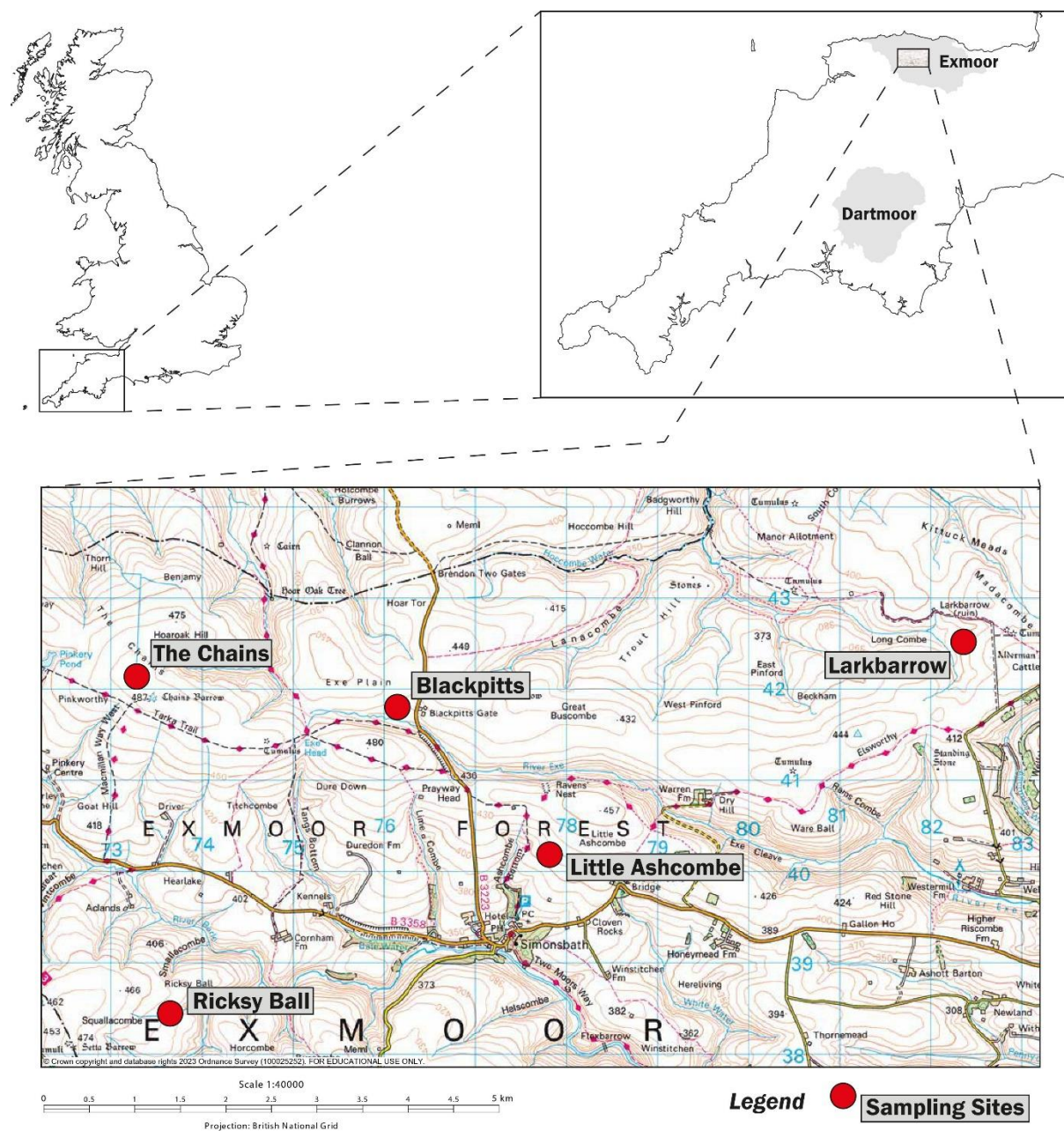
Palaeoecological Analysis

We draw on palaeoecological analyses from five sites (Figure 1). Vegetation change, grazing and burning histories were reconstructed for the last ~600 years using pollen, coprophilous fungal spores and microcharcoal, respectively. Standard methods were used for preparing and recording samples (Moore *et al.* 1991; Djamali & Cilleros 2020) and calculating concentrations and influx rates (Stockmarr 1971). Three dung-associated fungal spore types (*Sporormiella*-, *Podospora*- and *Sordaria*-types) (Perrotti & van Asperen, 2018) were recorded. Their abundances are reliable correlates of moorland stocking densities, particularly when multiple types are considered simultaneously (Davies *et al.*, 2022). Microcharcoal abundances were estimated by counting charcoal particles (shards) >50 μm (length). We found no evidence for disturbance of the core samples by human activities (e.g. ploughing) (Rowney *et al.* 2022, 2023).

All but one of the sites align with a major farm constructed during the Knights' tenure or an area that underwent numerous improvement projects. Ricksy Ball and Little Ashcombe were both parts of larger holdings: Cornham Farm and Simonsbath House Farm respectively. Similarly, sampling for Larkbarrow Farm was undertaken within the immediate vicinity of the farmstead. Unlike Ricksy Ball and Little Ashcombe, Larkbarrow was subjected to short periods of intensive 'improvement' between 1856-1858 and 1867-1869, refurbishing the farm as a centre for sheep ranching (Smith, 1849-1859, Smith to F. Knight, December 1857; Riley 2019). The farm was rarely inhabited by tenant farmers. In contrast, The Chains, a large upland heath and mire, experienced every act of 'improvement' trialled by the Knights. The final site,

Blackpitts, was used to provide fuel for local kilns via turf cutting (Riley, 2014). These five sites provide a representative cross-section of the various attempts to ‘reclaim’ Exmoor. From the estate-led schemes deployed on The Chains and Larkbarrow to the tenant-led projects witnessed at Rickys Ball and Little Ashcombe or the simple indifference at Blackpitts.

Figure 1 Map of palaeoecological sampling sites.



Results

The Ideology of Improvement

Exmoor was described as ‘one of the most deserted and uncultivated districts in England’ with a ‘savage people and dangerous climate’ (Spender & Isaac, 1858, pp. 156-7; “Public Meeting”, 1846). Yet, there was a prevailing belief that these wastes could be made profitable. The presence of ‘heath growing knee high’ was supposedly ‘proof that the land had strength’ and ‘wherever ferns grow [on Exmoor] wheat might be reaped’. Indeed, the only barrier to financial success was ‘a wonderful indifference to labour’ amongst locals (Pusey, 1843, p. 309). In 1852, Robert Smith wrote that the application of new fertilisers would easily ‘conquer the rugged moor’ (Smith, 1849-1859, Smith to F. Knight, March 1852). It was also claimed that investment in drainage and irrigation would ‘redeem the property’ and enable ‘permanent improvement’ through ‘forced spirits and bodily strength’ (Smith, 1849-1859, Smith to F. Knight, February 1853). As sociological studies have demonstrated, the desire to ‘dominate natural landscapes’ is common amongst farming populations (Saugeres, 2002). On Exmoor, this discourse became intertwined with contemporary beliefs that physical landscapes reflected their occupier's moral state (Warde, 2018 p. 133). A dichotomy was forged between ‘savage’ commoners and ‘civilizing’ acts of enclosure (Griffin, 2023). This political language directly influenced the Knights, who believed in the ‘ultimate success of the Forest’ as long as it was occupied by knowledgeable ‘cultivators’ rather than ‘backwards dairymen’ (Knight, 1841-1850, F. Knight to J. Knight, September 1848).

Such beliefs materially shaped the ‘reclamation’ schemes undertaken at the sites under consideration. Except for Blackpitts, all of these locations were intended to be advertisements for agricultural ‘improvement’. Cornham Farm, which encompasses Ricksy Ball, was intended as a ‘show farm’ for John Knight (Knight, 1819-1841, J. Knight to F. Knight, January 1835). Similarly, Larkbarrow Farm was redesigned by Smith to demonstrate his plans for landscape-

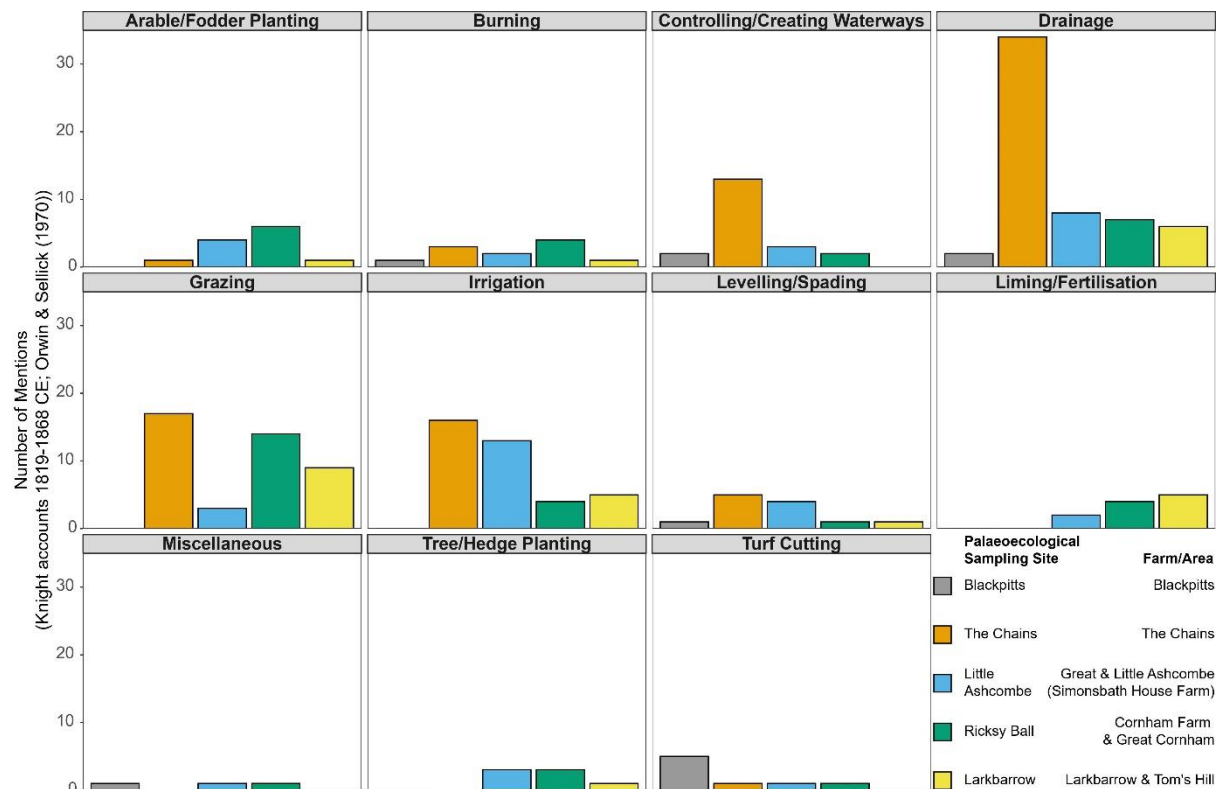
scale improvement while Little Ashcombe formed part of the estate's mid-nineteenth century centrepiece, Simonsbath House Farm (Knight Family, 1819-1867, Farm Building Accounts; Smith, 1849-1859, Smith to F. Knight, January 1853). Accordingly, plans for reclamation at these sites were heralded as 'revolutionary' acts that would radically alter the environment. At Larkbarrow the digging of a 'herringbone' drainage system was 'guaranteed' to 'improve the farm very much and the future hay crops will repay the outlay' (Smith, 1849-1859, Smith to F. Knight, December 1857). At Cornham and Little Ashcombe, it was asserted that a 'constant application of lime' would prevent the moorland's 'daily advance in dilapidation' by allowing 'good grass' to benefit via 'the exclusion of the sedgy mosses' (Smith, 1849-1859, Smith to F. Knight, April 1852; Smith, 1856). Tenants who did not engage in acts such as drainage or liming were castigated as 'lazy' and 'incompetent' (Smith, 1849-1859, Smith to F. Knight, January 1856).

Human Interventions

Drainage formed the centrepiece of the Knights' reclamation efforts, as demonstrated in Figure 2. In accordance with contemporary practice, the estate preferred 'open' drainage wherever possible, usually 'gutters from four to seven feet deep and from twenty to thirty feet apart' being cut across the moorland (Acland & Sturge, 1851, p. 13). As the largest area of moorland on Exmoor, The Chains was subjected to the largest outlay, with at least 4504 chains and 1 perch (approximately 91 km) of channels cut. The amount of moorland drained on other sites was far smaller but illustrated the centrality of this practice to 'reclamation'. On Larkbarrow drainage totalled 80 chains (2 km), while Cornham witnessed 83 chains and 3 perch (2 km) and on Ashcombe 154 chains and 3 perch (3 km). There are fewer references to drainage at Blackpitts during this period because the area was preserved for turf-cutting (Riley, 2014). Everywhere else, drainage became a recurrent expense for generations of occupants. As Riley's archaeological survey noted, the drains cut by the Knights in 1818 were still being maintained

when the estate was sold in 1897. Moreover, the recorded drainage efforts were only a fraction of what was conducted during this period (Riley, 2019).

Figure 2 Summary of documented activities for each area relevant to palaeoecological sampling data.



Although less prevalent than drainage, irrigation projects formed the second largest, publicly visible, outlay of labour and capital for the estate. On Exmoor, irrigation typically took the form of a series of water-carriages that fed hillside ‘water-meadows’. For centuries, farmers in North Devon and West Somerset had been experts in ‘flush irrigation’ and ‘catch-meadows’, which ran water mixed with natural fertilisers continuously across a valley’s slopes to secure ‘an early bite of grass’ (Riley, 2019). Unlike drainage, irrigation schemes were located close to existing farmsteads. At least 334 chains 2 perch (7 km) of channels and water-meadows were recorded on The Chains. In contrast, Ashcombe witnessed 180 chains 2 perch (4 km),

while Cornham had 224 chains 3 perch (5 km) and irrigation at Larkbarrow was recorded 4 times, but with no precise extents. Again, Blackpitts was left untouched by these projects, which sought to transform ‘nature’s grasses’ to ‘the farmers benefit’ (Smith, 1856).

The chronological patterns of irrigation and drainage also reflects changing approaches to ‘reclamation’ on Exmoor. Between 1819 and 1842 the estate was directly controlled by John Knight. In contrast, the tenure of Frederic Knight (1842-1897) saw a transition to tenant farming and sheep ranching (Orwin & Sellick, 1970). As such, the vast majority of large-scale irrigation and drainage schemes were initiated under John Knight. Of the 34 instances of drainage witnessed on The Chains, 32 were conducted prior to 1842. Similarly, under Frederic Knight there were only two new drainage schemes recorded at Ashcombe and one at Cornham. This pattern continues for irrigation, with Frederic Knight only initiating one major project on The Chains and none at Ashcombe or Cornham. Larkbarrow serves as the only exception witnessing five recorded instances of drainage and four entries for irrigation under the management of Frederic Knight. This is due to its refurbishments between 1856-1858 and 1867-1869, when the location was transformed into a ‘show farm’ (Smith, 1849-1859; Riley 2019). There is much less evidence of drainage undertaken by tenant farmers. Riley’s (2019) archaeological surveys indicate that tenants only made minor adjustments to pre-existing drainage systems. This was because the estate made a conscious effort to place new farms close to pre-existing projects (Knight Family, 1819-1867, Farm Building Accounts).

In contrast, less attention was given to liming and burning in the accounts than they received in contemporary debates. By the mid-nineteenth century, agriculturalists believed that lime should be ‘the foundation of the improvement’ for any ‘peaty ground’ (Pusey, 1841). Accordingly, Smith commanded that tenants on Exmoor should ‘apply 3 tons of lime per acre’ on all fields earmarked for ‘permanent improvement’ (Smith, 1849-1859, Smith to Fowler, November 1849). Burning the moorland was thought to allow the soil to be freed ‘from a

portion of its noxious constituents’ whilst providing carbon as ‘the principal constituent of the food of plants’ (Rennie, 1835). In his instructions, Smith recommended ‘paring and burning’ on the ‘best table land’ to create meadowland (Smith, 1856). However, liming and burning were small-scale and inexpensive activities, which were under-recorded by the estate. The local demand for peat as fuel may also have discouraged landscape-scale burning.

Land Management, Stocking and the Perception of Revolution

Livestock occupied a central role in nineteenth-century conceptions of the ‘success’ or ‘failure’ of ecological interventions as the combined emotional and economic connection to ‘living capital’ provided these beings with immense importance (Griffin 2012). In 1818, John Knight eliminated the practice of communal grazing on Exmoor and instead imported ‘fashionable’ breeds of Scotch Cattle (Strong, 1819, Strong to J. Knight, January 1819; Knight, 1819-1841, J. Knight to Jane Knight, October 1826). However, this ‘improved’ herd only reached 1197 heads (Knight Family, 1819-1867, Exmoor Cow Stock Book). Conversely, when the estate passed to Frederic Knight, he recruited pastoral farmers from Yorkshire, Lincolnshire, Leicestershire, and Derbyshire, implementing a ‘modification of the [reclamation] system of all those districts’ (Smith, 1849-1859, Smith to Fowler, November 1849), inspired by reports composed by influential members of the Royal Agricultural Society (Pusey, 1841; Johnson 1841; Watson, 1845).

After Smith’s dismissal in 1862, the estate purchased sheep from across Scotland to ‘replace’ native breeds (Smyth, 1867, Smyth to M Knight, December 1867). To feed these animals, the new steward (Frederick Smyth) changed the estate’s agricultural production from a mixed rotation of root crops and corn to three ‘successive crops of rape’ before the land was broken up and sown with ‘artificial grasses’. Sidney claimed this ‘ingenious experiment’ was ‘entirely’ Smyth’s invention and provided the ‘immediate return that would justify a farmer in breaking up [black-peat lands]’ (Sidney, 1878, pp. 87-89). Accordingly, the Knights’ sheep herds, which

were non-existent in 1862, grew to 15,877 animals in 1897 (Tait-Little, 1871-1905). The presence of animals on Exmoor held deep cultural meaning, convincing onlookers that the moorland had been fundamentally transformed and leading agriculturalists to declare that the Knights had created a landscape where formerly ‘unsound pastures’ were now ‘healthy feeding grounds’ hosting a ‘higher order of grasses’ (Brereton, 1865; Darby, 1873).

Palaeoecological Results

Rowney *et al.* (2022, 2023) demonstrate that although nineteenth-century drainage was associated with specific ecological changes on Exmoor, these changes should be set within a broader context of long-term ecological change and human use of the landscape. Post-drainage vegetation communities had lower abundances of *Sphagnum* moss and fewer taxa (lower taxon richness). In a detailed case study of Ricksy Ball (Rowney *et al.* 2022), different components of the ecosystem responded idiosyncratically following drainage: vegetation exhibited modest change (*e.g.* loss of *Sphagnum*); insect assemblages (Coleoptera, beetles) showed little change; microbial assemblages (testate amoebae) were rapidly transformed. Interrogation of the results from all five palaeoecological sites reveals that although drainage was undoubtedly one of the strongest influences on vegetation overall, notably through the loss of *Sphagnum* mosses (widely considered the most desirable aspect of vegetation for ‘restoration’), it was not the only driver of change. Over longer timescales, burning is closely (positively) associated with graminoid (grasses and sedges) abundances, and periods of more intense animal grazing coincide with reduced vegetation diversity (Rowney *et al.* 2023). This longer-term perspective also enabled critical appraisal of the concept of pre-reclamation “baseline” conditions against which restoration activities could be measured (*sensu* Higgs *et al.* 2014), and showed that *Sphagnum* mosses had not always been features of the peatland systems. The nineteenth century was not a period of unprecedented ecological change, and rates-of-change in vegetation communities were comparable to preceding centuries. Furthermore, research has demonstrated

a long history of human habitation and use of the landscape from at least the Neolithic (~4000 to 500 BCE) and Bronze Age (~500 BCE to 300 CE) (Fyfe, 2012; Fyfe, Brown, & Rippon, 2003), and potentially from the Mesolithic (*c.* >6000 BCE) (Fyfe, Brown, & Coles, 2003; Merryfield & Moore, 1974). Much of Exmoor has been open moorland for the last 600 years (Rowney *et al.* 2023), and probably for at least 2000 to 4000 years (Fyfe *et al.*, 2017), but moorland characteristics have not remained static.

These important ecological analyses can readily complement historical research, but the data has limitations. For example, pollen records do not reflect ecological change across the entire 60 km² estate, but rather within <1 km from each sampling site (though this varies depending on context) (Sugita 1994; Broström *et al.* 2016; Farrell *et al.* 2016). Pollen records also only represent past vegetation changes, not other components of the local ecosystem (microbes, insects, birds, etc), which may respond differently to human disturbances (Rowney *et al.* 2022).

Contextualising the Knight Archive

Quantitative historical sources confirm that the ecological ‘transformation’ of Exmoor was far more limited than existing studies suggest. After the landscape-scale drainage, irrigation and liming projects of the initial decades, the pace of ‘improvement’ slowed dramatically. Of the 89 drainage and irrigation projects recorded, 59 were enacted prior to 1835. Initially, this was due to a lack of funds as by 1847 the estate’s expenditure exceeded its income by £7200 per annum (Knight, 1841-1850, F Knight to J Knight, January 1848). The death of John Knight in 1850 then led to a series of legal battles between his heirs, limiting Frederic Knight’s control over the estate’s revenues, and investments, until 1863 (Knight, 1861; French & Baker, 2023). To counteract this, Robert Smith shifted the financial burden of reclamation onto the tenantry via a series of ‘liberal leases’. Under this system any ‘permanent improvement’ by the tenant would be compensated through rent abatements (Smith, 1856). For example, Gerald Spooner’s lease for Wintershead required him to ‘improve’ 300 acres in four years, at an estimated cost

of £1275, to qualify (Orwin & Sellick, 1970, p. 87). Such rapid investment was unlikely due to the financial insecurity of Exmoor's tenantry (French & Baker, 2023). Consequently, landscape-scale 'improvement' became increasingly curtailed.

The Board of Agriculture returns (Ministry for Agriculture, Fisheries and Food, 1866-1901) (Figures 3 to 5) show how changes in livestock numbers and cropped acreages plateaued or only increased slightly. In Figure 3, there is a steady increase in the number of sheep on the estate during the late-nineteenth century. Figure 4 indicates that relative to the much greater grazed acreage of pasture and moorland available on Exmoor, the 'experiments' conducted by Smyth had little long-term impact on stocking rates. Similar patterns are witnessed in the recording of crop acreages in Figure 5. Apart from momentary spikes in rape and wheat, Figures 3 to 5 demonstrate that land use on Exmoor was not particularly unique or innovative. Rather, during this period Exmoor was becoming incorporated into the agricultural trends of Southwest England, which was increasingly focused on sheep ranching (Capie & Perren, 1980). As Figure 4 highlights, allowing for Exmoor's larger area, the upswing in sheep populations was proportionate with neighbouring parishes. Moreover, Exmoor's cattle herds lagged behind (relative to available land) and, as Figure 5 reveals, the smaller communities were planting far more crops than on Exmoor. The yearly rate of change in the acreages of livestock and crops on Exmoor was also less pronounced than in Dulverton or Hawkrigde.

Despite the raw number of acres 'improved' and made available for sheep and crops on Exmoor, grazing on the estate was probably less intensive than during the common pasture regime on Exmoor throughout the seventeenth and eighteenth centuries (MacDermot, 1973), demonstrated by palaeoecological evidence (Rowney *et al.* 2023). In the final years of the Royal Forest, an average of 26,177 sheep were pastured annually (Lock, 1814-1817). In 1736 there were 30,136 sheep 'in the Forest' and in 1634 it was estimated that 'two thousand people put in sheep to depasture' (Siraut, 2009, p. 88; MacDermot 1973, p. 285). Far from being a

‘revolution’, the purchase of the estate by John Knight resulted in stocking rates plummeting. In 1897, after 30 years of sheep-grazing, there were only 15,877 sheep on Exmoor. There was no significant increase in grazing intensity and acreage usage, despite claims of wholesale ‘improvement’.

Figure 3 Total numbers of livestock on Exmoor and in surrounding parishes in Board of Agriculture returns. Livestock units calculated according to Rural Payments Agency (2021).

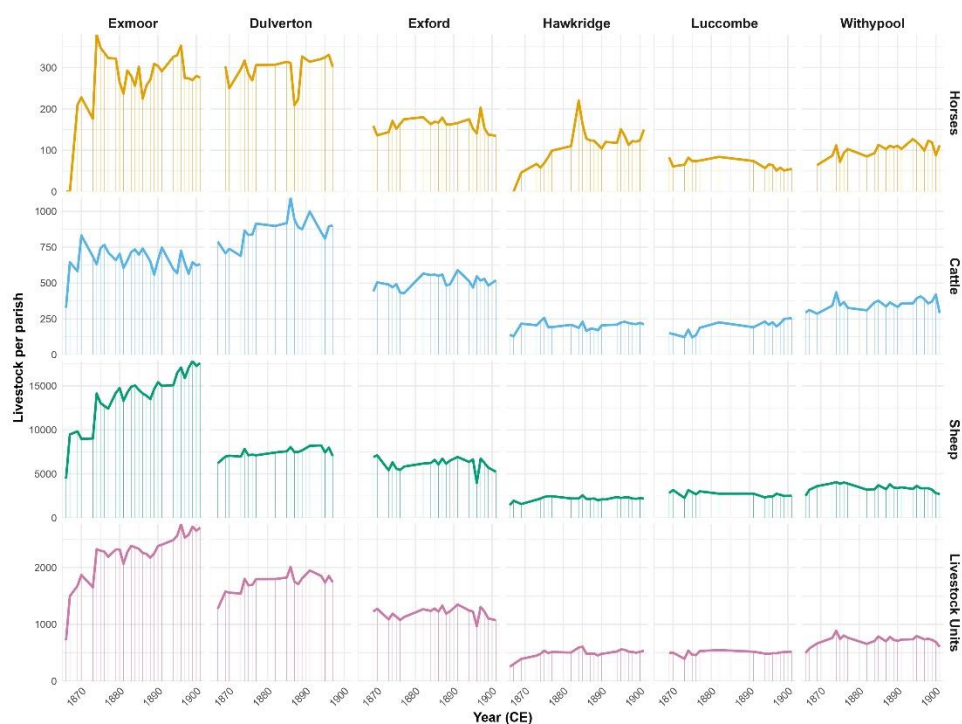


Figure 4 Livestock per acre of available grazing land, including moorland (estimated) on Exmoor and in surrounding parishes documented in Board of Agriculture returns. Livestock units calculated according to Rural Payments Agency (2021).

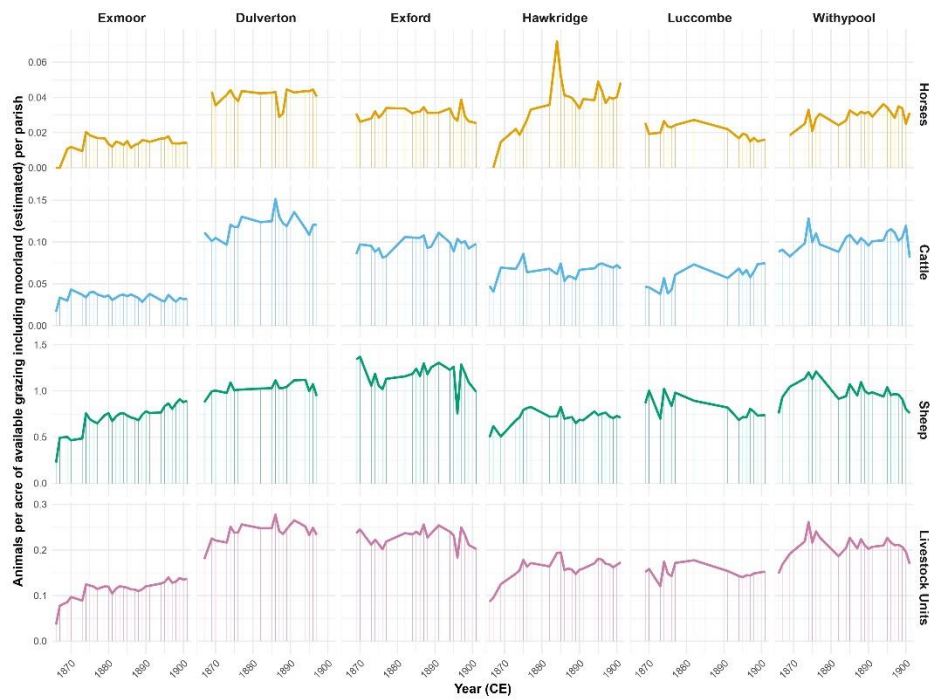
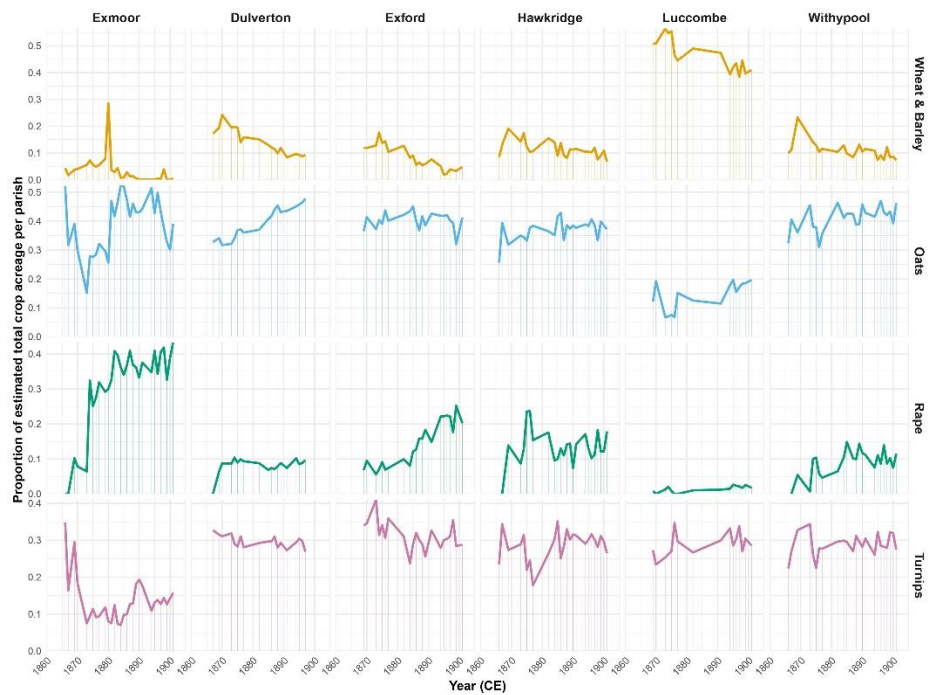


Figure 5 Acreage of selected crops on Exmoor and surrounding parishes in Board of Agriculture returns.



Discussion

Revolution and Continuity

The ‘Reclamation of Exmoor’ occurred during a century where it was frequently argued that through new techniques and technologies, ‘productive soils’ could be created anywhere in Britain (Morton, 1861). Our research demonstrates that there was a marked difference between the descriptions of these ecological transformations by nineteenth-century protagonists and the impacts identified by palaeoecological research. Accounts of ecological change left by Robert Smith, John Knight or Frederick Smyth were frequently shaped by ideologies of what Exmoor ‘should be’, rather than intricate understandings of local ecosystems. These also recast the failure of certain farmers as a moral failure. An overreliance on the assessments of contemporary land agents, landowners, or commentators, therefore, risks misrepresenting the extent and intensity of ecological change.

During this period, the Knights constructed roads to connect Exmoor with surrounding communities; enclosed fields and built farms; established the largest parish in Somerset complete with a church, schoolhouse, and various public amenities. The transformation of Simonsbath from an isolated mansion into a typical rural village is one of the most significant shifts witnessed during this period (Siraut, 2009; French & Baker, 2023). Unfortunately, contemporaries often conflated visible infrastructure projects, population growth and landscape interventions with ‘ecological revolution’ (O’Donnell, 2015; McDonagh, 2013; Williams, 1972). In fact, it was very difficult for observers to assess the extent of long-term ecological change, because this often occurred over much more extended timescales. Yet, the Knights, and their agents, clearly understood some of the consequences of their actions. When Larkbarrow was advertised for rent ‘unexhausted improvements’ to the ‘native grasses’ were attributed to ‘open drainage’ in ways that correspond to the palaeoecological evidence (“Farms to be Let”, 1849; Rowney *et al.* 2023). Such changes were geographically specific and

chronologically limited, and their palaeoecological ‘footprint’ is not substantially different from preceding centuries (Rowney *et al.* 2022, 2023).

Ironically, Exmoor was one of the few nineteenth-century ‘reclamation’ projects to generate significant income precisely because the Knights’ financial constraints prevented reckless ecological interventions (French & Baker, 2023; Simpson, 2022; Tindley, 2010). After reluctantly reverting to ‘traditional’ sheep ranching, the estate yielded approximately £8500 income per annum by 1886 (Orwin & Sellick, 1970, p. 131). It was this inadvertent, and largely unintentional, success that provided the framework for initial proclamations of ecological revolution (Sindey, 1878; Darby, 1873).

Human Perceptions, Motivations and Ecological Change

Many collaborations between archival research and paleoecology have focused on structural change and economic history (Hanley et al., 2008; Hanley et al., 2009; Tipping, 2005). This ‘value-neutral’ approach has overlooked the importance of human perceptions and motivations. In contrast, as studies of enclosure have noted, during the late-eighteenth and nineteenth centuries the transformation of ‘wasteland’ was couched in discourses of ‘civilization’ and moral ‘improvement’ (Howkins, 2014; Warde, 2018; Griffin, 2023). Our research confirms that these cultural impetuses were also applied to moorland reclamation. Whether it was drainage, irrigation, liming, or pasturing sheep the material act of reclamation became inseparable from moral judgement. Those who ‘marked the land lightly’ were deemed to be ‘unprogressive and backward’ (Harris 2004). Exmoor was regarded by advocates of ‘improvement’ as a ‘useless and void space’, ripe for economic and social reform (Billingsley, 1798; Smith, 1850-1859, Smith to F. Knight, March 1852). The rapid succession of changes implemented by John Knight, Robert Smith and Frederick Smyth illustrate how the moor was regarded as having no previous or intrinsic value. However, the moral aspect of improvement

ensured that actors gained more rewards for highly visible short-term infrastructural ‘improvements’, rather than for sustained long-term ecological changes.

The prevailing discourses surrounding enclosure meant that anything less than a ‘revolution’ on Exmoor would have been disastrous to the reputations and livelihoods of land agent and owner (Griffin, 2023). The interventions of the Knights, Smith and Smyth had to result in agrarian transformation, or else their status as ‘knowledgeable men’ would have been threatened. Any admission that their efforts had made little impact, exposed them to charges of technical ineptitude, financial waste and moral failure. This helps to explain the significant discrepancies between their accounts and the surviving palaeoecological evidence.

Conclusion

Revaluating the ‘reclamation’ of Exmoor using archival and palaeoecological data reveals critical differences between what historical actors wanted to happen, what they believed was happening and what was actually happening to local ecosystems. This was not because the Knights, or their agents, were charlatans, or ignorant or inexperienced. Even the most educated farmer in this period was working on understandings of ecological processes that were still in their infancy. As Warde has noted, many nineteenth-century moral judgements regarding ‘productivity’ and ‘progress’ were used to bridge the gap between contemporary knowledge and ecological processes (2018, pp. 309-316). It is in this area that palaeoecology provides a necessary perspective on ‘revolutionary’ moments that can correct or moderate the largely uncritical acceptance of contemporary sources witnessed elsewhere.

By synthesising palaeoecological and historical research, we can assess the impacts of human interventions during the ‘improvement’ of Exmoor’s moorland landscapes. Our work reveals that many of the schemes and projects that historians focus upon during assessments of upland ‘improvement’ were far less ecologically significant than previously assumed. Although the

estate's drainage schemes had a noticeable impact on local ecologies, other highly praised 'transformations' failed to yield similar results. Unfortunately, this was not the exciting story of technological 'progress' and 'conquest' that the Knights, their agents, or subsequent commentators, wished for. The overlooking of 'silent' continuities in previous accounts highlights the need to go beyond these simplistic, and human-focused, narratives.

Due to ethnocentric bias and the availability of sources, previous histories of Exmoor have centred around dramatic accounts of doomed agricultural projects, human conflict and 'top-down' reclamation schemes. The unfortunate conflation of social, infrastructural, and institutional change with ecological upheaval has obscured a more complex narrative of change. These 'more-than-human' histories expose the differences between perceptions of ecological change and the actual impacts of human intervention (O'Gorman & Gaynor, 2020).

We hope that this paper can provide a model for future collaborations between palaeoecological and historical studies. Without recognising the long-term contexts that surrounded acts of 'reclamation' and agricultural improvement modern efforts to return these landscapes to their 'natural' state risk making the same misinterpretations and miscalculations as their nineteenth-century predecessors.

Acknowledgements

We would like to thank the two anonymous reviewers for their comments and suggestions; Rob Wilson-North, Shirley Blaylock and Martin Gillard (Exmoor National Park Authority) for their discussions regarding the historical and archaeological evidence and for providing access to the Historical Environment Record; Morag Angus and colleagues in the Southwest Peatland Partnership for comments on the utility of the results for peatland restoration; U3A Minehead volunteers for transcribing the Knight Family Papers; Bette Baldwin and The Friends of Hoar Oak Cottage for digitising and transcribing the diaries and stocking records of Robert Tait Little.

Funding

This work was supported by an award from the Leverhulme Trust under Grant RPG-2020-045.

Notes on Contributors

Leonard Baker received a PhD in History from the University of Bristol in 2020 and was a post-doctoral research fellow on the ‘A Landscape Transformed: The Reclaiming of Exmoor’ project at the University of Exeter, 2020-22.

Francis Rowney received a PhD in Physical Geography from the University of Plymouth in 2018 and was a post-doctoral research fellow on the ‘Landscape Transformed’ project at the University of Plymouth, 2020-2022.

Henry French is Professor of Social History in the Department of Archaeology & History at the University of Exeter and was co-investigator on the ‘Landscape Transformed’ project, 2020-22.

Ralph Fyfe is Associate Dean and Professor of Geospatial Information in the Department of Geography, Earth and Environmental Sciences at the University of Plymouth and was co-investigator on the ‘Landscape Transformed’ project, 2020-2022.

References

- Acland T., & Sturge W. (1851), *The Farming of Somersetshire*. London.
- Allen R. (1992), *Enclosure and the Yeoman: The Agricultural Development of the South Midlands, 1450-1850*. Oxford: Oxford University Press.
- Atkins W. (2015), *The Moor: A Journey into the English Wilderness*. London: Faber & Faber.
- Baker L. (2019) Human and Animal Trespass as Protest: Space and Continuity in Rural Somerset and Dorset. *History Workshop Journal*, 87, 72-93. Doi:10.1093/hwj/dbz011
- Billingsley J. (1798). *General View of the Agriculture of Somerset*. Bath.
- Brereton J.L. (1865). On Stocking Land. *Journal of the Royal Agricultural Society of England*, 2(1), 130-40.
- Broström, A., Sugita, S., Gaillard, M.J., & Pilesjö, P. (2016). Estimating the spatial scale of pollen dispersal in the cultural landscape of southern Sweden., 15(2), 252–262. doi:10.1191/0959683605HL790RP
- Buchanan B.J. (1982), The Financing of Parliamentary Enclosure: Some Evidence from North Somerset, 1770-1830, *Agricultural History Review*, 30, 112-126.
- Capie F. and R. Perren (1980), The British Market for Meat, 1850-1914, *Agricultural History*, 54(4), 502-515.
- Chapman J. and S. Seeliger (2001), *Enclosure, Environment & Landscape in Southern England*. Stroud: Tempus.
- Darby J. (1873). The Farming of Somerset. *Journal of the Bath and West of England Society*, 5, 96-172.

- Davies, A. L., Harrauld, L., Milek, K., McClymont, E. L., Dallimer, M., Hamilton, A., & Warburton, J. (2022). A multiproxy approach to long-term herbivore grazing dynamics in peatlands based on pollen, coprophilous fungi and faecal biomarkers. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 598, doi:10.1016/j.palaeo.2022.111032
- Di Palma V. (2014), *Wasteland: A History*. New Haven: Yale University Press.
- Djamali, M., & Cilleros, K. (2020). Statistically significant minimum pollen count in Quaternary pollen analysis; the case of pollen-rich lake sediments. *Review of Palaeobotany and Palynology*, 275. doi:10.1016/j.revpalbo.2019.104156
- Farrell, M., Bunting, M.J., & Middleton, R. (2016). Replicability of data collected for empirical estimation of Relative Pollen Productivity. *Review of Palaeobotany and Palynology*, 232, 1–13. doi:10.1016/j.revpalbo.2016.04.009
- Farms to be Let. (1849, September 3). *Bells Weekly Messenger*.
- Fowler C. (2020), *Green Unpleasant Land: Creative Responses to Rural England's Colonial Connections*. Leeds: Peepal Tree.
- Fisher, J. (2022), *The Enclosure of Knowledge: Books, Power and Agrarian Capitalism in Britain, 1600-1800*. Cambridge: Cambridge University Press.
- French H. & L. Baker, (2023), 'The Result Never Quite Equalled the Promise': Risk, Reward, and Reclamation on Exmoor, 1840-1897, *Agricultural History Review*, 71(1), 45-65.
- Fyfe, R.M., A.G. Brown, B. Coles (2003), Mesolithic to bronze age vegetation change and human activity in the Exe valley, Devon, UK. *Proceedings of the Prehistoric Society*, 69, 161–181. doi:10.1017/s0079497x00001298
- Fyfe, R.M., A.G. Brown, S.J. Rippon (2003), Mid-to late-Holocene vegetation history of Greater Exmoor, UK: estimating the spatial extent of human-induced vegetation change. *Vegetation History and Archaeobotany* 12, 215-232.
- Fyfe, R.M. (2012). Bronze Age landscape dynamics: Spatially detailed pollen analysis from a ceremonial complex. *Journal of Archaeological Science*, 39(8), 2764–2773. doi:10.1016/j.jas.2012.04.015
- Fyfe R., H. Ombashi, H.J. Davies and K. Head (2017), Quantified Moorland Vegetation and Assessment of the Role of Burning over the Past Five Millenia. *Journal of Vegetation Science*, 29(3), 393-403. doi:10.1111/jvs.12594
- Goddard N. (1983), The Development and Influence of Agricultural Periodicals and Newspapers, 1780-1880, *Agricultural History Review*, 31(2), 116-31.
- Grand-Clement, E., Anderson, K., Smith, D., Luscombe, D., Gatis, N., Ross, M., & Brazier, R. E. (2013). Evaluating ecosystem goods and services after restoration of marginal upland peatlands in South-West England. *Journal of Applied Ecology*, 50(2), 324–334. doi:10.1111/1365-2664.12039

- Griffin C. (2012), Animal Maiming, Intimacy and the Politics of Shared Life: The Bestial and the Beastly in Eighteenth- and Early Nineteenth-Century England, *Transactions of the Institute of British Geographers*, 37(2), 301-316.
- Griffin C. (2023), Enclosure as Internal Colonisation: The Subaltern Commoner, Terra Nullius and the Settling of England's "Wastes", *Transactions of the Royal Historical Society*, 1-26. doi:10.1017/S0080440123000014
- Gritt A. (2018), Making Good Land from Bad: The Drainage of West Lancashire, c. 1650-1850, *Rural History*, 19(1), 1-27. doi:10.1017/S0956793307002282
- Hanley N., A. Davies, K. Angelopoulos, A. Hamilton, A. Ross, D. Tinch and F. Watson (2008). Economic Determinants of Biodiversity Change Over a 400-year period in the Scottish Uplands. *Journal of Applied Ecology*, 45, 1557-1565. doi:10.1111/j.1365-2664.2008.01570.x
- Hanley N., D. Tinch, K. Angelopoulos, A. Davies, E. Barbier, F. Watson (2009). What drives long-run biodiversity change? New Insights from Combining Economics, Paleoecology and Environmental History. *Journal of Environmental Economics and Management*, 57(1), 5-20. doi:10.1016/j.jeem.2008.03.005.
- Harris C. (2004), How Did Colonialism Dispossess? Comments from an Edge of Empire, *Annals of the Association of American Geographers*, 94, 165-82.
- Higgs E., D.A. Falk, A. Guerrini, M. Hall, J. Harris, R.J. Hobbs, S.T. Jackson, J.M. Rhemtulla, W. Throop (2014), The changing role of history in restoration ecology. *Frontiers in Ecology and the Environment*, 12(9), 499-506.
- Howkins A. (2014), The Use and Abuse of the English Commons, 1845-1914, *History Workshop Journal*, 78, 107-32.
- Johnson C.W. (1841). On the Improvement of Peat Soils. *Journal of the Royal Agricultural Society of England*, 2, 390-400.
- Knight Family, (1819-1867) *Financial and Accounting Papers Relating to Exmoor*, Knight Family Papers, (A/EJM/3/3), Somerset Archives, Taunton, UK.
- Knight F., (1841-1850) *Correspondence*, Knight Family Papers, (A/EJM/1/1/6), Somerset Archives, Taunton, UK.
- Knight F., (1852-1863), *Rental Accounts*, Knight Family Papers, (A/EJM/2/2), Somerset Archives, Taunton, UK.
- Knight F., (1861, October 23), To the Editor, *Taunton Courier*.
- Knight F., (1864-1875), *Rental Accounts*, Fortescue Family Papers, (1262M/0/3/20/152-3), Devon Archives, Exeter, UK.
- Knight, J., (1819-1841) *Correspondence*, Sellick Papers, (A/BAZ/1/5), Somerset Archives, Taunton, UK.

- Lock, W. (1814-1817), *Accounts of the Deputy Forester of Exmoor*, (LR/5/1/2), National Archives, London, UK.
- MacDermot E. (1973), *A History of the Forest of Exmoor*. Exeter: David and Charles.
- McDonagh B. (2019), Disobedient Objects: Material Readings of Enclosure Protest in Sixteenth-Century England, *Journal of Medieval History*, 45(2), 254-75. doi:10.1080/03044181.2019.1593629
- Merryfield, D.L., & Moore, P. D. (1974). Prehistoric human activity and blanket peat initiation on Exmoor. *Nature*, 250(5465), 439–441. doi:10.1038/250439a0
- Minayeva, T. Y., Bragg, O. M., & Sirin, A. A. (2017). Towards ecosystem-based restoration of peatland biodiversity. *Mires and Peat*, 19, 1–36. doi:10.19189/MaP.2013.OMB.150
- Ministry for Agriculture, Fisheries and Food. (1866-1901). *Parish Summaries of Agricultural Returns*, (MAF 68), National Archives, London, UK.
- Mingay G.E. (1997), *Parliamentary Enclosure in England: An Introduction to its Causes, Incidence and Impact, 1750-1850*. London: Routledge.
- Moore, P. D., Webb, J., & Collinson, M. E. (1991). *Pollen Analysis*. Blackwell, Oxford.
- Morton J. (1861) Some Lessons of Recent Agricultural Experience. *Journal of the Bath and West of England Society*, 9, 249-50.
- O'Donnell R. (2015), *Assembling Enclosure: Transformations in the Rural Landscape of Post-Medieval North-East England*. Hatfield: University of Hertfordshire Press.
- O'Gorman E. and A. Gaynor (2020), More-Than-Human Histories, *Environmental History*, 25, 711-735.
- Orwin C.S. and R.J. Sellick (1970), *The Reclamation of Exmoor Forest*. Tiverton: Exmoor Press.
- Perrotti, A. G., & van Asperen, E. N. (2018). Dung fungi as a proxy for megaherbivores: opportunities and limitations for archaeological applications. *Vegetation History and Archaeobotany*, 0(0), 1–12. doi:10.1007/s00334-018-0686-7
- Phillips A.D.M (1989), *The Underdraining of Farmland in England During the Nineteenth Century*. Cambridge: Cambridge University Press.
- Public Meeting. (1846, February 14). *Norfolk News*.
- Pusey P. (1841). Some Account of the Practice of English Farmers in the Improvement of Peaty Ground. *Journal of the Royal Agricultural Society of England*, 2, 400-416.
- Pusey P. (1843). On the Agricultural Improvements of Lincolnshire. *Journal of the Royal Agricultural Society of England*, 4, 287-315.
- Rennie J. (1835) The Practice of Fallowing, of Paring and Burning, or Irrigation, and of Draining, Explained on New Scientific Principles, *Quarterly Journal of Agriculture*, 5, 1-31.

- Riley H. (2014), *Turf Cutting on Exmoor: An Archaeological and Historical Study*. Exmoor Mires Project.
- Riley H. (2019), *The Landscape of the Knights on Exmoor: A Case Study for the Exmoor Mires Partnership*. Exmoor Mires Project. doi:10.5284/1082836
- Ritson, J. P., Bell, M., Brazier, R. E., Grand-Clement, E., Graham, N. J. D., Freeman, C., ... Clark, J. M. (2016). Managing peatland vegetation for drinking water treatment. *Scientific Reports*, 6(1), 1–9. doi:10.1038/srep36751
- Rodgers C.P., E. Straughton, A. Winchester and M. Pieraccini (2011), *Contested Common Land: Environmental Governance Past and Present*. London: Earthscan.
- Rowney F.M., R.M Fyfe, P. Anderson, R. Barnett, W. Blake, T. Daley, K. Head, A. MacLeod, I. Matthews and D.N. Smith (2022), Ecological Consequences of Historic Moorland ‘Improvement’, *Biodiversity and Conservation*, 31, 3137-3161. doi:10.1007/s10531-022-02479-6
- Rowney F.M., R.M. Fyfe., L. Baker, H. French, H. Ombashi, R. Timms, M. Hall and G. Millward (2023), Historical Disturbance Regimes Explain Moorland Vegetation Dynamics, *Ecology and Evolution*, 13, doi:10.1002/ece3.9876.
- Rural Payments Agency. (2021). Countryside Stewardship: Mid-Tier and Wildlife Offers Manual for Agreements (Annex 6C: Convert Livestock Numbers into Livestock Units). Retrieved from <https://www.gov.uk/guidance/countryside-stewardship-mid-tier-and-wildlife-offers-manual-for-agreements-starting-on-1-january-2022/annex-6c-convert-livestock-numbers-into-livestock-units>
- Saugeres L. (2002), The Cultural Representation of the Farming Landscape: Masculinity, Power and Nature, *Journal of Rural Studies*, 18, 373-84.
- Shaw-Taylor L. (2001), Parliamentary Enclosure and the Emergence of an English Agricultural Proletariat, *Journal of Economic History*, 61(3), 640-662.
- Sidney S. (1878), Exmoor Reclamation, *Journal of the Royal Agricultural Society of England*, 2(14), 72-96.
- Simpson D. (2022), ‘Culmaily, a Model of Improvement: Reform, Resistance and Rationalisation in South-Eastern Sutherland’, in S. Evans, T. McCarthy and A. Tindley (eds), *Land Reform in the British and Irish Isles Since 1800* (pp. 27-47). Edinburgh: Edinburgh University Press.
- Siraut M., (2009), *Exmoor: The Making of An English Upland*. Chichester: Phillimore & Co.
- Smith R. (1847), The Management of Sheep, *Journal of the Royal Agricultural Society of England*, 8, 1-32.
- Smith R. (1848), The Management of Grass Lands, *Journal of the Royal Agricultural Society of England*, 9, 1-26.
- Smith, R. (1849-1859), *Correspondence*, (A/EJM/1/1/5-16), Somerset Archives, Taunton, UK.

- Smith R. (1856), Bringing Moorland into Cultivation, *Journal of the Royal Agricultural Society of England*, 17, 349-393.
- Smyth, F. (1867), *Correspondence*, (A/EJM/1/3/16), Somerset Archives, Taunton, UK.
- Spender E. and T.W.P. Isaac (1858), The Labourer, *Journal of the Bath and West of England Society*, 6, 130-77.
- Stockmarr, J. (1971). Tablets with spores used in absolute pollen analysis. *Pollen et Spores*, 13, 615–621.
- Strong, R. (1819). *Correspondence*, (A/EJM/1/3/1). Somerset Archives, Taunton, UK.
- Sugita, S. (1994). Pollen Representation of Vegetation in Quaternary Sediments: Theory and Method in Patchy Vegetation. *Journal of Ecology*, 82(4), 881. doi:10.2307/2261452
- Tait-Little, R. (1871-1905). *Stock Book of Sheep on the Exmoor Estate*, (3394.HOC263). Friends of Hoar Oak Collection, Lynmouth, UK.
- Tindley A. (2010), *The Sutherland Estate, 1850-1920: Aristocratic Decline, Estate Management and Land Reform*. Edinburgh: Edinburgh University Press.
- Tipping R. (2005), Paleoecology and Political History: Evaluating Driving Forces in Historic Landscape Change in Southern Scotland, in I. Whyte and A. Winchester (eds.), *Society, Landscape and Environment in Upland Britain*, (pp. 11-20). Society for Landscape Studies Supplementary Series.
- Turner M. (1980), *English Parliamentary Enclosures: Its Historical Geography and Economic History*. Folkestone: Dawson.
- Warde P. (2018), *The Invention of Sustainability: Nature and Destiny, c. 1500-1870*. Cambridge: Cambridge University Press.
- Watson J. (1845), On Reclaiming Heath Land, *Journal of the Royal Agricultural Society of England*, 6, 79-101.
- Whyte I. (2003), *Transforming Fell and Valley: Landscape and Parliamentary Enclosure in North West England*. Lancaster: University of Lancaster Press.
- Whyte I. (2006), Upland Britain, Cultural Processes and Landscape Change Through Time, *International Journal of Biodiversity Science and Management*, 2, 138-141.
- Williams M., (1972) The Enclosure of Waste Land in Somerset, 1700-1900, *Transactions of the Institute of British Geographers*, 57, 99-123.
- Wilson-North R. (2018), The Rediscovery of the Knight Family and its Importance to Exmoor, *Proceedings of the Somerset Archaeological and Natural History Society*, 161, 189-94.
- Winchester A., (2022), *Common Land in Britain: A History From the Middle Ages to the Present Day*. Woodbridge: Boydell.
- Zak, D., & McInnes, R. J. (2022). A call for refining the peatland restoration strategy in Europe. *Journal of Applied Ecology*, (September), 1–7. doi:10.1111/1365-2664.14261.